

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Electronics & Communication Engineering
 (Applicable from the academic session 2018-2019)

Curriculum Structure

2nd Year: 3rd Semester

A. Theory							
Sl No.	Field	Theory	Contact Hours/week				Credit Points
			L	T	P	Total	
1.	EC301	Electronic Devices	3	0	0	3	3
2.	EC302	Digital System Design	3	0	0	3	3
3.	EC303	Signals and Systems	3	0	0	3	3
4.	EC304	Network Theory	3	0	0	3	3
5.	ES-CS301	Data Structure & Algorithm (ES)	3	0	0	3	3
6.	BS-M301	Probability & Statistics(BS)	3	0	0	3	3
Total Theory						18	18
B. Practical							
7.	EC391	Electronic Devices Lab.	0	0	2	2	1
8.	EC392	Digital System Design Lab.	0	0	2	2	1
9	ES-CS391	Data Structure Lab(ES)	0	0	2	2	1
Total Practical						6	3
Total Credits						24	21
C. Non Credit Course							
	MC381	Environmental Science	0	0	2	2	0

2ndYear: 4th Semester

A. Theory							
Sl No.	Field	Theory	Contact Hours/week				Credit Points
			L	T	P	Total	
1.	EC401	Analog Communication	3	0	0	3	3
2.	EC402	Analog Electronic Circuits	3	0	0	3	3
3.	EC403	Microprocessor & Microcontrollers	3	0	0	3	3
4.	ES-CS401	Design and Analysis of Algorithm(ES)	3	0	0	3	3
5.	BS-M401	Numerical Methods(BS)	2	0	0	2	2
6.	BS-B401	Biology for Engineers	2	1	0	3	3
Total Theory						14	17
B. Practical							
7.	EC491	Analog Communication Lab	0	0	2	2	1
8.	EC492	Analog Electronic Circuits Lab.	0	0	2	2	1
9.	EC493	Microprocessor & Microcontrollers Lab	0	0	2	2	1
10.	BS-M(CS)491	Numerical Methods Lab	0	0	2	2	1
11.	HS-HU481	Soft Skill Development Lab	0	0	2	2	1
Total Practical						10	5
Total Credits						24	22

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3rd Year: 5th Semester

A. Theory							
Sl No.	Field	Theory	Contact Hours/week				Credit Points
			L	T	P	Total	
1.	EC501	Electromagnetic Waves	3	0	0	3	3
2.	EC502	Computer Architecture	3	0	0	3	3
3.	EC503	Digital Communication & Stochastic Process	3	1	0	4	3.5
4.	EC504	Digital Signal Processing	3	0	0	3	3
5.	PE-EC505 A/B/C/D	Program Elective I	3	0	0	3	3
6.	OE-EC506 A/B/C	Open Elective I	3	0	0	3	3
Total Theory						19	18.5
B. Practical							
7.	EC591	Electromagnetic Wave Lab	0	0	2	2	1
8.	EC592	Digital Communication Lab.	0	0	2	2	1
9.	EC593	Digital Signal Processing Lab.	0	0	2	2	1
Total Practical						6	3
C Sessional							
10	MC-HU581	Effective Technical Communication	0	0	3	3	0
Total Credits						28	21.5

3rd Year: 6th Semester

C. Theory							
Sl No.	Field	Theory	Contact Hours/week				Credit Points
			L	T	P	Total	
1.	EC601	Control System & Instrumentation	3	0	0	3	3
2.	EC602	Computer Network	3	0	0	3	3
3.	PE-EC603	Program Elective II	3	0	0	3	3
4.	OE-EC604	Open Elective II	3	0	0	3	3
5.	HS-HU601	Economics for Engineers	3	0	0	3	3
Total Theory						15	15
D. Practical							
6.	EC692	Computer Network Lab.	0	0	2	2	1
7.	EC691	Control System and Instrumentation Lab.	0	0	2	2	1
8.	EC681	Mini Project/ Electronic Design Workshop	0	0	4	4	2
Total Practical						8	4
Total Credits						23	19
9	MC681	Universal Human Values	2	0	0	2	0

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4th Year: 7th Semester

D. Theory							
Sl No.	Field	Theory	Contact Hours/week				Credit Points
			L	T	P	Total	
1.	PE-EC701	Program Elective -3	3	0	0	3	3
2.	PE-EC702	Program Elective -4	3	0	0	3	3
3.	PE-EC703	Program Elective -5	3	0	0	3	3
4.	OE-EC704	Open Elective - 3	3	0	0	3	3
5.	HS-HU701	Principles of Management	2	0	0	2	2
Total Theory						14	14
E. Practical							
6	EC781	Industrial Training	During Semester Break(6 th & 7 th)				1
7.	EC782	Project Stage – I	0	0	8	8	4
Total Practical						8	5
Total Credits						22	19

4th Year: 8th Semester

E. Theory							
Sl No.	Field	Theory	Contact Hours/week				Credit Points
			L	T	P	Total	
1.	PE-EC801	Program Elective – 6	3	0	0	3	3
2.	PE-EC802	Program Elective - 7	3	0	0	3	3
3.	OE-EC803	Open Elective - 4	3	0	0	3	3
4.	OE-EC804	Open Elective - 5	3	0	0	3	3
Total Theory						12	12
F. Practical							
5.	EC881	Project Stage – II	0	0	15	15	7.5
6.	EC891	Grand Viva					1.5
Total Practical						15	9
Total Contact /Credits						27	21

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Professional Electives

Sl No.	Course Code	Course Title	Hours/week			Credits	Semester
			L	T	P		
1	PE-EC505A	Nano Electronics	3	0	0	3	V
2	PE-EC505B	Speech and Audio Processing	3	0	0	3	
3	PE-EC505C	Power Electronics	3	0	0	3	
4	PE-EC505D	Scientific Computing	3	0	0	3	
5	PE-EC603A	Introduction to MEMS	3	0	0	3	VI
6	PE-EC603B	Bio-Medical Electronics	3	0	0	3	
7	PE-EC603C	CMOS VLSI Design	3	0	0	3	
8	PE-EC603D	Information Theory & Coding	3	0	0	3	
9	PE-EC701A	Microwave Theory and Techniques	3	0	0	3	VII
10	PE-EC701B	Satellite Communication	3	0	0	3	
11	PE-EC701C	Mobile Communication and Networks	3	0	0	3	
12	PE-EC702A	Adaptive Signal Processing	3	0	0	3	
13	PE-EC702B	Digital Image and Video Processing	3	0	0	3	
14	PE-EC702C	Neural Network and Fuzzy Logic Control	3	0	0	3	
15	PE-EC703A	Embedded System	3	0	0	3	
16	PE-EC703B	Wireless Sensor Networks	3	0	0	3	
17	PE-EC703C	Wavelet Transforms	3	0	0	3	VIII
18	PE-EC801A	Antennas and Propagation	3	0	0	3	
19	PE-EC801B	Fibre Optic Communication	3	0	0	3	
20	PE-EC801C	Error Correcting Codes	3	0	0	3	
21	PE-EC802A	Mixed Signal Design	3	0	0	3	
22	PE-EC802B	Industrial Automation and Control	3	0	0	3	
23	PE-EC802C	VLSI Design Automation	3	0	0	3	

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List of Open Elective

Sl No.	Course Code	Course Title	Hours/week			Credits	Semester
			L	T	P		
1	OE-EC506A	Soft Skill and Interpersonal Communication	3	0	0	3	V
2	OE-EC506B	Cyber Law & Intellectual Property Rights	3	0	0	3	
3	OE-EC506C	Human Resource Management	3	0	0	3	
4	OE-EC604A	Electronic Measurements and Measuring Instruments	3	0	0	3	VI
5	OE-EC604B	Operating System	3	0	0	3	
6	OE-EC604C	Object Oriented Programming	3	0	0	3	
7	OE-EC704A	Web Technology	3	0	0	3	VII
8	OE-EC704B	Optimisation Technique	3	0	0	3	
9	OE-EC704C	Entrepreneurship	3	0	0	3	
10	OE-EC803A	Internet of Things(IoT)	3	0	0	3	VIII
11	OE-EC803B	Big Data Analysis	3	0	0	3	
12	OE-EC803C	Cyber Security	3	0	0	3	
13	OE-EC804A	Artificial Intelligence	3	0	0	3	
14	OE-EC804B	Microwave Integrated Circuits	3	0	0	3	
15	OE-EC804C	Organisational Behaviour	3	0	0	3	

1st Year Curriculum for B.Tech courses in Engineering & Technology

(Applicable from the academic session 2018-2019)



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BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
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A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits

B. Range of credits :

A range of credits from 150 to 160 for a student to be eligible to get B.Tech Degree in Engineering. A student will be eligible to get B.Tech Degree *with Honours*, if he/she completes an additional 20 credits. These could be acquired through Massive Open Online Courses (MOOCs).

C. MOOCs for B. Tech Honours

The additional 20 credits (for obtaining B. Tech with Honours) are to be gained through MOOCs. The complete description of the MOOCs relevant for the first year course are given in *Annexure-I*. The courses for subsequent years of study will be posted subsequently.

D. Guidelines regarding Mandatory Induction Program for the new students

All concerned are requested to follow the guidelines given in *Annexure-II* (Notice dt.06/12/2017) concerning Mandatory Induction Program. The colleges/ Institute may also refer to the AICTE Model Curriculum for Undergraduate Degree Courses in Engineering & Technology (January 2018) -Volume I (Page No.31-38), if necessary.

E. Mandatory Additional Requirement for earning B. Tech Degree

All concerned are requested to follow the guidelines in *Annexure-III* concerning Mandatory Additional Requirements.

F. Group division:

Group-A:

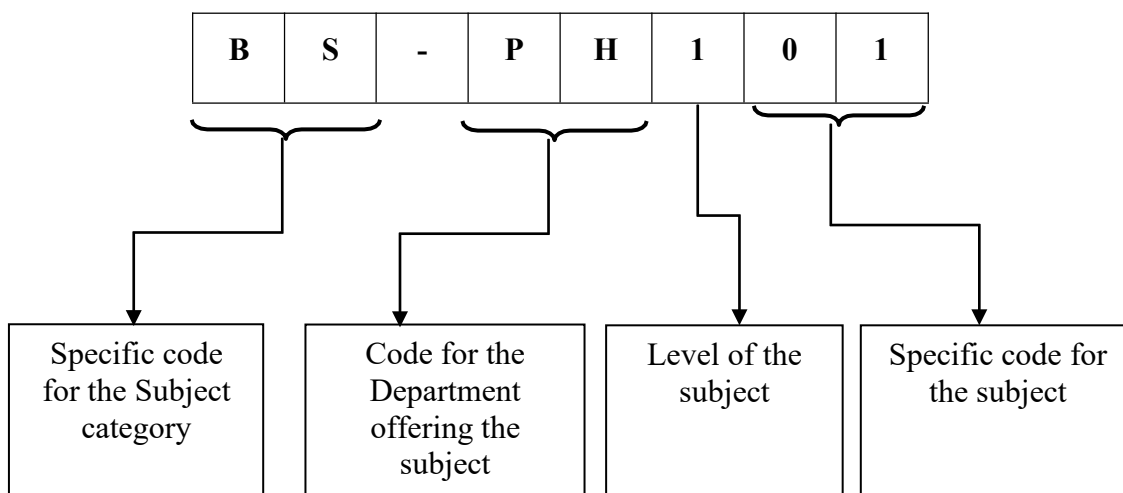
Chemistry based subjects: [Bio-Technology, Food Technology, Leather Technology, Textile Technology, Ceramic Technology, Chemical Engineering and any other Engineering that chooses to be Chemistry based] + Physics based subjects: [Mechanical Engineering, Production Engineering, Civil Engineering, Automobile Engineering, Marine Engineering, Apparel Production Engineering, Computer Science & Engineering, Information Technology.]

Group-B:

All Physics based subjects which are also Electrical & Electronics based [Electrical Engineering, Electronics & Communication Engineering, Applied Electronics & Instrumentation Engineering, Power Engineering, Electrical & Electronics Engineering, Bio-Medical Engineering, Instrumentation & Control Engineering]

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G. Subject Numbering Scheme:



List of Codes for Subject Category	
Code	Category Name
BS	Basic Science Courses
ES	Engineering Science Courses
HM	Humanities and Social Sciences including Management courses
PC	Professional core courses
PE	Professional Elective courses
OE	Open Elective courses
MC	Mandatory courses
PW	Project

List of Codes for Departments			
Code	Name of the Department	Code	Name of the Department
APM	Apparel Production Engineering	ECE	Electronics & Communication Engineering
AEIE	Applied Electronics & Instrumentation Engineering	FT	Food Technology
AUE	Automobile Engineering	IT	Information Technology
BME	Bio-Medical Engineering	ICE	Instrumentation & Control Engineering
BT	Bio-Technology	LT	Leather Technology
CT	Ceramic Technology	MRE	Marine Engineering
CHE	Chemical Engineering	ME	Mechanical Engineering
CE	Civil Engineering	PWE	Power Engineering
CSE	Computer Science & Engineering	PE	Production Engineering
EEE	Electrical & Electronics Engineering	TT	Textile Technology
EE	Electrical Engineering		

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First Year First Semester							
Mandatory Induction Program- 3 weeks duration							
Sl No.	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science course	BS-PH101/ BS-CH101	Physics-I (Gr-A)/ Chemistry-I(Gr-B)	3	1	0	4
2	Basic Science course	BS-M101/ BS-M102	Mathematics –IA*/ Mathematics –IB *	3	1	0	4
3	Engineering Science Courses	ES-EE101	Basic Electrical Engineering	3	1	0	4
	Total Theory			9	3	0	12
Practical							
1	Basic Science course	BS-PH191/ BS-CH191	Physics-I Laboratory (Gr-A)/ Chemistry-I Laboratory (Gr-B)	0	0	3	1.5
2	Engineering Science Courses	ES-EE191	Basic Electrical Engineering Laboratory	0	0	2	1
3	Engineering Science Courses	ES-ME191/ ES-ME192	Engineering Graphics & Design(Gr-B)/ Workshop/Manufacturing Practices(Gr-A)	1	0	4	3
	Total Practical			1		9	5.5
	Total of First Semester			10	3	9	17.5

* Mathematics –IA (BS-M101) - CSE & IT
 Mathematics –IB (BS-M102) - All stream except CSE & IT

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First Year Second Semester							
Sl No.	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science courses	BS-PH201/ BS-CH201	Physics-I (Gr-B)/ Chemistry-I (Gr-A)	3	1	0	4
2	Basic Science courses	BS-M201/ BS-M202	Mathematics –IIA [#] / Mathematics –IIB [#]	3	1	0	4
3	Engineering Science Courses	ES-CS201	Programming for Problem Solving	3	0	0	3
4	Humanities and Social Sciences including Management courses	HM-HU201	English	2	0	0	2
	Total Theory			11	2	0	13
Practical							
1	Basic Science courses	BS-PH291/ BS-CH291	Physics-I Laboratory (Gr-B)/ Chemistry-I Laboratory (Gr-A)	0	0	3	1.5
2	Engineering Science Courses	ES-CS291	Programming for Problem Solving	0	0	4	2
3	Engineering Science Courses	ES-ME291/ ES-ME292	Engineering Graphics & Design(Gr-A)/ Workshop/Manufacturing Practices(Gr-B)	1	0	4	3
4	Humanities and Social Sciences including Management courses	HM-HU291	Language Laboratory	0	0	2	1
	Total Practical			1	0	13	7.5
	Total of Second Semester			12	2	13	20.5

Mathematics –II (BS-M201) - CSE & IT
 Mathematics –II (BS-M202) - All stream except CSE & IT

	Group-A	Group-B
1 st Year 1 st Semester	Physics-I (BS-PH101); Workshop/Manufacturing Practices (ES-ME192)	Chemistry-I (BS-CH101); Engineering Graphics & Design (ES-ME191)
1 st Year 2 nd Semester	Chemistry-I (BS-CH201); Engineering Graphics & Design (ES-ME291)	Physics-I (BS-PH201); Workshop/Manufacturing Practices (ES-ME292)

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Course Code : BS-PH101/ BS-PH201	Category : Basic Science Courses
Course Title : Physics-I	Semester : First/ Second
L-T-P : 3-1-0	Credit:4
Pre-Requisites:	

Course objectives :

Basic concepts of mechanics, optics and its applications, electricity, magnetism and qualitative understanding of concepts of quantum physics and statistical mechanics.

1. Mechanics (7L)

Problems including constraints & friction. Basic ideas of vector calculus and partial differential equations. Potential energy function $F = -\text{grad } V$, equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy & momentum. Non-inertial frames of reference. Harmonic oscillator; Damped harmonic motion forced oscillations and resonance. Motion of a rigid body in a plane and in 3D. Angular velocity vector. Moment of inertia.

2. Optics (5L)

- Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits (only the expressions for max;min, & intensity and qualitative discussion of fringes); diffraction grating(resolution formulac only), characteristics of diffraction grating and its applications.
- Polarisation : Introduction, polarisation by reflection, polarisation by double reflection, scattering of light, circular and elliptical polarisation, optical activity.
- Lasers : Principles and working of laser : population inversion, pumping, various modes, threshold population inversion with examples .

3. Electromagnetism and Dielectric Magnetic Properties of Materials (8L)

- Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielecrrics, internal fields in a solid, Clausius- Mossotti equation(expression only), applications of dielectrics.
- Magnetisation , permeability and susceptibility, classificationof magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.

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4. Quantum Mechanics (16L)

- Introduction to quantum physics, black body radiation, explanation using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.

5. Statistical Mechanics (8L)

- Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics.

Course outcomes:

Students will be familiar with

- Basic concepts of mechanics
- Bragg's Law and introduction to the principles of lasers, types of lasers and applications.
- Various terms related to properties of materials such as, permeability, polarization, etc.
- Some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials.
- Simple quantum mechanics calculations.
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Learning Resources:

1. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited
2. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker, Wiley
3. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press
4. Engineering Mechanics (In SI Units) (SIE), S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati, McGraw Hill Education
5. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education
6. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education
7. Engineering Mechanics, M.K. Harbola, Cengage India
8. An Introduction to Mechanics (SIE), David Kleppner, Robert Kolenkow, McGraw Hill Education
9. Principles of mechanics, John L. Synge and Byron A. Griffith, New York, McGraw-Hill
10. Mechanics (Dover Books on Physics), J. P. Den Hartog, Dover Publications Inc.
11. Engineering Mechanics: Dynamics, L.G. Kraige J.L. Meriam, Wiley
12. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, Robert Eisberg, Robert Resnick, Wiley
13. Introduction to Quantum Mechanics, J. Griffiths David, Pearson Education
14. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press
15. Optics, Hecht, Pearson Education
16. Optics, Ghatak, McGraw Hill Education India Private Limited
17. Fundamentals of Statistical and Thermal Physics, Reif, Sarat Book Distributors
18. Statistical Mechanics, Pathria, Elsevier
19. Statistical Physics, L.D. Landau, E.M. Lifshitz, Butterworth-Heinemann

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Course Code : BS-CH101/ BS-CH201	Category : Basic Science Courses
Course Title : Chemistry-I	Semester : First/ Second
L-T-P : 3-1-0	Credit:4
Pre-Requisites:	

Detailed contents

i) Atomic and molecular structure (10 lectures)

Schrodinger equation. Particle in a box solutions and their applications for simple sample. Molecular orbitals of diatomic molecules (e.g.H₂). Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

ii) Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

iii) Intermolecular forces and potential energy surfaces (4 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena.

iv) Use of free energy in chemical equilibria (8 lectures)

First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

v) Periodic properties (4 Lectures)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

vi) Stereochemistry (4 lectures)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

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vii) Organic reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

Learning Resources:

1. Engineering Chemistry, Satyaprakash, Khanna Book Publishing, Delhi
2. University chemistry, by B. H. Mahan
3. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
4. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
5. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
6. Physical Chemistry, by P. W. Atkins
7. Spectroscopy of Organic Compounds, by P.S.Kalsi, New Age International Pvt Ltd Publishers
8. Physical Chemistry, P. C. Rakshit, Sarat Book House
9. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition
<http://bcs.whfreeman.com/vollhardtschore5e/default.asp>

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Course Code : BS-M101	Category : Basic Science Course
Course Title : Mathematics – I A	Semester : First (CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic	Lectures Hours
1	<i>Calculus (Integration):</i> Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	<i>Calculus (Differentiation):</i> Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	<i>Matrices:</i> Matrices, Vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.	7
4	<i>Vector Spaces:</i> Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem, composition of linear maps, Matrix associated with a linear map.	9
5	<i>Vector Spaces (Continued):</i> Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.	10

Course Outcomes:

The students will be able to:

Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

Understand the domain of applications of mean value theorems to engineering problems.

Learn different types of matrices, concept of rank, methods of matrix inversion and their applications.

Understand linear spaces, its basis and dimension with corresponding applications in the field of computer science.

Learn and apply the concept of eigen values, eigen vectors, diagonalisation of matrices and orthogonalization in inner product spaces for understanding physical and engineering problems

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Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. S.K. Mapa, Higher Algebra: Abstract and Linear, Sarat Book House Pvt.Ltd.
8. Hoffman and Kunze: Linear algebra, PHI.

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Course Code : BS-M102	Category : Basic Science Course
Course Title : Mathematics –I B	Semester : First (All stream except CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic	Lectures Hours
1	<i>Calculus (Integration):</i> Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	<i>Calculus (Differentiation):</i> Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	<i>Sequence and Series:</i> Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.	11
4	<i>Multivariate Calculus:</i> Limit, continuity and partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, Curl and Divergence.	9
5	<i>Matrices:</i> Inverse and rank of a matrix, Rank-nullity theorem; System of linear equations; Symmetric, Skew-symmetric and Orthogonal matrices; Determinants; Eigenvalues and Eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.	8

Course Outcomes:

After completing the course the student will be able to

Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

Understand the domain of applications of mean value theorems to engineering problems.

Learn the tools of power series and Fourier series to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.

Apply the knowledge for addressing the real life problems which comprises of several variables or attributes and identify extremum points of different surfaces of higher dimensions.

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Understand different types of matrices, their eigen values, eigen vectors, rank and also their orthogonal transformations which are essential for understanding physical and engineering problems.

Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.

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Course Code : ES-EE101	Category : Engineering Science Courses
Course Title : Basic Electrical Engineering	Semester : First
L-T-P : 3-1-0	Credit: 4
Pre-Requisites:	

Detailed contents:

Module 1: DC Circuits (8 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers (6 hours)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 hours)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters (6 hours)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

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Course Outcomes

To understand and analyze basic electric and magnetic circuits

To study the working principles of electrical machines and power converters.

To introduce the components of low voltage electrical installations

Learning Recourses:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Book Publishing Co. (P) Ltd., Delhi.
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
4. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
5. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
6. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

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Course Code : BS-PH191/ BS-PH291	Category : Basic Science course
Course Title : Physics-I Laboratory	Semester : First/ Second
L-T-P : 0-0-3	Credit:1.5
Pre-Requisites:	

Choose 10 experiments including at least one from Optics, Electricity and Magnetism and Quantum Mechanics and at least a total of six from these three groups.

Experiments in Optics

1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of a monochromatic light by Newton's ring
3. Determination of wavelength of a monochromatic light by Fresnel's bi-prism
4. Determination of wavelength of the given laser source by diffraction method

Electricity & Magnetism experiments

1. Determination of thermo electric power of a given thermocouple.
2. Determination of specific charge (e/m) of electron by J.J. Thompson's method.
3. Determination of dielectric constant of a given dielectric material.
4. Determination of Hall coefficient of a semiconductor by four probe method.
5. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.
6. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
7. Determination of unknown resistance using Carey Foster's bridge
8. Study of Transient Response in LR, RC and LCR circuits using expeyes
9. Generating sound from electrical energy using expeyes

Experiments in Quantum Physics

1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Lande-g factor using Electron spin resonance spectrometer.
4. Determination of Rydberg constant by studying Hydrogen spectrum.
5. Determination of Band gap of semiconductor.
6. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

Miscellaneous experiments

1. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure
2. Determination of bending moment and shear force of a rectangular beam of uniform cross-section
3. Determination of modulus of rigidity of the material of a rod by static method
4. Determination of rigidity modulus of the material of a wire by dynamic method
5. To determine the moment of inertia of a body about an axis passing through its centre of gravity and to determine the modulus of rigidity of the material of the suspended wire
6. Determination of coefficient of viscosity by Poiseuille's capillary flow method

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Course Code : BS-CH191/ BS-CH291	Category : Basic Science Courses
Course Title : Chemistry-I Laboratory	Semester : First/ Second
L-T-P : 0-0-3	Credit:1.5
Pre-Requisites:	

Choose 10 experiments from the following:

1. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
2. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
3. Determination of dissolved oxygen present in a given water sample.
4. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution)
5. Determination of surface tension and viscosity
6. Thin layer chromatography
7. Ion exchange column for removal of hardness of water
8. Determination of the rate constant of a reaction
9. Determination of cell constant and conductance of solutions
10. Potentiometry - determination of redox potentials and emfs
11. Saponification/acid value of an oil
12. Chemical analysis of a salt
13. Determination of the partition coefficient of a substance between two immiscible liquids
14. Adsorption of acetic acid by charcoal
15. Use of the capillary viscosimeters to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

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Course Code : ES-EE191	Category : Engineering Science Courses
Course Title : Basic Electrical Engineering Laboratory	Semester : First
L-T-P : 0-0-2	Credit: 1
Pre-Requisites:	

Choose 10 experiments from the following:

1. First activity: Introduction to basic safety precautions and mentioning of the do's and Don'ts. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about the modalities of evaluation.
2. Introduction and uses of following instruments :
 - (a) Voltmeter
 - (b) Ammeter
 - (c) Multimeter
 - (d) Oscilloscope

Demonstration of real life resistors, capacitors with color code , inductors and autotransformer.

3. Demonstration of cut-out sections of machines: DC machine, Induction machine, Synchronous machine and single phase induction machine.
4. Calibration of ammeter and Wattmeter.
5. Determination of steady state and transient response of R-L, R-C and R-L-C circuit to a step change in voltage.
6. Determination of steady state response of R-L and R-C and R-L-C circuit and calculation of impedance and power factor.
7. Determination of resonance frequency and quality factor of series and parallel R-L-C circuit.
8. (a) Open circuit and short circuit test of a single-phase transformer
(b) Load test of the transformer and determination of efficiency and regulation
9. Demonstration of three phase transformer connections. Voltage and current relationship, phase shifts between the primary and secondary side.
10. Measurement of power in a three phase unbalanced circuit by two wattmeter method.
11. Determination of Torque –Speed characteristics of separately excited DC motor.
12. Determination of Torque speed characteristics and observation of direction reversal by change of phase sequence of connection of Induction motor.
13. Determination of operating characteristics of Synchronous generator.
14. Demonstration of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter for speed control of an Induction motor
15. Demonstration of components of LT switchgear.

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Course Code : ES-ME191/ ES-ME 291	Category : Engineering Science Courses
Course Title : Engineering Graphics & Design	Semester : First/ Second
L-T-P : 1-0-4	Credit: 3
Pre-Requisites:	

Sl. No.	Content	Lecture (L)	Practical (P)
1	INTRODUCTION TO ENGINEERING DRAWING Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes.	1	4
2	LETTERING, DIMENSIONING, SCALES Plain scale, Diagonal scale and Vernier Scales.	1	4
3	GEOMETRICAL CONSTRUCTION AND CURVES Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Archimedian Spiral.	1	4
4	PROJECTION OF POINTS, LINES, SURFACES Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle, pentagon, Hexagon etc.) inclined Planes - Auxiliary Planes.	1	4
5	PROJECTION OF REGULAR SOLIDS Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).	1	4
6	COMBINATION OF REGULAR SOLIDS, FLOOR PLANS Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.	1	4
7	ISOMETRIC PROJECTIONS Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;	1	4

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8	SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)	1	4
9	OVERVIEW OF COMPUTER GRAPHICS, CUSTOMISATION & CAD DRAWING listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;	1	4
	ANNOTATIONS, LAYERING & OTHER FUNCTIONS applying dimensions to objects, applying annotations to drawings;		
10	Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;	2	8

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11	DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).	2	8
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Course Outcomes

The student will learn:

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling

General Instructions

1. In every topic some problems are to be done in the class and some are to be given to students as home assignment.
2. The problems for class work are to be prepared on drawing sheet of A1 size in the class/ using AutoCAD software.
3. The problems for home assignments are to be prepared on drawing copy/ using AutoCAD software.
4. Print out of every assignment is to be taken for CAD Drawings on Drawing sheets (A4 Sheets).
5. A title block must be prepared in each sheet/ assignment.

Following is the list of drawing instruments that required for making engineering drawings on paper with perfection.

1. Drawing Board
2. Mini drafter/ Set-squares (45°–45° & 60°–90°), T-square
3. Protractor (180°, 360°)
4. Scales (Plain, Diagonal)
5. Compass (Small and Large)
6. Divider (Small and Large)

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7. French Curves
8. Drawing paper (A1 Size)
9. Drawing pencil (H, HB, B)
10. Sharpener
11. Eraser
12. Drawing pins & clips
13. Duster or handkerchief etc.

Learning Resources:

1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House
2. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
5. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
6. Corresponding set of CAD Software Theory and User Manuals

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Course Code : ES-ME192/ ES-ME 292	Category : Engineering Science Courses
Course Title : Workshop/ Manufacturing Practices	Semester : First/ Second
L-T-P : 1-0-4	Credit:3
Pre-Requisites:	

(i) Lectures & videos:

Detailed contents:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Electrical & Electronics
5. Carpentry
6. Plastic moulding, glass cutting
7. Metal casting
8. Welding (arc welding & gas welding), brazing

(ii) Workshop Practice:

Machine shop (8 hours)

Typical jobs that may be made in this practice module:

To make a pin from a mild steel rod in a lathe.

To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Fitting shop (8 hours)

Typical jobs that may be made in this practice module:

To make a Gauge from MS plate.

Carpentry (8 hours)

Typical jobs that may be made in this practice module:

To make wooden joints and/or a pattern or like.

Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs))

Typical jobs that may be made in this practice module:

ARC WELDING (4 hours): To join two thick (approx 6mm) MS plates by manual metal arc welding.

GAS WELDING (4 hours): To join two thin mild steel plates or sheets by gas welding.

Casting (8 hours)

Typical jobs that may be made in this practice module:

One/ two green sand moulds to prepare, and a casting be demonstrated.

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Smithy (4 hours) ~ 4 hours

Typical jobs that may be made in this practice module:

A simple job of making a square rod from a round bar or like.

Plastic moulding & Glass cutting (4 hours)

Typical jobs that may be made in this practice module:

For plastic moulding, making at least one simple plastic component should be made.

For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made.

Electrical & Electronics (8 hours)

Familiarization with LT switchgear elements, making its sketches and noting down its specification. Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable.

Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point.

Simple wiring exercise to be executed to understand the basic electrical circuit.

Simple soldering exercises to be executed to understand the basic process of soldering.

Fabrication of a single-phase full wave rectifier with a step down transformer using four diodes and electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes

Upon completion of this laboratory course, students will be able to fabricate components with their own hands.

They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

By assembling different components, they will be able to produce small devices of their interest.

Learning Resources:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. and Steven S. Schmid, “Manufacturing Engineering and Technology”, 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu, “Manufacturing Technology – I” Pearson Education, 2008.
4. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4th edition, Prentice Hall India, 1998.
5. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGrawHill House, 2017.

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Course Code : BS-M201	Category : Basic Science Course
Course Title : Mathematics – II A	Semester : Second (CSE &IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics and BS-M101	

Module No.	Description of Topic	Lectures Hours
1	Basic Probability: Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the Multinomial distribution, Poisson approximation to the Binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.	11
2	Continuous Probability Distributions: Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities.	4
3	Bivariate Distributions: Bivariate distributions and their properties, distribution of sums and quotients, Conditional densities, Bayes' rule.	5
4	Basic Statistics: Measures of Central tendency, Moments, Skewness and Kurtosis, Probability distributions: Binomial, Poisson and Normal and evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.	8
5	Applied Statistics: Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	8
6	Small samples: Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	4

Course Outcomes:

The students will be able to:

Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.

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Understand the basic ideas of statistics with different characterisation of a univariate and bivariate data set.

Apply statistical tools for analysing data samples and drawing inference on a given data set.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
3. S. Ross, A First Course in Probability, Pearson Education India
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.
5. John E. Freund, Ronald E. Walpole, Mathematical Statistics, Prentice Hall.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
7. N.G. Das, Statistical Methods (Combined Volume), Tata-McGraw Hill.

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Course Code : BS-M202	Category : Basic Science Course
Course Title : Mathematics – II B	Semester : Second (All stream except CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics and BS-M102	

Module No.	Description of Topic	Lectures Hours
1	<i>Multivariate Calculus (Integration):</i> Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, change of variables (Cartesian to Polar), Applications: Areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.	11
2	<i>First order ordinary differential equations:</i> Exact, linear and Bernoulli's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.	5
3	<i>Ordinary differential equations of higher orders:</i> Second order linear differential equations with constant coefficients, Use of D-operators, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.	9
4	<i>Complex Variable – Differentiation</i> Differentiation of complex functions, Cauchy-Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithmic) and their properties; Conformal mappings, Mobius transformations and their properties.	6
5	<i>Complex Variable – Integration</i> Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, Zeros of analytic functions, Singularities, Laurent's series; Residues, Cauchy residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.	9

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Course Outcomes:

The students will be able to:

Learn the methods for evaluating multiple integrals and their applications to different physical problems.

Understand different techniques to solve first and second order ordinary differential equations with its formulation to address the modelling of systems and problems of engineering sciences.

Learn different tools of differentiation and integration of functions of a complex variable that are used with various other techniques for solving engineering problems.

Apply different types of transformations between two 2- dimensional planes for analysis of physical or engineering problems.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. E. L. Ince, Ordinary Differential Equations, Dover Publications.
8. J. W. Brown and R. V. Churchill, Complex Variables and Applications, Mc-Graw Hill.

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Course Code : ES-CS201	Category : Engineering Science Courses
Course Title : Programming for Problem Solving	Semester : Second
L-T-P : 3-0-0	Credit :3
Pre-Requisites:	

Detailed contents

Unit 1: Introduction to Programming (4 lectures)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - **(1 lecture)**.

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. **(1 lecture)**

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- **(2 lectures)**

Unit 2: Arithmetic expressions and precedence (2 lectures)

Unit 3: Conditional Branching and Loops (6 lectures)

Writing and evaluation of conditionals and consequent branching **(3 lectures)**

Iteration and loops **(3 lectures)**

Unit 4: Arrays (6 lectures)

Arrays (1-D, 2-D), Character arrays and Strings

Unit 5: Basic Algorithms (6 lectures)

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 6: Function (5 lectures)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Unit 7: Recursion (4 -5 lectures)

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 8: Structure (4 lectures)

Structures, Defining structures and Array of Structures

Unit 9: Pointers (2 lectures)

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Unit 10: File handling (only if time is available, otherwise should be done as part of the lab)

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

Course Outcomes

The student will learn

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical errors.
- To implement conditional branching, iteration and recursion.
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- To apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.

Learning Resources:

1. R. S. Salaria, Computer Concepts and Programming in C, Khanna Publishers
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
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Course Code : ES-CS291	Category : Engineering Science Courses
Course Title : Programming for Problem Solving	Semester : Second
L-T-P : 0-0-4	Credit:2
Pre-Requisites:	

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

Tutorial 12: File handling:

Lab 12: File operations

Laboratory Outcomes

To formulate the algorithms for simple problems

To translate given algorithms to a working and correct program

To be able to correct syntax errors as reported by the compilers

To be able to identify and correct logical errors encountered at run time

To be able to write iterative as well as recursive programs

To be able to represent data in arrays, strings and structures and manipulate them through a program

To be able to declare pointers of different types and use them in defining self-referential structures.

To be able to create, read and write to and from simple text files.

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

Course Code : HM-HU201	Category : Humanities and Social Sciences including Management courses
Course Title : English	Semester : Second
L-T-P : 2-0-0	Credit:2
Pre-Requisites:	

Detailed contents

1. Vocabulary Building

- 1.1 The concept of Word Formation: Compounding, Backformation, Clipping, Blending.
- 1.2 Root words from foreign languages and their use in English
- 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
- 1.4 Synonyms, antonyms, and standard abbreviations: Acronyms

2. Basic Writing Skills

- 2.1 Sentence Structures & Types: Simple, Compound, Complex
- 2.2 Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration
- 2.3 Importance of proper punctuation
- 2.4 Creating coherence: Arranging paragraphs & Sentences in logical order
- 2.5 Creating Cohesion: Organizing principles of paragraphs in documents
- 2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

- 3.1 Subject-verb agreement
- 3.2 Noun-pronoun agreement
- 3.3 Misplaced modifiers
- 3.4 Articles
- 3.5 Prepositions
- 3.6 Redundancies
- 3.7 Clichés

4. Nature and Style of sensible Writing

- 4.1 Describing
- 4.2 Defining
- 4.3 Classifying
- 4.4 Providing examples or evidence
- 4.5 Writing introduction and conclusion

5. Writing Practices

- 5.1 Comprehension
- 5.2 Précis Writing
- 5.3 Essay Writing
- 5.4 Business Letter, Cover Letter & CV; E-mail

Addendum

Some examples of English words with foreign roots

Greek Root/Affix	Examples
Anti	Antisocial, antiseptic

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Auto	Automatic, autograph
Anthropos	Anthropology, philanthropy
Bio	Biography
Chronos	Time
Di	Dilemma
Bio	Biology
Biblio	Bibliography
Chron	Chronology
Cracy	Contradiction
Geo	Geology
Hyper	Hyperactive
Mania	Kleptomania
Mega	Megaserial
Eu	Eulogy, euphoria
Geo	Geology
Graph	autograph, photograph
Hetero	Heterogeneous
Hyper	Hyperactive
Hypo	hypodermic, hypoglycemia
Macro	Macrocosm
Mega	megalomania
Micro	microcosm

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Mono	Monarch
Pan	Panorama
Pathos	Pathetic
Phobia	Hydrophobia
Pod (Gk), ped (Latin)	Pseudopodia
Poly	polyglot
Tele	Telephone
Theo	Theology, theist
Latin Root	Examples
Aud	Audible
Bene	Beneficial
Brev	abbreviate, brief
circum	Circulate
Contra	Contradict
Cred	Credible
Dict	Diction
Femina	Feminine
Inter	Internet, interval
Magna	Magnificent
Mal	Malnutrition
Multi	multinational
Nova	Novel
Multi	Multiple, multiplex
Non	Nonstop

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Pre	Previous, predicate
Re	Redo, rewind
Scrib	Scripture
Spect	Spectator
Trans	Transport
Uni	Unity
Omni	Omnipotent
Semi	Semicircle
Sub	Subway
somnus	Insomnia,
Super	Superman
Sym	Sympathy
scribe	Describe, scribble(write illegibly), inscribe
Trans	Transform
Un	Unnecessary
Uni	Universal

Learning Resources:

- (i) Kulbushan Kumar, R S Salaria, Effective Communication Skills, Khanna Publishing House, Delhi.
- (ii) Practical English Usage. Michael Swan. OUP. 1995.
- (iii) Remedial English Grammar. F.T. Wood. Macmillan. 2007
- (iv) On Writing Well. William Zinsser. Harper Resource Book. 2001
- (v) Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- (vi) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
- (vii) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
- (viii) Universal English Prof. Prasad Kataria Publications, 2019.
- (ix) "Communication Skills for Professionals"-Nira Konar, Prentice Hall of India 2nd edition, New Delhi, 2011
- (x) Gajendra Singh Chauhan, Smita Kashiramka and L. Thimmesha. Functional English. Cengage, 2019.

Course Outcomes

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Course Code : HM-HU291	Category : Humanities and Social Sciences including Management courses
Course Title : Language Laboratory	Semester : Second
L-T-P : 0-0-2	Credit:1
Pre-Requisites:	

- | | |
|---|----|
| 1) Honing 'Listening Skill' and its sub skills through Language Lab Audio device; | 3P |
| 2) Honing 'Speaking Skill' and its sub skills | 2P |
| 3) Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/
Voice modulation/ Stress/ Intonation/ Pitch & Accent) of connected speech | 2P |
| 4) Honing 'Conversation Skill' using Language Lab Audio –Visual input;
Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone &
Role Play Mode) | 2P |
| 5) Introducing 'Group Discussion' through audio –Visual input and acquainting them
with key strategies for success | 2P |
| 6) G D Practice Sessions for helping them internalize basic Principles
(turn- taking, creative intervention, by using correct body language, courtesies &
other soft skills) of GD | 4P |
| 7) Honing 'Reading Skills' and its sub skills using Visual / Graphics/
Diagrams /Chart Display/Technical/Non Technical Passages
Learning Global / Contextual / Inferential Comprehension; | 2P |
| 8) Honing 'Writing Skill' and its sub skills by using
Language Lab Audio –Visual input; Practice Sessions | 2P |

Course Outcomes

- The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

MOOCs for B. Tech Honours



Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal

Notice

1st May, 2018

MOOCs for B.Tech Honours (Applicable from the session 2018-2019)

Preamble

All India Council for Technical Education (AICTE) has introduced Model Curriculum for Bachelor of Technology programme with 160 credits in the entire programme of 4 years, and additional 20 credits will be required to be done for the degree of Bachelor of Technology with Honours. These additional 20 credits will have to be acquired with online courses (MOOCs) as per AICTE. So students will have to complete additional 20 credits through MOOCs within 4 years of time. This creates an excellent opportunity for students to acquire the necessary skill set for employability through massive online courses where the rare expertise of world famous experts from academics and industry are available. Maulana Abul Kalam Azad University of Technology, West Bengal (MAKAUT,WB) has thus decided to introduce AICTE model curriculum for its B.Tech Programmes and suggest baskets for MOOCs available year wise for the four-year long B.Tech programme from the sessions 2018-2019. The basket for MOOCs will be a dynamic one, as courses keep on updating with time. Few essential skill sets required for employability are also identified year wise by MAKAUT,WB. For MOOCs platforms where examination or assessment is absent (like SWAYAM) or where certification is costly (like Coursera or edX), faculty members of the Institutes are to audit the courses and prepare the examination question papers, for the courses undertaken by the students of respective Institutes, so that MAKAUT,WB can conduct examination for the course. The total of 20 credits that is required to be attained for B.Tech Honours degree are distributed over four years in the following way:

For first year	:	8 credits
For second year	:	4 credits
For third year	:	4 credits
For fourth year	:	4 credits

A student of first year has to cover courses from at least three skills :

1. Computer Programing with Python / R
2. Soft skill
3. Ethics

Courses are * marked in the above areas

If a student is unable to cover the credits assigned for the first year, he/she can do these courses in either of the subsequent years, but he/she has to choose the courses from the basket of MOOCs announced by MAKAUT,WB from time to time. The same rule will be applicable for the other years of the programme.

The basket for MOOCs for the 1st year B. Tech for the session 2018-2019 are made available herewith.

By order.

MOOCs for First Year, Engineering and Technology

Sl. No	Course	Provider	Duration	Credits	Name of University / Institution
1.	Presentation Skills: Designing Presentation Slides	Coursera *	4 weeks	1	Tomsk State University
2.	Effective Problem-Solving and Decision-Making	Coursera	4 weeks	1	University of California
3.	Communication in the 21st Century Workplace	Coursera *	4 weeks	1	University of California
4.	Psychology at Work	Coursera *	6 weeks	2	University of Western Australia
5.	Critical Thinking & Problem Solving	EdX *	3 weeks	3	Rochester Institute of Technology
6.	Successful Career Development	Coursera	7 weeks	2	University System of Georgia
7.	Working in Teams: A Practical Guide	edX	4 weeks	1	University of Queensland
8.	Communication theory: bridging academia and practice	Coursera	9 weeks	3	Higher School of Economics
9.	Speaking Effectively	NPTEL *	8 weeks	3	Indian Institute of Technology, Kharagpur
10.	Introduction to Philosophy	Coursera	5 weeks	1	University of Edinburgh
11.	Moralities of Everyday Life	Coursera	6 weeks	2	Yale University
12.	Introduction to Logic	Coursera *	10 weeks	3	Stanford University
13	Write Professional Emails in English	Coursera *	5 weeks	2	Georgia Institute of Technology
14	Technical Writing	Coursera	5 weeks	1	Moscow Institute of Physics and Technology
15	Learn to Program: The Fundamentals	Coursera	7 weeks	2	University of Toronto
16	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
17	Introduction to Problem Solving and Programming	NPTEL	12 weeks	4	NPTEL
18	The Science of Well Being	Coursera	6 weeks	2	Yale University
19	Developing Soft Skills and Personality	NPTEL	8 weeks	3	
20	Programming Basics	edX	9 weeks	3	IIT Bombay
21	Introduction to Python: Absolute Beginner	EdX *	5 weeks	2	Microsoft
22	Inferential Statistics	Coursera *	7 weeks	2	University of Amsterdam
23	Linear Regression and Modelling	Coursera	4 weeks	1	Duke University
24	Foundation of Data Structures	edX	6 weeks	2	IIT Bombay
25	Introduction to Logic	NPTEL	12 weeks	4	NPTEL
26	Introduction to Probability and Data	Coursera *	5 weeks	1	Duke University
27	Ethics	NPTEL *	12 weeks	4	
28	Science, Technology and Society	NPTEL	12 weeks	4	
29	Creating Innovation	Coursera	6 weeks	2	Macquarie University
30	Ethical Leadership Through Giving Voice to Values	Coursera *	4 weeks	2	University of Virginia
31	Creativity, Innovation, and Change	Coursera *	6 weeks	2	Pennsylvania State University
32	Interpersonal Communication for Engineering Leaders	Coursera	4 weeks	1	Rice University

33	Learn to Program: The Fundamentals	Coursera *	7 weeks	3	University of Toronto
34	Introduction to Mathematical Thinking	Coursera *	9 weeks	3	Stanford University
35	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
36	A Life of Happiness and Fulfillment	Coursera	6 weeks	2	Indian School of Business
37	Model Thinking	Coursera	12 weeks	4	University of Michigan
38	Introduction to Philosophy: God, Knowledge, and Consciousness	edX	12 weeks	4	MIT
39	Soft skills	NPTEL *	12 Weeks	4	IIT Roorkee
40	Developing Soft Skills and Personality	NPTEL *	8 weeks	3	IIT Kanpur
41	Indian Fiction in English	NPTEL	12 Weeks	4	IIT Madras
42	Development of Sociology in India	NPTEL	4 Weeks	1	IIT Kanpur
43	Intellectual Property	NPTEL	12 Weeks	4	IIT Madras
44	Essential Statistics for Data Analysis using Excel	EdX *	Self Paced	3	Microsoft
45	Ethics and Law in Data and Analytics	edX	Self Paced	4	Microsoft
46	Climate Change Mitigation in Developing Countries	Coursera *	6 weeks	3	University of Cape town
47	Web Design for Everybody (Basics of Web Development and Coding) Specialization	Coursera	15weeks	4	University of Michigan
48	Ecology: Ecosystem Dynamics and Conservation	Coursera	5 weeks	1	American Museum of Natural History, Howard Hughes Medical Institute
49	Environmental Studies: A Global Perspective	EdX *	Self Paced	4	Curtin University
50	Introduction to Computer Science and Programming Using Python	edX *	Self Paced	4	MIT, USA
51	Statistics and R	edX *	Self Paced	4	Harvard University
52	Introduction to Programming in C	Coursera *	4 weeks	4	Duke University
53	Java Programming: Solving Problems with Software	Coursera	4 weeks	4	Duke University
54	Grammar and Punctuation	Coursera	4 weeks	1	University of California
55	How to Write an Essay	Coursera *	5 weeks	1	University of California, Berkeley
56	Conversational English Skills	EdX *	10 weeks	3	Tsinghua University
57	Advanced Writing	Coursera *	4 weeks	1	University of California, Irvine
58	Speak English Professionally: In Person, Online & On the Phone	Coursera *	5 weeks	1	Georgia Institute of Technology
59	English for Science, Technology, Engineering, and Mathematics	Coursera	5 weeks	1	University of Pennsylvania
60	English Composition	edX	8 weeks	3	Arizona State University
61	Take Your English Communication Skills to the Next Level	Coursera *	4 weeks	1	Georgia Institute of Technology

**Guidelines regarding
Mandatory Induction Program for
the new students**



Maulana Abul Kalam Azad University of Technology, West Bengal
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BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Date: 06.12.2017

Maulana Abul Kalam Azad University of Technology, West Bengal

Guidelines regarding Induction Programme for the new students

(As per Model Curriculum for 1st Year UG degrees courses in Engineering & Technology, November 2017)

To be followed from the 2018-19 academic session

Preamble: Engineering education has evolved globally in a continuous manner to address the twin needs of industry and society. It is now an accepted fact that the institutions imparting technical education should aspire to create manpower who will possess strong technical knowledge and skill, have leadership qualities and be a team player, capable of coming up with innovative solutions and be alive to societal and community concerns.

The aim of the Induction Programme is to acclimatize the students to the environment of their engineering institution, give them a flavour of the exciting new world of education that they are entering, provide them with mentoring schemes, and make them aware of their neighbourhood, society and people. This will allow them to evolve as well rounded individuals.

The following schedule is laid down by the University to implement the three week long Induction Programme:

Week 1	1 st Half	Day 1	Overall introduction of the new students to the Institution, its different Departments & Faculty Members
	2 nd Half	Day 1	(a) Assignment of faculty mentors to the new students (b) Assessment and allotment for mentoring by senior students preferably from the second year
	2 hrs	Day 2, 3, 4, 5	Lectures by eminent personalities on different areas such as (a) Introduction to Engineering (b) Various topics of science and technology (c) Innovation and entrepreneurship (d) Creative and performing arts (e) Social issues
	2 hrs.	Day 2, 3, 4, 5	Participation in Games, Yoga, Meditation etc.
	2 hrs	Day 2, 3, 4, 5	Visit to the different Departments of the Institute
Week 2 (All Days)	2hrs		Scheduled class lectures as per time table.
	2hrs		Students to be conducted through proficiency modules to be prepared by respective Colleges for ascertaining English skills & Computer knowledge of the students

			and to prepare a report on the same
	2hrs		Participation in Games, Sports, Yoga, Creative arts etc.
Week 3	2hrs		Scheduled class lectures as per time table
		Day 1	Visits to neighbourhood locations
		Day 2	Visits to natural spots in adjoining areas to understand the effect of nature on society
		Day 3	Visits to Science Museum / laboratories
		Day 4	Visits to NGOs
		Day 5	

Any other activity, as deemed fit by the Director/Principal of the affiliated Colleges, may be proposed and discussed with the Academic Coordinator of the University, by sending email to the following address: academics.makaut@gmail.com.

Note: 1) If necessary, networking may be established with NGOs to facilitate the different components and aspects of the Induction Programme.

Mandatory Additional Requirement for earning B. Tech Degree



Maulana Abul Kalam Azad University of Technology, West Bengal
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Notice

Mandatory Additional Requirement for earning B.Tech Degree

Addressing the needs of the industry and the society: Globally, engineering education systems have continuously evolved, in order to address the needs of the industry and the society. It is becoming imperative that every University should create opportunities for the students to inculcate attributes, which are not restricted only to engineering knowledge and acumen. Industry needs professionals who can work successfully in teams, who have leadership qualities, who are alive to social and community needs and who can bring innovation and creativity to their work and who are also digitally proficient. Hence, in order to prepare its students to match these multiple requirements, MAKAUT, WB has created a unique mechanism of awarding 100 Activity Points over and above the academic grades. It is planned that the students at MAKAUT, WB will be able to reap benefits from these activities at their own pace and comfort. It is expected that by the time MAKAUT, WB's students reach their Final Year, they would have developed themselves so well both through their studies in the respective technological field and through their active participation in the co-curricular and extra-curricular activities as also through SAWYAM based learning activities that they would be well-prepared for contributing to building the India and the world of their dreams.

The additional requirement applies to: Every student, who is admitted to the 4 years B.Tech program from the academic year 2018-19 onwards, is required to earn minimum 100 Activity Points in addition to the required academic grades, for getting MAKAUT, WB's B.Tech degree. Similarly, it is mandatory to earn 75 Activity Points, in addition to the academic grades, for getting B.Tech degree by a student (Lateral Entry) who is admitted to the B.Tech program from the academic year 2018-19 onwards. *(Please see Table 1 for details.)* [Lateral Entry students will have a multiplying factor of 1.33 to bring uniformity in score].

Level of Entry in B.Tech Course	Total duration for earning Points	Minimum Points
1 st Year from the academic year 2018-19 onwards	1 st to 4 th Year	100
2 nd Year from the academic year 2018-19 onwards (Lateral Entry)	2 nd to 4 th Year	75

Table – I

For existing Students (except students in the 4th year): Every student, who is admitted to the 4 years B.Tech program prior to the academic year 2018-19, is required to earn minimum number of Activity Points as per Table II in addition to the required academic grades, for getting MAKAUT, WB's B.Tech degree.

Current Semester	Total Points to be earned During the full course
2 nd	100
4 th	75
6 th	50

Table –II

These points must be earned on the basis of active participation in co-curricular and extracurricular activities spanning through all the semesters of study. Every student may choose, as per his/her liking, activities in order to achieve the mandatory points (as per Table-III, depending on his/her entry level), before becoming eligible for award of the Degree. These activities can be spread over the years, as per convenience of the student.

Notes:

- **Current 4th year students who are going to sit for Final Semester examination in May-June, 2018 are outside the preview of this Mandatory Additional Requirement**
- Every student shall participate in the co-curricular and extra-curricular activities and produce documentary proof to the designated Faculty Members appointed by the Head of Department / Principal / Director in the respective college. Thereby the student should earn the required Points before *her* she appears for his/ her Final Examinations.
- A student's result of his/her Final Examinations will be withheld until he/she completes the minimum Activity Points by the end of his/her B.Tech Program.
- In every semester, every student is required to prepare a file containing documentary proofs of activities, done by him / her. This file will be duly verified and Activity Points will be assigned by the teachers as appointed above, at the end of every semester.
- The college will form a 3 members committee and finalize the Activity Points for each student before entering them into the Online Point Entry System (at the URL, as specified by the COE of the University).
- Every student has to earn at least 100 activity points. The points students has earned will be reflected in the student's marksheet.
- Activity points earned by Lateral Entry students will be multiplied by 1.33.

Table III provides a List of Activity Heads and Sub-Activity Heads along with their capping of the Activity Points that can be earned by the students during the entire B.Tech duration.

Sl. No.	Name of the Activity	Points	Maximum Points Allowed
1.	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) (per course)	20	40
2.	Tech Fest/Teachers Day/Freshers Welcome		
	Organizer	5	10
	Participants	3	6
5.	Rural Reporting	5	10
6.	Tree Plantation (per tree)	1	10
7.	Participation in Relief Camps	20	40
8.	Participation in Debate/Group Discussion/ Tech quiz	10	20
9.	Publication of Wall magazine in institutional level (magazine/article/internet)	10	20
10.	Publication in News Paper, Magazine & Blogs	10	20
11.	Research Publication (per publication)	15	30
12.	Innovative Projects (other than course curriculum)	30	60
13.	Blood donation	8	16
	Blood donation camp Organization	10	20
15.	Participation in Sports/Games		
	College level	5	10
	University Level	10	20
	District Level	12	24
	State Level	15	30
	National/International Level	20	20
21.	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20
22.	Member of Professional Society	10	20
23.	Student Chapter	10	20
24.	Relevant Industry Visit & Report	10	20
25.	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	5	10
26.	Participation in Yoga Camp (Certificate to be submitted)	5	10
27.	Self-Entrepreneurship Programme	20	20
28.	Adventure Sports with Certification	10	20
29.	Training to under privileged/Physically challenged	15	30
30.	Community Service & Allied Activities	10	20

Suggestions from the College Principals will be considered to append in the above Table-III.

Sd/-

Registrar(Acting)
MAKAUT,WB

Maulana Abul Kalam Azad University of Technology, West Bengal
Record of Activities for Mandatory Additional Requirement

Annexure-I
Rev:00

College Name (College Code):						Department:						
Student Name:				University Roll No:			Registration No:					
Sl No	Activity	Points	Max. Points Allowed	Points Earned								
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	Total
1	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) per course											
	For 12 weeks duration	20	40									
	For 8 weeks duration	16										
2	Tech Fest/Teachers Day/Freshers Welcome											
	Organizer	5	10									
	Participants	3	6									
3	Rural Reporting	5	10									
4	Tree Plantation and up keeping (per tree)	1	10									
5	Participation in Relief Camps	20	40									
6	Participation in Debate/Group Discussion/ Tech quiz	10	20									
7	Publication of Wall magazine in institutional level (magazine/article/internet)											
	Editor	10	20									
	Writer	6	12									
8	Publication in News Paper, Magazine & Blogs	10	20									
9	Research Publication (per publication)	15	30									
10	Innovative Projects (other than course curriculum)	30	60									
11	Blood donation	8	16									
	Blood donation camp Organization	10	20									

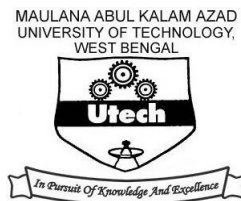
Maulana Abul Kalam Azad University of Technology, West Bengal
Record of Activities for Mandatory Additional Requirement

Annexure-I
Rev:00

Sl No	Activity	Points	Max. Points Allowed	Points Earned								Total
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	
12	<i>Participation in Sports/Games</i>											
	College level	5	10									
	University Level	10	20									
	District Level	12	24									
	State Level	15	30									
	National/International Level	20	20									
13	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20									
14	Member of Professional Society	10	20									
15	Student Chapter	10	20									
16	Relevant Industry Visit & Report	10	20									
17	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	5	10									
18	Participation in Yoga Camp (Certificate to be submitted)	5	10									
19	Self-Entrepreneurship Programme	20	20									
20	Adventure Sports with Certification	10	20									
21	Training to under privileged / Differently abled	15	30									
22	Community Service & Allied Activities	10	20									
Total Points												
Signature of Mentor												
Signature of HOD												
*Please abide strictly to the Notes at the end of the Notice by Registrar, MAKAUT, WB regarding Mandatory Additional Requirement for earning B.Tech Degree												
* <i>Annexure-I</i> is to be retained in the Institute records with all documentary proofs of activities (to be verified by the University as and when required).												

1st Year Curriculum for B.Tech courses in Engineering & Technology

(Applicable from the academic session 2018-2019)



Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits

B. Range of credits :

A range of credits from 150 to 160 for a student to be eligible to get B.Tech Degree in Engineering. A student will be eligible to get B.Tech Degree *with Honours*, if he/she completes an additional 20 credits. These could be acquired through Massive Open Online Courses (MOOCs).

C. MOOCs for B. Tech Honours

The additional 20 credits (for obtaining B. Tech with Honours) are to be gained through MOOCs. The complete description of the MOOCs relevant for the first year course are given in *Annexure-I*. The courses for subsequent years of study will be posted subsequently.

D. Guidelines regarding Mandatory Induction Program for the new students

All concerned are requested to follow the guidelines given in *Annexure-II* (Notice dt.06/12/2017) concerning Mandatory Induction Program. The colleges/ Institute may also refer to the AICTE Model Curriculum for Undergraduate Degree Courses in Engineering & Technology (January 2018) -Volume I (Page No.31-38), if necessary.

E. Mandatory Additional Requirement for earning B. Tech Degree

All concerned are requested to follow the guidelines in *Annexure-III* concerning Mandatory Additional Requirements.

F. Group division:

Group-A:

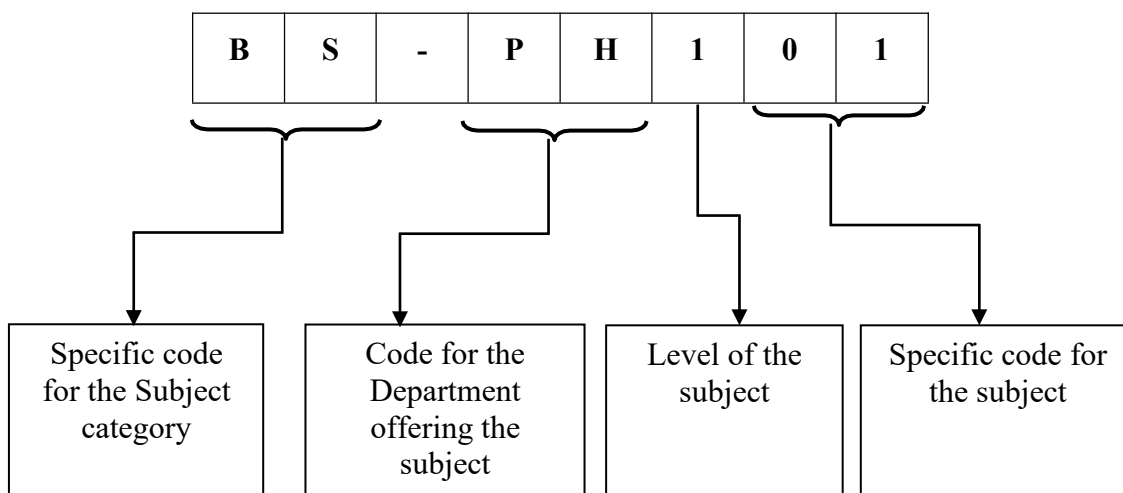
Chemistry based subjects: [Bio-Technology, Food Technology, Leather Technology, Textile Technology, Ceramic Technology, Chemical Engineering and any other Engineering that chooses to be Chemistry based] + Physics based subjects: [Mechanical Engineering, Production Engineering, Civil Engineering, Automobile Engineering, Marine Engineering, Apparel Production Engineering, Computer Science & Engineering, Information Technology.]

Group-B:

All Physics based subjects which are also Electrical & Electronics based [Electrical Engineering, Electronics & Communication Engineering, Applied Electronics & Instrumentation Engineering, Power Engineering, Electrical & Electronics Engineering, Bio-Medical Engineering, Instrumentation & Control Engineering]

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G. Subject Numbering Scheme:



List of Codes for Subject Category	
Code	Category Name
BS	Basic Science Courses
ES	Engineering Science Courses
HM	Humanities and Social Sciences including Management courses
PC	Professional core courses
PE	Professional Elective courses
OE	Open Elective courses
MC	Mandatory courses
PW	Project

List of Codes for Departments			
Code	Name of the Department	Code	Name of the Department
APM	Apparel Production Engineering	ECE	Electronics & Communication Engineering
AEIE	Applied Electronics & Instrumentation Engineering	FT	Food Technology
AUE	Automobile Engineering	IT	Information Technology
BME	Bio-Medical Engineering	ICE	Instrumentation & Control Engineering
BT	Bio-Technology	LT	Leather Technology
CT	Ceramic Technology	MRE	Marine Engineering
CHE	Chemical Engineering	ME	Mechanical Engineering
CE	Civil Engineering	PWE	Power Engineering
CSE	Computer Science & Engineering	PE	Production Engineering
EEE	Electrical & Electronics Engineering	TT	Textile Technology
EE	Electrical Engineering		

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First Year First Semester							
Mandatory Induction Program- 3 weeks duration							
Sl No.	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science course	BS-PH101/ BS-CH101	Physics-I (Gr-A)/ Chemistry-I(Gr-B)	3	1	0	4
2	Basic Science course	BS-M101/ BS-M102	Mathematics –IA*/ Mathematics –IB *	3	1	0	4
3	Engineering Science Courses	ES-EE101	Basic Electrical Engineering	3	1	0	4
	Total Theory			9	3	0	12
Practical							
1	Basic Science course	BS-PH191/ BS-CH191	Physics-I Laboratory (Gr-A)/ Chemistry-I Laboratory (Gr-B)	0	0	3	1.5
2	Engineering Science Courses	ES-EE191	Basic Electrical Engineering Laboratory	0	0	2	1
3	Engineering Science Courses	ES-ME191/ ES-ME192	Engineering Graphics & Design(Gr-B)/ Workshop/Manufacturing Practices(Gr-A)	1	0	4	3
	Total Practical			1		9	5.5
	Total of First Semester			10	3	9	17.5

* Mathematics –IA (BS-M101) - CSE & IT
 Mathematics –IB (BS-M102) - All stream except CSE & IT

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First Year Second Semester							
Sl No.	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science courses	BS-PH201/ BS-CH201	Physics-I (Gr-B)/ Chemistry-I (Gr-A)	3	1	0	4
2	Basic Science courses	BS-M201/ BS-M202	Mathematics –IIA [#] / Mathematics –IIB [#]	3	1	0	4
3	Engineering Science Courses	ES-CS201	Programming for Problem Solving	3	0	0	3
4	Humanities and Social Sciences including Management courses	HM-HU201	English	2	0	0	2
	Total Theory			11	2	0	13
Practical							
1	Basic Science courses	BS-PH291/ BS-CH291	Physics-I Laboratory (Gr-B)/ Chemistry-I Laboratory (Gr-A)	0	0	3	1.5
2	Engineering Science Courses	ES-CS291	Programming for Problem Solving	0	0	4	2
3	Engineering Science Courses	ES-ME291/ ES-ME292	Engineering Graphics & Design(Gr-A)/ Workshop/Manufacturing Practices(Gr-B)	1	0	4	3
4	Humanities and Social Sciences including Management courses	HM-HU291	Language Laboratory	0	0	2	1
	Total Practical			1	0	13	7.5
	Total of Second Semester			12	2	13	20.5

Mathematics –II (BS-M201) - CSE & IT
 Mathematics –II (BS-M202) - All stream except CSE & IT

	Group-A	Group-B
1 st Year 1 st Semester	Physics-I (BS-PH101); Workshop/Manufacturing Practices (ES-ME192)	Chemistry-I (BS-CH101); Engineering Graphics & Design (ES-ME191)
1 st Year 2 nd Semester	Chemistry-I (BS-CH201); Engineering Graphics & Design (ES-ME291)	Physics-I (BS-PH201); Workshop/Manufacturing Practices (ES-ME292)

Maulana Abul Kalam Azad University of Technology, West Bengal
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Course Code : BS-PH101/ BS-PH201	Category : Basic Science Courses
Course Title : Physics-I	Semester : First/ Second
L-T-P : 3-1-0	Credit:4
Pre-Requisites:	

Course objectives :

Basic concepts of mechanics, optics and its applications, electricity, magnetism and qualitative understanding of concepts of quantum physics and statistical mechanics.

1. Mechanics (7L)

Problems including constraints & friction. Basic ideas of vector calculus and partial differential equations. Potential energy function $F = -\text{grad } V$, equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy & momentum. Non-inertial frames of reference. Harmonic oscillator; Damped harmonic motion forced oscillations and resonance. Motion of a rigid body in a plane and in 3D. Angular velocity vector. Moment of inertia.

2. Optics (5L)

- Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits (only the expressions for max;min, & intensity and qualitative discussion of fringes); diffraction grating(resolution formulac only), characteristics of diffraction grating and its applications.
- Polarisation : Introduction, polarisation by reflection, polarisation by double reflection, scattering of light, circular and elliptical polarisation, optical activity.
- Lasers : Principles and working of laser : population inversion, pumping, various modes, threshold population inversion with examples .

3. Electromagnetism and Dielectric Magnetic Properties of Materials (8L)

- Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielecrrics, internal fields in a solid, Clausius- Mossotti equation(expression only), applications of dielectrics.
- Magnetisation , permeability and susceptibility, classificationof magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.

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4. Quantum Mechanics (16L)

- Introduction to quantum physics, black body radiation, explanation using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.

5. Statistical Mechanics (8L)

- Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics.

Course outcomes:

Students will be familiar with

- Basic concepts of mechanics
- Bragg's Law and introduction to the principles of lasers, types of lasers and applications.
- Various terms related to properties of materials such as, permeability, polarization, etc.
- Some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials.
- Simple quantum mechanics calculations.
-

Learning Resources:

1. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited
2. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker, Wiley
3. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press
4. Engineering Mechanics (In SI Units) (SIE), S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati, McGraw Hill Education
5. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education
6. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education
7. Engineering Mechanics, M.K. Harbola, Cengage India
8. An Introduction to Mechanics (SIE), David Kleppner, Robert Kolenkow, McGraw Hill Education
9. Principles of mechanics, John L. Synge and Byron A. Griffith, New York, McGraw-Hill
10. Mechanics (Dover Books on Physics), J. P. Den Hartog, Dover Publications Inc.
11. Engineering Mechanics: Dynamics, L.G. Kraige J.L. Meriam, Wiley
12. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, Robert Eisberg, Robert Resnick, Wiley
13. Introduction to Quantum Mechanics, J. Griffiths David, Pearson Education
14. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press
15. Optics, Hecht, Pearson Education
16. Optics, Ghatak, McGraw Hill Education India Private Limited
17. Fundamentals of Statistical and Thermal Physics, Reif, Sarat Book Distributors
18. Statistical Mechanics, Pathria, Elsevier
19. Statistical Physics, L.D. Landau, E.M. Lifshitz, Butterworth-Heinemann

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Course Code : BS-CH101/ BS-CH201	Category : Basic Science Courses
Course Title : Chemistry-I	Semester : First/ Second
L-T-P : 3-1-0	Credit:4
Pre-Requisites:	

Detailed contents

i) Atomic and molecular structure (10 lectures)

Schrodinger equation. Particle in a box solutions and their applications for simple sample. Molecular orbitals of diatomic molecules (e.g.H₂). Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

ii) Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

iii)Intermolecular forces and potential energy surfaces (4 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena.

iv) Use of free energy in chemical equilibria (8 lectures)

First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

v) Periodic properties (4 Lectures)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

vi) Stereochemistry (4 lectures)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

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vii) Organic reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

Learning Resources:

1. Engineering Chemistry, Satyaprakash, Khanna Book Publishing, Delhi
2. University chemistry, by B. H. Mahan
3. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
4. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
5. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
6. Physical Chemistry, by P. W. Atkins
7. Spectroscopy of Organic Compounds, by P.S.Kalsi, New Age International Pvt Ltd Publishers
8. Physical Chemistry, P. C. Rakshit, Sarat Book House
9. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition
<http://bcs.whfreeman.com/vollhardtschore5e/default.asp>

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Course Code : BS-M101	Category : Basic Science Course
Course Title : Mathematics – I A	Semester : First (CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic	Lectures Hours
1	<i>Calculus (Integration):</i> Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	<i>Calculus (Differentiation):</i> Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	<i>Matrices:</i> Matrices, Vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.	7
4	<i>Vector Spaces:</i> Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem, composition of linear maps, Matrix associated with a linear map.	9
5	<i>Vector Spaces (Continued):</i> Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.	10

Course Outcomes:

The students will be able to:

Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

Understand the domain of applications of mean value theorems to engineering problems.

Learn different types of matrices, concept of rank, methods of matrix inversion and their applications.

Understand linear spaces, its basis and dimension with corresponding applications in the field of computer science.

Learn and apply the concept of eigen values, eigen vectors, diagonalisation of matrices and orthogonalization in inner product spaces for understanding physical and engineering problems

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Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. S.K. Mapa, Higher Algebra: Abstract and Linear, Sarat Book House Pvt.Ltd.
8. Hoffman and Kunze: Linear algebra, PHI.

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Course Code : BS-M102	Category : Basic Science Course
Course Title : Mathematics –I B	Semester : First (All stream except CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic	Lectures Hours
1	<i>Calculus (Integration):</i> Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	<i>Calculus (Differentiation):</i> Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	<i>Sequence and Series:</i> Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.	11
4	<i>Multivariate Calculus:</i> Limit, continuity and partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, Curl and Divergence.	9
5	<i>Matrices:</i> Inverse and rank of a matrix, Rank-nullity theorem; System of linear equations; Symmetric, Skew-symmetric and Orthogonal matrices; Determinants; Eigenvalues and Eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.	8

Course Outcomes:

After completing the course the student will be able to

Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

Understand the domain of applications of mean value theorems to engineering problems.

Learn the tools of power series and Fourier series to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.

Apply the knowledge for addressing the real life problems which comprises of several variables or attributes and identify extremum points of different surfaces of higher dimensions.

1st Year Curriculum Structure for B.Tech courses in Engineering & Technology

(Applicable from the academic session 2018-2019)

Understand different types of matrices, their eigen values, eigen vectors, rank and also their orthogonal transformations which are essential for understanding physical and engineering problems.

Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.

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Course Code : ES-EE101	Category : Engineering Science Courses
Course Title : Basic Electrical Engineering	Semester : First
L-T-P : 3-1-0	Credit: 4
Pre-Requisites:	

Detailed contents:

Module 1: DC Circuits (8 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers (6 hours)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 hours)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters (6 hours)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

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Course Outcomes

To understand and analyze basic electric and magnetic circuits

To study the working principles of electrical machines and power converters.

To introduce the components of low voltage electrical installations

Learning Recourses:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Book Publishing Co. (P) Ltd., Delhi.
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
4. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
5. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
6. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

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Course Code : BS-PH191/ BS-PH291	Category : Basic Science course
Course Title : Physics-I Laboratory	Semester : First/ Second
L-T-P : 0-0-3	Credit:1.5
Pre-Requisites:	

Choose 10 experiments including at least one from Optics, Electricity and Magnetism and Quantum Mechanics and at least a total of six from these three groups.

Experiments in Optics

1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of a monochromatic light by Newton's ring
3. Determination of wavelength of a monochromatic light by Fresnel's bi-prism
4. Determination of wavelength of the given laser source by diffraction method

Electricity & Magnetism experiments

1. Determination of thermo electric power of a given thermocouple.
2. Determination of specific charge (e/m) of electron by J.J. Thompson's method.
3. Determination of dielectric constant of a given dielectric material.
4. Determination of Hall coefficient of a semiconductor by four probe method.
5. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.
6. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
7. Determination of unknown resistance using Carey Foster's bridge
8. Study of Transient Response in LR, RC and LCR circuits using expeyes
9. Generating sound from electrical energy using expeyes

Experiments in Quantum Physics

1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Lande-g factor using Electron spin resonance spectrometer.
4. Determination of Rydberg constant by studying Hydrogen spectrum.
5. Determination of Band gap of semiconductor.
6. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

Miscellaneous experiments

1. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure
2. Determination of bending moment and shear force of a rectangular beam of uniform cross-section
3. Determination of modulus of rigidity of the material of a rod by static method
4. Determination of rigidity modulus of the material of a wire by dynamic method
5. To determine the moment of inertia of a body about an axis passing through its centre of gravity and to determine the modulus of rigidity of the material of the suspended wire
6. Determination of coefficient of viscosity by Poiseuille's capillary flow method

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Course Code : BS-CH191/ BS-CH291	Category : Basic Science Courses
Course Title : Chemistry-I Laboratory	Semester : First/ Second
L-T-P : 0-0-3	Credit:1.5
Pre-Requisites:	

Choose 10 experiments from the following:

1. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
2. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
3. Determination of dissolved oxygen present in a given water sample.
4. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution)
5. Determination of surface tension and viscosity
6. Thin layer chromatography
7. Ion exchange column for removal of hardness of water
8. Determination of the rate constant of a reaction
9. Determination of cell constant and conductance of solutions
10. Potentiometry - determination of redox potentials and emfs
11. Saponification/acid value of an oil
12. Chemical analysis of a salt
13. Determination of the partition coefficient of a substance between two immiscible liquids
14. Adsorption of acetic acid by charcoal
15. Use of the capillary viscosimeters to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

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Course Code : ES-EE191	Category : Engineering Science Courses
Course Title : Basic Electrical Engineering Laboratory	Semester : First
L-T-P : 0-0-2	Credit: 1
Pre-Requisites:	

Choose 10 experiments from the following:

1. First activity: Introduction to basic safety precautions and mentioning of the do's and Don'ts. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about the modalities of evaluation.
2. Introduction and uses of following instruments :
 - (a) Voltmeter
 - (b) Ammeter
 - (c) Multimeter
 - (d) Oscilloscope

Demonstration of real life resistors, capacitors with color code , inductors and autotransformer.

3. Demonstration of cut-out sections of machines: DC machine, Induction machine, Synchronous machine and single phase induction machine.
4. Calibration of ammeter and Wattmeter.
5. Determination of steady state and transient response of R-L, R-C and R-L-C circuit to a step change in voltage.
6. Determination of steady state response of R-L and R-C and R-L-C circuit and calculation of impedance and power factor.
7. Determination of resonance frequency and quality factor of series and parallel R-L-C circuit.
8. (a) Open circuit and short circuit test of a single-phase transformer
(b) Load test of the transformer and determination of efficiency and regulation
9. Demonstration of three phase transformer connections. Voltage and current relationship, phase shifts between the primary and secondary side.
10. Measurement of power in a three phase unbalanced circuit by two wattmeter method.
11. Determination of Torque –Speed characteristics of separately excited DC motor.
12. Determination of Torque speed characteristics and observation of direction reversal by change of phase sequence of connection of Induction motor.
13. Determination of operating characteristics of Synchronous generator.
14. Demonstration of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter for speed control of an Induction motor
15. Demonstration of components of LT switchgear.

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Course Code : ES-ME191/ ES-ME 291	Category : Engineering Science Courses
Course Title : Engineering Graphics & Design	Semester : First/ Second
L-T-P : 1-0-4	Credit: 3
Pre-Requisites:	

Sl. No.	Content	Lecture (L)	Practical (P)
1	INTRODUCTION TO ENGINEERING DRAWING Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes.	1	4
2	LETTERING, DIMENSIONING, SCALES Plain scale, Diagonal scale and Vernier Scales.	1	4
3	GEOMETRICAL CONSTRUCTION AND CURVES Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Archimedian Spiral.	1	4
4	PROJECTION OF POINTS, LINES, SURFACES Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle, pentagon, Hexagon etc.) inclined Planes - Auxiliary Planes.	1	4
5	PROJECTION OF REGULAR SOLIDS Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).	1	4
6	COMBINATION OF REGULAR SOLIDS, FLOOR PLANS Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.	1	4
7	ISOMETRIC PROJECTIONS Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;	1	4

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8	SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)	1	4
9	OVERVIEW OF COMPUTER GRAPHICS, CUSTOMISATION & CAD DRAWING listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;	1	4
	ANNOTATIONS, LAYERING & OTHER FUNCTIONS applying dimensions to objects, applying annotations to drawings;		
10	Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;	2	8

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11	DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).	2	8
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Course Outcomes

The student will learn:

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling

General Instructions

1. In every topic some problems are to be done in the class and some are to be given to students as home assignment.
2. The problems for class work are to be prepared on drawing sheet of A1 size in the class/ using AutoCAD software.
3. The problems for home assignments are to be prepared on drawing copy/ using AutoCAD software.
4. Print out of every assignment is to be taken for CAD Drawings on Drawing sheets (A4 Sheets).
5. A title block must be prepared in each sheet/ assignment.

Following is the list of drawing instruments that required for making engineering drawings on paper with perfection.

1. Drawing Board
2. Mini drafter/ Set-squares (45°–45° & 60°–90°), T-square
3. Protractor (180°, 360°)
4. Scales (Plain, Diagonal)
5. Compass (Small and Large)
6. Divider (Small and Large)

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7. French Curves
8. Drawing paper (A1 Size)
9. Drawing pencil (H, HB, B)
10. Sharpener
11. Eraser
12. Drawing pins & clips
13. Duster or handkerchief etc.

Learning Resources:

1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House
2. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
5. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
6. Corresponding set of CAD Software Theory and User Manuals

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Course Code : ES-ME192/ ES-ME 292	Category : Engineering Science Courses
Course Title : Workshop/ Manufacturing Practices	Semester : First/ Second
L-T-P : 1-0-4	Credit:3
Pre-Requisites:	

(i) Lectures & videos:

Detailed contents:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Electrical & Electronics
5. Carpentry
6. Plastic moulding, glass cutting
7. Metal casting
8. Welding (arc welding & gas welding), brazing

(ii) Workshop Practice:

Machine shop (8 hours)

Typical jobs that may be made in this practice module:

To make a pin from a mild steel rod in a lathe.

To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Fitting shop (8 hours)

Typical jobs that may be made in this practice module:

To make a Gauge from MS plate.

Carpentry (8 hours)

Typical jobs that may be made in this practice module:

To make wooden joints and/or a pattern or like.

Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs))

Typical jobs that may be made in this practice module:

ARC WELDING (4 hours): To join two thick (approx 6mm) MS plates by manual metal arc welding.

GAS WELDING (4 hours): To join two thin mild steel plates or sheets by gas welding.

Casting (8 hours)

Typical jobs that may be made in this practice module:

One/ two green sand moulds to prepare, and a casting be demonstrated.

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Smithy (4 hours) ~ 4 hours

Typical jobs that may be made in this practice module:

A simple job of making a square rod from a round bar or like.

Plastic moulding & Glass cutting (4 hours)

Typical jobs that may be made in this practice module:

For plastic moulding, making at least one simple plastic component should be made.

For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made.

Electrical & Electronics (8 hours)

Familiarization with LT switchgear elements, making its sketches and noting down its specification. Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable.

Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point.

Simple wiring exercise to be executed to understand the basic electrical circuit.

Simple soldering exercises to be executed to understand the basic process of soldering.

Fabrication of a single-phase full wave rectifier with a step down transformer using four diodes and electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes

Upon completion of this laboratory course, students will be able to fabricate components with their own hands.

They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

By assembling different components, they will be able to produce small devices of their interest.

Learning Resources:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. and Steven S. Schmid, “Manufacturing Engineering and Technology”, 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu, “Manufacturing Technology – I” Pearson Education, 2008.
4. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4th edition, Prentice Hall India, 1998.
5. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGrawHill House, 2017.

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Course Code : BS-M201	Category : Basic Science Course
Course Title : Mathematics – II A	Semester : Second (CSE &IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics and BS-M101	

Module No.	Description of Topic	Lectures Hours
1	Basic Probability: Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the Multinomial distribution, Poisson approximation to the Binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.	11
2	Continuous Probability Distributions: Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities.	4
3	Bivariate Distributions: Bivariate distributions and their properties, distribution of sums and quotients, Conditional densities, Bayes' rule.	5
4	Basic Statistics: Measures of Central tendency, Moments, Skewness and Kurtosis, Probability distributions: Binomial, Poisson and Normal and evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.	8
5	Applied Statistics: Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	8
6	Small samples: Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	4

Course Outcomes:

The students will be able to:

Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.

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Understand the basic ideas of statistics with different characterisation of a univariate and bivariate data set.

Apply statistical tools for analysing data samples and drawing inference on a given data set.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
3. S. Ross, A First Course in Probability, Pearson Education India
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.
5. John E. Freund, Ronald E. Walpole, Mathematical Statistics, Prentice Hall.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
7. N.G. Das, Statistical Methods (Combined Volume), Tata-McGraw Hill.

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Course Code : BS-M202	Category : Basic Science Course
Course Title : Mathematics – II B	Semester : Second (All stream except CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics and BS-M102	

Module No.	Description of Topic	Lectures Hours
1	<i>Multivariate Calculus (Integration):</i> Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, change of variables (Cartesian to Polar), Applications: Areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.	11
2	<i>First order ordinary differential equations:</i> Exact, linear and Bernoulli's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.	5
3	<i>Ordinary differential equations of higher orders:</i> Second order linear differential equations with constant coefficients, Use of D-operators, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.	9
4	<i>Complex Variable – Differentiation</i> Differentiation of complex functions, Cauchy-Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithmic) and their properties; Conformal mappings, Mobius transformations and their properties.	6
5	<i>Complex Variable – Integration</i> Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, Zeros of analytic functions, Singularities, Laurent's series; Residues, Cauchy residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.	9

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Course Outcomes:

The students will be able to:

Learn the methods for evaluating multiple integrals and their applications to different physical problems.

Understand different techniques to solve first and second order ordinary differential equations with its formulation to address the modelling of systems and problems of engineering sciences.

Learn different tools of differentiation and integration of functions of a complex variable that are used with various other techniques for solving engineering problems.

Apply different types of transformations between two 2- dimensional planes for analysis of physical or engineering problems.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. E. L. Ince, Ordinary Differential Equations, Dover Publications.
8. J. W. Brown and R. V. Churchill, Complex Variables and Applications, Mc-Graw Hill.

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Course Code : ES-CS201	Category : Engineering Science Courses
Course Title : Programming for Problem Solving	Semester : Second
L-T-P : 3-0-0	Credit:3
Pre-Requisites:	

Detailed contents

Unit 1: Introduction to Programming (4 lectures)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - **(1 lecture)**.

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. **(1 lecture)**

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- **(2 lectures)**

Unit 2: Arithmetic expressions and precedence (2 lectures)

Unit 3: Conditional Branching and Loops (6 lectures)

Writing and evaluation of conditionals and consequent branching **(3 lectures)**

Iteration and loops **(3 lectures)**

Unit 4: Arrays (6 lectures)

Arrays (1-D, 2-D), Character arrays and Strings

Unit 5: Basic Algorithms (6 lectures)

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 6: Function (5 lectures)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Unit 7: Recursion (4 -5 lectures)

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 8: Structure (4 lectures)

Structures, Defining structures and Array of Structures

Unit 9: Pointers (2 lectures)

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Unit 10: File handling (only if time is available, otherwise should be done as part of the lab)

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Course Outcomes

The student will learn

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical errors.
- To implement conditional branching, iteration and recursion.
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- To apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.

Learning Resources:

1. R. S. Salaria, Computer Concepts and Programming in C, Khanna Publishers
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

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Course Code : ES-CS291	Category : Engineering Science Courses
Course Title : Programming for Problem Solving	Semester : Second
L-T-P : 0-0-4	Credit:2
Pre-Requisites:	

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

Tutorial 12: File handling:

Lab 12: File operations

Laboratory Outcomes

To formulate the algorithms for simple problems

To translate given algorithms to a working and correct program

To be able to correct syntax errors as reported by the compilers

To be able to identify and correct logical errors encountered at run time

To be able to write iterative as well as recursive programs

To be able to represent data in arrays, strings and structures and manipulate them through a program

To be able to declare pointers of different types and use them in defining self-referential structures.

To be able to create, read and write to and from simple text files.

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Course Code : HM-HU201	Category : Humanities and Social Sciences including Management courses
Course Title : English	Semester : Second
L-T-P : 2-0-0	Credit:2
Pre-Requisites:	

Detailed contents

1. Vocabulary Building

- 1.1 The concept of Word Formation: Compounding, Backformation, Clipping, Blending.
- 1.2 Root words from foreign languages and their use in English
- 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
- 1.4 Synonyms, antonyms, and standard abbreviations: Acronyms

2. Basic Writing Skills

- 2.1 Sentence Structures & Types: Simple, Compound, Complex
- 2.2 Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration
- 2.3 Importance of proper punctuation
- 2.4 Creating coherence: Arranging paragraphs & Sentences in logical order
- 2.5 Creating Cohesion: Organizing principles of paragraphs in documents
- 2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

- 3.1 Subject-verb agreement
- 3.2 Noun-pronoun agreement
- 3.3 Misplaced modifiers
- 3.4 Articles
- 3.5 Prepositions
- 3.6 Redundancies
- 3.7 Clichés

4. Nature and Style of sensible Writing

- 4.1 Describing
- 4.2 Defining
- 4.3 Classifying
- 4.4 Providing examples or evidence
- 4.5 Writing introduction and conclusion

5. Writing Practices

- 5.1 Comprehension
- 5.2 Précis Writing
- 5.3 Essay Writing
- 5.4 Business Letter, Cover Letter & CV; E-mail

Addendum

Some examples of English words with foreign roots

Greek Root/Affix	Examples
Anti	Antisocial, antiseptic

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Auto	Automatic, autograph
Anthropos	Anthropology, philanthropy
Bio	Biography
Chronos	Time
Di	Dilemma
Bio	Biology
Biblio	Bibliography
Chron	Chronology
Cracy	Contradiction
Geo	Geology
Hyper	Hyperactive
Mania	Kleptomania
Mega	Megaserial
Eu	Eulogy, euphoria
Geo	Geology
Graph	autograph, photograph
Hetero	Heterogeneous
Hyper	Hyperactive
Hypo	hypodermic, hypoglycemia
Macro	Macrocosm
Mega	megalomania
Micro	microcosm

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Mono	Monarch
Pan	Panorama
Pathos	Pathetic
Phobia	Hydrophobia
Pod (Gk), ped (Latin)	Pseudopodia
Poly	polyglot
Tele	Telephone
Theo	Theology, theist
Latin Root	Examples
Aud	Audible
Bene	Beneficial
Brev	abbreviate, brief
circum	Circulate
Contra	Contradict
Cred	Credible
Dict	Diction
Femina	Feminine
Inter	Internet, interval
Magna	Magnificent
Mal	Malnutrition
Multi	multinational
Nova	Novel
Multi	Multiple, multiplex
Non	Nonstop

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Pre	Previous, predicate
Re	Redo, rewind
Scrib	Scripture
Spect	Spectator
Trans	Transport
Uni	Unity
Omni	Omnipotent
Semi	Semicircle
Sub	Subway
somnus	Insomnia,
Super	Superman
Sym	Sympathy
scribe	Describe, scribble(write illegibly), inscribe
Trans	Transform
Un	Unnecessary
Uni	Universal

Learning Resources:

- (i) Kulbushan Kumar, R S Salaria, Effective Communication Skills, Khanna Publishing House, Delhi.
- (ii) Practical English Usage. Michael Swan. OUP. 1995.
- (iii) Remedial English Grammar. F.T. Wood. Macmillan. 2007
- (iv) On Writing Well. William Zinsser. Harper Resource Book. 2001
- (v) Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- (vi) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
- (vii) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
- (viii) Universal English Prof. Prasad Kataria Publications, 2019.
- (ix) "Communication Skills for Professionals"-Nira Konar, Prentice Hall of India 2nd edition, New Delhi, 2011
- (x) Gajendra Singh Chauhan, Smita Kashiramka and L. Thimmesha. Functional English. Cengage , 2019.

Course Outcomes

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Course Code : HM-HU291	Category : Humanities and Social Sciences including Management courses
Course Title : Language Laboratory	Semester : Second
L-T-P : 0-0-2	Credit:1
Pre-Requisites:	

- | | |
|---|----|
| 1) Honing ‘Listening Skill’ and its sub skills through Language Lab Audio device; | 3P |
| 2) Honing ‘Speaking Skill’ and its sub skills | 2P |
| 3) Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/
Voice modulation/ Stress/ Intonation/ Pitch & Accent) of connected speech | 2P |
| 4) Honing ‘Conversation Skill’ using Language Lab Audio –Visual input;
Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone &
Role Play Mode) | 2P |
| 5) Introducing ‘Group Discussion’ through audio –Visual input and acquainting them
with key strategies for success | 2P |
| 6) G D Practice Sessions for helping them internalize basic Principles
(turn- taking, creative intervention, by using correct body language, courtesies &
other soft skills) of GD | 4P |
| 7) Honing ‘Reading Skills’ and its sub skills using Visual / Graphics/
Diagrams /Chart Display/Technical/Non Technical Passages
Learning Global / Contextual / Inferential Comprehension; | 2P |
| 8) Honing ‘Writing Skill’ and its sub skills by using
Language Lab Audio –Visual input; Practice Sessions | 2P |

Course Outcomes

- The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

MOOCs for B. Tech Honours



Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal

Notice

1st May, 2018

MOOCs for B.Tech Honours (Applicable from the session 2018-2019)

Preamble

All India Council for Technical Education (AICTE) has introduced Model Curriculum for Bachelor of Technology programme with 160 credits in the entire programme of 4 years, and additional 20 credits will be required to be done for the degree of Bachelor of Technology with Honours. These additional 20 credits will have to be acquired with online courses (MOOCs) as per AICTE. So students will have to complete additional 20 credits through MOOCs within 4 years of time. This creates an excellent opportunity for students to acquire the necessary skill set for employability through massive online courses where the rare expertise of world famous experts from academics and industry are available. Maulana Abul Kalam Azad University of Technology, West Bengal (MAKAUT,WB) has thus decided to introduce AICTE model curriculum for its B.Tech Programmes and suggest baskets for MOOCs available year wise for the four-year long B.Tech programme from the sessions 2018-2019. The basket for MOOCs will be a dynamic one, as courses keep on updating with time. Few essential skill sets required for employability are also identified year wise by MAKAUT,WB. For MOOCs platforms where examination or assessment is absent (like SWAYAM) or where certification is costly (like Coursera or edX), faculty members of the Institutes are to audit the courses and prepare the examination question papers, for the courses undertaken by the students of respective Institutes, so that MAKAUT,WB can conduct examination for the course. The total of 20 credits that is required to be attained for B.Tech Honours degree are distributed over four years in the following way:

For first year	:	8 credits
For second year	:	4 credits
For third year	:	4 credits
For fourth year	:	4 credits

A student of first year has to cover courses from at least three skills :

1. Computer Programing with Python / R
2. Soft skill
3. Ethics

Courses are * marked in the above areas

If a student is unable to cover the credits assigned for the first year, he/she can do these courses in either of the subsequent years, but he/she has to choose the courses from the basket of MOOCs announced by MAKAUT,WB from time to time. The same rule will be applicable for the other years of the programme.

The basket for MOOCs for the 1st year B. Tech for the session 2018-2019 are made available herewith.

By order.

MOOCs for First Year, Engineering and Technology

Sl. No	Course	Provider	Duration	Credits	Name of University / Institution
1.	Presentation Skills: Designing Presentation Slides	Coursera *	4 weeks	1	Tomsk State University
2.	Effective Problem-Solving and Decision-Making	Coursera	4 weeks	1	University of California
3.	Communication in the 21st Century Workplace	Coursera *	4 weeks	1	University of California
4.	Psychology at Work	Coursera *	6 weeks	2	University of Western Australia
5.	Critical Thinking & Problem Solving	EdX *	3 weeks	3	Rochester Institute of Technology
6.	Successful Career Development	Coursera	7 weeks	2	University System of Georgia
7.	Working in Teams: A Practical Guide	edX	4 weeks	1	University of Queensland
8.	Communication theory: bridging academia and practice	Coursera	9 weeks	3	Higher School of Economics
9.	Speaking Effectively	NPTEL *	8 weeks	3	Indian Institute of Technology, Kharagpur
10.	Introduction to Philosophy	Coursera	5 weeks	1	University of Edinburgh
11.	Moralities of Everyday Life	Coursera	6 weeks	2	Yale University
12.	Introduction to Logic	Coursera *	10 weeks	3	Stanford University
13	Write Professional Emails in English	Coursera *	5 weeks	2	Georgia Institute of Technology
14	Technical Writing	Coursera	5 weeks	1	Moscow Institute of Physics and Technology
15	Learn to Program: The Fundamentals	Coursera	7 weeks	2	University of Toronto
16	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
17	Introduction to Problem Solving and Programming	NPTEL	12 weeks	4	NPTEL
18	The Science of Well Being	Coursera	6 weeks	2	Yale University
19	Developing Soft Skills and Personality	NPTEL	8 weeks	3	
20	Programming Basics	edX	9 weeks	3	IIT Bombay
21	Introduction to Python: Absolute Beginner	EdX *	5 weeks	2	Microsoft
22	Inferential Statistics	Coursera *	7 weeks	2	University of Amsterdam
23	Linear Regression and Modelling	Coursera	4 weeks	1	Duke University
24	Foundation of Data Structures	edX	6 weeks	2	IIT Bombay
25	Introduction to Logic	NPTEL	12 weeks	4	NPTEL
26	Introduction to Probability and Data	Coursera *	5 weeks	1	Duke University
27	Ethics	NPTEL *	12 weeks	4	
28	Science, Technology and Society	NPTEL	12 weeks	4	
29	Creating Innovation	Coursera	6 weeks	2	Macquarie University
30	Ethical Leadership Through Giving Voice to Values	Coursera *	4 weeks	2	University of Virginia
31	Creativity, Innovation, and Change	Coursera *	6 weeks	2	Pennsylvania State University
32	Interpersonal Communication for Engineering Leaders	Coursera	4 weeks	1	Rice University

33	Learn to Program: The Fundamentals	Coursera *	7 weeks	3	University of Toronto
34	Introduction to Mathematical Thinking	Coursera *	9 weeks	3	Stanford University
35	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
36	A Life of Happiness and Fulfillment	Coursera	6 weeks	2	Indian School of Business
37	Model Thinking	Coursera	12 weeks	4	University of Michigan
38	Introduction to Philosophy: God, Knowledge, and Consciousness	edX	12 weeks	4	MIT
39	Soft skills	NPTEL *	12 Weeks	4	IIT Roorkee
40	Developing Soft Skills and Personality	NPTEL *	8 weeks	3	IIT Kanpur
41	Indian Fiction in English	NPTEL	12 Weeks	4	IIT Madras
42	Development of Sociology in India	NPTEL	4 Weeks	1	IIT Kanpur
43	Intellectual Property	NPTEL	12 Weeks	4	IIT Madras
44	Essential Statistics for Data Analysis using Excel	EdX *	Self Paced	3	Microsoft
45	Ethics and Law in Data and Analytics	edX	Self Paced	4	Microsoft
46	Climate Change Mitigation in Developing Countries	Coursera *	6 weeks	3	University of Cape town
47	Web Design for Everybody (Basics of Web Development and Coding) Specialization	Coursera	15weeks	4	University of Michigan
48	Ecology: Ecosystem Dynamics and Conservation	Coursera	5 weeks	1	American Museum of Natural History, Howard Hughes Medical Institute
49	Environmental Studies: A Global Perspective	EdX *	Self Paced	4	Curtin University
50	Introduction to Computer Science and Programming Using Python	edX *	Self Paced	4	MIT, USA
51	Statistics and R	edX *	Self Paced	4	Harvard University
52	Introduction to Programming in C	Coursera *	4 weeks	4	Duke University
53	Java Programming: Solving Problems with Software	Coursera	4 weeks	4	Duke University
54	Grammar and Punctuation	Coursera	4 weeks	1	University of California
55	How to Write an Essay	Coursera *	5 weeks	1	University of California, Berkeley
56	Conversational English Skills	EdX *	10 weeks	3	Tsinghua University
57	Advanced Writing	Coursera *	4 weeks	1	University of California, Irvine
58	Speak English Professionally: In Person, Online & On the Phone	Coursera *	5 weeks	1	Georgia Institute of Technology
59	English for Science, Technology, Engineering, and Mathematics	Coursera	5 weeks	1	University of Pennsylvania
60	English Composition	edX	8 weeks	3	Arizona State University
61	Take Your English Communication Skills to the Next Level	Coursera *	4 weeks	1	Georgia Institute of Technology

**Guidelines regarding
Mandatory Induction Program for
the new students**



Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Date: 06.12.2017

Maulana Abul Kalam Azad University of Technology, West Bengal

Guidelines regarding Induction Programme for the new students

(As per Model Curriculum for 1st Year UG degrees courses in Engineering & Technology, November 2017)

To be followed from the 2018-19 academic session

Preamble: Engineering education has evolved globally in a continuous manner to address the twin needs of industry and society. It is now an accepted fact that the institutions imparting technical education should aspire to create manpower who will possess strong technical knowledge and skill, have leadership qualities and be a team player, capable of coming up with innovative solutions and be alive to societal and community concerns.

The aim of the Induction Programme is to acclimatize the students to the environment of their engineering institution, give them a flavour of the exciting new world of education that they are entering, provide them with mentoring schemes, and make them aware of their neighbourhood, society and people. This will allow them to evolve as well rounded individuals.

The following schedule is laid down by the University to implement the three week long Induction Programme:

Week 1	1 st Half	Day 1	Overall introduction of the new students to the Institution, its different Departments & Faculty Members
	2 nd Half	Day 1	(a) Assignment of faculty mentors to the new students (b) Assessment and allotment for mentoring by senior students preferably from the second year
	2 hrs	Day 2, 3, 4, 5	Lectures by eminent personalities on different areas such as (a) Introduction to Engineering (b) Various topics of science and technology (c) Innovation and entrepreneurship (d) Creative and performing arts (e) Social issues
	2 hrs.	Day 2, 3, 4, 5	Participation in Games, Yoga, Meditation etc.
	2 hrs	Day 2, 3, 4, 5	Visit to the different Departments of the Institute
Week 2 (All Days)	2hrs		Scheduled class lectures as per time table.
	2hrs		Students to be conducted through proficiency modules to be prepared by respective Colleges for ascertaining English skills & Computer knowledge of the students

			and to prepare a report on the same
	2hrs		Participation in Games, Sports, Yoga, Creative arts etc.
Week 3	2hrs		Scheduled class lectures as per time table
		Day 1	Visits to neighbourhood locations
		Day 2	Visits to natural spots in adjoining areas to understand the effect of nature on society
		Day 3	Visits to Science Museum / laboratories
		Day 4	Visits to NGOs
		Day 5	

Any other activity, as deemed fit by the Director/Principal of the affiliated Colleges, may be proposed and discussed with the Academic Coordinator of the University, by sending email to the following address: academics.makaut@gmail.com.

Note: 1) If necessary, networking may be established with NGOs to facilitate the different components and aspects of the Induction Programme.

Mandatory Additional Requirement for earning B. Tech Degree



Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal
BF-142, Sector-I, Saltlake

Notice

Mandatory Additional Requirement for earning B.Tech Degree

Addressing the needs of the industry and the society: Globally, engineering education systems have continuously evolved, in order to address the needs of the industry and the society. It is becoming imperative that every University should create opportunities for the students to inculcate attributes, which are not restricted only to engineering knowledge and acumen. Industry needs professionals who can work successfully in teams, who have leadership qualities, who are alive to social and community needs and who can bring innovation and creativity to their work and who are also digitally proficient. Hence, in order to prepare its students to match these multiple requirements, MAKAUT, WB has created a unique mechanism of awarding 100 Activity Points over and above the academic grades. It is planned that the students at MAKAUT, WB will be able to reap benefits from these activities at their own pace and comfort. It is expected that by the time MAKAUT, WB's students reach their Final Year, they would have developed themselves so well both through their studies in the respective technological field and through their active participation in the co-curricular and extra-curricular activities as also through SAWYAM based learning activities that they would be well-prepared for contributing to building the India and the world of their dreams.

The additional requirement applies to: Every student, who is admitted to the 4 years B.Tech program from the academic year 2018-19 onwards, is required to earn minimum 100 Activity Points in addition to the required academic grades, for getting MAKAUT, WB's B.Tech degree. Similarly, it is mandatory to earn 75 Activity Points, in addition to the academic grades, for getting B.Tech degree by a student (Lateral Entry) who is admitted to the B.Tech program from the academic year 2018-19 onwards. *(Please see Table 1 for details.)* [Lateral Entry students will have a multiplying factor of 1.33 to bring uniformity in score].

Level of Entry in B.Tech Course	Total duration for earning Points	Minimum Points
1 st Year from the academic year 2018-19 onwards	1 st to 4 th Year	100
2 nd Year from the academic year 2018-19 onwards (Lateral Entry)	2 nd to 4 th Year	75

Table – I

For existing Students (except students in the 4th year): Every student, who is admitted to the 4 years B.Tech program prior to the academic year 2018-19, is required to earn minimum number of Activity Points as per Table II in addition to the required academic grades, for getting MAKAUT, WB's B.Tech degree.

Current Semester	Total Points to be earned During the full course
2 nd	100
4 th	75
6 th	50

Table –II

These points must be earned on the basis of active participation in co-curricular and extracurricular activities spanning through all the semesters of study. Every student may choose, as per his/her liking, activities in order to achieve the mandatory points (as per Table-III, depending on his/her entry level), before becoming eligible for award of the Degree. These activities can be spread over the years, as per convenience of the student.

Notes:

- **Current 4th year students who are going to sit for Final Semester examination in May-June, 2018 are outside the preview of this Mandatory Additional Requirement**
- Every student shall participate in the co-curricular and extra-curricular activities and produce documentary proof to the designated Faculty Members appointed by the Head of Department / Principal / Director in the respective college. Thereby the student should earn the required Points before *her* she appears for his/ her Final Examinations.
- A student's result of his/her Final Examinations will be withheld until he/she completes the minimum Activity Points by the end of his/her B.Tech Program.
- In every semester, every student is required to prepare a file containing documentary proofs of activities, done by him / her. This file will be duly verified and Activity Points will be assigned by the teachers as appointed above, at the end of every semester.
- The college will form a 3 members committee and finalize the Activity Points for each student before entering them into the Online Point Entry System (at the URL, as specified by the COE of the University).
- Every student has to earn at least 100 activity points. The points students has earned will be reflected in the student's marksheet.
- Activity points earned by Lateral Entry students will be multiplied by 1.33.

Table III provides a List of Activity Heads and Sub-Activity Heads along with their capping of the Activity Points that can be earned by the students during the entire B.Tech duration.

Sl. No.	Name of the Activity	Points	Maximum Points Allowed
1.	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) (per course)	20	40
2.	Tech Fest/Teachers Day/Freshers Welcome		
	Organizer	5	10
	Participants	3	6
5.	Rural Reporting	5	10
6.	Tree Plantation (per tree)	1	10
7.	Participation in Relief Camps	20	40
8.	Participation in Debate/Group Discussion/ Tech quiz	10	20
9.	Publication of Wall magazine in institutional level (magazine/article/internet)	10	20
10.	Publication in News Paper, Magazine & Blogs	10	20
11.	Research Publication (per publication)	15	30
12.	Innovative Projects (other than course curriculum)	30	60
13.	Blood donation	8	16
	Blood donation camp Organization	10	20
15.	Participation in Sports/Games		
	College level	5	10
	University Level	10	20
	District Level	12	24
	State Level	15	30
	National/International Level	20	20
21.	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20
22.	Member of Professional Society	10	20
23.	Student Chapter	10	20
24.	Relevant Industry Visit & Report	10	20
25.	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	5	10
26.	Participation in Yoga Camp (Certificate to be submitted)	5	10
27.	Self-Entrepreneurship Programme	20	20
28.	Adventure Sports with Certification	10	20
29.	Training to under privileged/Physically challenged	15	30
30.	Community Service & Allied Activities	10	20

Suggestions from the College Principals will be considered to append in the above Table-III.

Sd/-

Registrar(Acting)
MAKAUT,WB

Maulana Abul Kalam Azad University of Technology, West Bengal
Record of Activities for Mandatory Additional Requirement

Annexure-I
Rev:00

College Name (College Code):						Department:						
Student Name:				University Roll No:			Registration No:					
Sl No	Activity	Points	Max. Points Allowed	Points Earned								
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	Total
1	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) per course											
	For 12 weeks duration	20	40									
	For 8 weeks duration	16										
2	Tech Fest/Teachers Day/Freshers Welcome											
	Organizer	5	10									
	Participants	3	6									
3	Rural Reporting	5	10									
4	Tree Plantation and up keeping (per tree)	1	10									
5	Participation in Relief Camps	20	40									
6	Participation in Debate/Group Discussion/ Tech quiz	10	20									
7	Publication of Wall magazine in institutional level (magazine/article/internet)											
	Editor	10	20									
	Writer	6	12									
8	Publication in News Paper, Magazine & Blogs	10	20									
9	Research Publication (per publication)	15	30									
10	Innovative Projects (other than course curriculum)	30	60									
11	Blood donation	8	16									
	Blood donation camp Organization	10	20									

Maulana Abul Kalam Azad University of Technology, West Bengal
Record of Activities for Mandatory Additional Requirement

Annexure-I
Rev:00

Sl No	Activity	Points	Max. Points Allowed	Points Earned								Total
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	
12	<i>Participation in Sports/Games</i>											
	College level	5	10									
	University Level	10	20									
	District Level	12	24									
	State Level	15	30									
	National/International Level	20	20									
13	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20									
14	Member of Professional Society	10	20									
15	Student Chapter	10	20									
16	Relevant Industry Visit & Report	10	20									
17	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	5	10									
18	Participation in Yoga Camp (Certificate to be submitted)	5	10									
19	Self-Entrepreneurship Programme	20	20									
20	Adventure Sports with Certification	10	20									
21	Training to under privileged / Differently abled	15	30									
22	Community Service & Allied Activities	10	20									
Total Points												
Signature of Mentor												
Signature of HOD												
*Please abide strictly to the Notes at the end of the Notice by Registrar, MAKAUT, WB regarding Mandatory Additional Requirement for earning B.Tech Degree												
* <i>Annexure-I</i> is to be retained in the Institute records with all documentary proofs of activities (to be verified by the University as and when required).												

Maulana Abul Kalam Azad University of Technology, West Bengal
Syllabus for B. Tech in Electronics & Communication Engineering
(Applicable from the academic session 2018-2019)

Semester-III

EC301	Electronic Devices	3L:0T:0P	3 credits
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Module I

6L

Energy bands & Current Carriers in Semiconductors: Bonding Forces in Solids, Energy Bands theory in crystals (Qualitative Analysis), Metals, Semiconductors, & Insulators, Fermi-Level, Intrinsic and Extrinsic Semiconductors, Concept of Holes, Carrier Concentration. and Mobility, diffusion and drift of carriers, continuity equation, Injected minority carrier charge, Recombination and generation of charge carriers. Generation and recombination of carriers; Poisson and continuity equation

Module II

10L

P-N junction: Physical Description of p-n junction, Basic device technologies for fabrication of a p-n junction, I-V characteristics, and small signal switching models; Avalanche breakdown, Zener diode, Schottky diode

Bipolar Junction Transistor: Basic Construction, I-V characteristics, Ebers-Moll Model.

Module III

6L

MOSFET: MOS capacitor, C-V characteristics, MOSFET, I-V characteristics, and small signal models of MOS transistor

MODULE IV

10L

Opto-Electronics: Optical absorption in semiconductors, photovoltaic effects, solar cells (p-n junction), Photoconductors, Photodiode, PIN photodiode, Avalanche photodiode, Phototransistor, LED, Semiconductor Laser (p-n junction)

Integrated circuit: fabrication process: oxidation, diffusion, ion implantation, photolithography, etching, chemical vapor deposition, sputtering, twin-tub CMOS process.

Text /Reference Books:

1. G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices," 7th edition, Pearson, 2014.
2. D. Neamen, D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education
3. S. M. Sze and K. N. Kwok, "Physics of Semiconductor Devices," 3rd edition, John Wiley & Sons, 2006.
4. C.T. Sah, "Fundamentals of solid state electronics," World Scientific Publishing Co. Inc, 1991.
5. Y. Tsividis and M. Colin, "Operation and Modeling of the MOS Transistor," Oxford Univ. Press, 2011.

Course Outcomes:

At the end of this course students will demonstrate the ability to

- CO1. Differentiate the conduction techniques in semi-conductor materials.
- CO2. Analyze characteristics of Semi-conductor diodes and solve problems.
- CO3. Analyze characteristics of Bi-polar Transistors and solve problems.
- CO4. Analyze characteristics of MOS Transistors and solve problems.
- CO5. Differentiate between different Opto-electronic devices.

Maulana Abul Kalam Azad University of Technology, West Bengal
Syllabus for B. Tech in Electronics & Communication Engineering
(Applicable from the academic session 2018-2019)

EC302	Digital System Design	3L:0T:0P	3 credits
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Module I

10 L

Review of Number System, Signed and Unsigned Number.

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh's map, Binary codes, Code Conversion.

MSI devices like Comparators, Multiplexers, Encoder, Decoder, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Fast adders, Barrel shifter and ALU.

Module II

6L

Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM. Designing synchronous circuits like Synchronous Counter, Pulse train generator, Pseudo Random Binary Sequence generator,

Module III

8L

Logic Families and Semiconductor Memories: TTL, ECL, CMOS families

Semiconductor Memories, Concept of Programmable logic devices like FPGA. Logic implementation using Programmable Devices.

Different types of A/D and D/A conversion techniques. Sample & Hold Circuit

Module IV

8L

VLSI Design flow: Design entry Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation VHDL constructs and codes for combinational and sequential circuits.

Text/Reference Books:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009.
2. Schilling & Belove, Digital Integrated Electronics, Tata McGraw Hill,
2. Douglas Perry, "VHDL", Tata McGraw Hill, 4th edition, 2002.
3. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2nd edition, 2006.
4. D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill, 1989
5. Charles Roth, "Digital System Design using VHDL", Tata McGraw Hill 2nd edition 2012.
6. R. Anand, "Digital Electronics", Khanna Publishing House, New Delhi, 2017.

Course outcomes:

At the end of this course students will demonstrate the ability to

1. Design and analyze combinational logic circuits
2. Design & analyze modular combinational circuits with MUX/DEMUX, Decoder, Encoder
3. Design & analyze synchronous sequential logic circuits

Maulana Abul Kalam Azad University of Technology, West Bengal
Syllabus for B. Tech in Electronics & Communication Engineering
(Applicable from the academic session 2018-2019)

EC303	Signals and System	3L:0T:0P	3 credits
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Module I

6L

Signals and systems as seen in everyday life, and in various branches of engineering and science.

Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability.

Module II

6L

Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs. Characterization of causality and stability of linear shift invariant systems. System representation through differential equations.

Module III

8L

Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. The idea of signal space and orthogonal bases.

Module IV

8L

Evolution of Transforms: Fourier Transform, Laplace Transform , Z-transform (single sided and Double sided)

The Laplace Transform, notion of eigen functions of LSI systems, a basis of eigen functions, region of convergence, poles and zeros of system, , solution to differential equations and system behavior using Laplace Transformation

The z-Transform for discrete time signals and systems- eigen functions, region of convergence, z-domain analysis.

Module V

4L

The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects. Relation between continuous and discrete time systems.

Text/Reference books:

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.
2. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
3. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
4. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
5. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition.
6. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia).
7. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley and Sons, 1995.
8. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH.
9. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.
10. Ashok Ambardar, "Analog and Digital Signal Processing", 2nd Edition, Brooks/ Cole Publishing Company (An international Thomson Publishing Company), 1999.
11. R. Anand, Signals and Systems, Khanna Publishing House, 2018.

Maulana Abul Kalam Azad University of Technology, West Bengal
Syllabus for B. Tech in Electronics & Communication Engineering

(Applicable from the academic session 2018-2019)

Course outcomes:

At the end of this course students will demonstrate the ability to

1. Analyze different types of signals
2. Represent continuous and discrete systems in time and frequency domain using different transforms
3. Investigate whether the system is stable
4. Sampling and reconstruction of a signal

Maulana Abul Kalam Azad University of Technology, West Bengal
Syllabus for B. Tech in Electronics & Communication Engineering
(Applicable from the academic session 2018-2019)

EC304	Network Theory	3L:0T:0P	3 credits
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Module I

8L

Node and Mesh Analysis, matrix approach of network containing voltage and current sources, and reactances, source transformation and duality. Network theorems: Superposition, reciprocity,

Thevenin's, Norton's, Maximum power Transfer, compensation and Tellegen's theorem as applied to AC circuits.

Module II

6L

Trigonometric and exponential Fourier series: Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra, three phase unbalanced circuit and power calculation.

Module III

6L

Laplace transforms and properties: Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions.

Module IV

12L

Transient behavior, concept of complex frequency, Driving points and transfer functions poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations, convolution theorem and Two four port network and interconnections, Behaviors of series and parallel resonant circuits, Introduction to band pass, low pass, high pass and band reject filters.

Text/Reference Books

1. Ashfaq Husain, Networks & Systems, Khanna Publishing House, New Delhi, 2018.
2. Van, Valkenburg.; "Network analysis"; Prentice hall of India, 2000
3. Sudhakar, A., Shyammoan, S. P.; "Circuits and Network"; Tata McGraw-Hill New Delhi, 1994
4. A William Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand basics electrical circuits with nodal and mesh analysis.
2. Appreciate electrical network theorems.
3. Apply Laplace Transform for steady state and transient analysis.
4. Determine different network functions.
5. Appreciate the frequency domain techniques.

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Syllabus for B. Tech in Electronics & Communication Engineering
(Applicable from the academic session 2018-2019)

ES-CS301	Data Structure & Algorithms	3L:0T: 4P	3 credits
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Objectives of the course:

1. To impart the basic concepts of data structures and algorithms.
2. To understand concepts about searching and sorting techniques
3. To understand basic concepts about stacks, queues, lists, trees and graphs.
4. To enable them to write algorithms for solving problems with the help of fundamental data structures

Detailed contents:

Module 1 **6L**

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off.

Searching: Linear Search and Binary Search Techniques and their complexity analysis.

Module 2: **8L**

Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation - corresponding algorithms and complexity analysis. ADT queue,

Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

Module 3: **8L**

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Module 4: **8L**

Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Suggested books:

1. Data Structures & Algorithms using C, R.S. Salaria, Khanna Publishing House, New Delhi, 2018.

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“Fundamentals of Data Structures”, Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.

Suggested reference books:

1. Algorithms, Data Structures, and Problem Solving with C++”, Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company
2. “How to Solve it by Computer”, 2nd Impression by R.G. Dromey, Pearson Education.
3. Expert Data Structures with C, R. B. Patel, Khanna Publishing House, New Delhi

Course outcomes

1. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
2. For a given Search problem (Linear Search and Binary Search) student will able to implement it.
3. For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.
4. Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.
5. Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.

Maulana Abul Kalam Azad University of Technology, West Bengal
Syllabus for B. Tech in Electronics & Communication Engineering
(Applicable from the academic session 2018-2019)

BS-M301	Probability and Statistics	3L:0T: 3P	3 credits
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Module 1: Basic Probability:

8L

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

Module 2: Continuous Probability Distributions:

4L

Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.

Module 3: Bivariate Distributions:

4L

Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

Module 4: Basic Statistics:

6L

Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression - Rank correlation.

Module 5: Applied Statistics:

6L

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

Module 6: Small samples:

4L

Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Suggested Text/Reference Books

- (i) Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
- (ii) P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
- (iii) S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
- (iv) W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
- (v) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
- (vi) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
- (vii) Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.
- (viii) Chandrika Prasad & Reena Garg, Advanced Engineering Mathematics, Khanna Publishing House, New Delhi, 2018.
- (ix) Manish Sharma & Amit Gupta, Business Statistics, Khanna Book Publishing Company, New Delhi, 2012.

Course Outcomes

The objective of this course is to familiarize the students with statistical techniques. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.

The students will learn:

- The ideas of probability and random variables and various discrete and continuous probability distributions and their properties.

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- The basic ideas of statistics including measures of central tendency, correlation and regression.
- The statistical methods of studying data samples.

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(Applicable from the academic session 2018-2019)

MC381	Environmental Science	0L:0T: 2P	0 credits
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Purpose: We as human being are not an entity separate from the environment around us rather we are a constituent seamlessly integrated and co-exist with the environment around us. We are not an entity so separate from the environment that we can think of mastering and controlling it rather we must understand that each and every action of ours reflects on the environment and vice versa. Ancient wisdom drawn from Vedas about environment and its sustenance reflects these ethos. There is a direct application of this wisdom even in modern times.

Idea of an activity based course on environment protection is to sensitize the students on the above issues through following two type of activities.

(a) Awareness Activities:

- i) Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste
- ii) Slogan making event
- iii) Poster making event
- iv) Cycle rally
- v) Lectures from experts

(b) Actual Activities:

- i) Plantation
- ii) Gifting a tree to see its full growth
- iii) Cleanliness drive
- iv) Drive for segregation of waste
- v) To live some big environmentalist for a week or so to understand his work
- vi) To work in kitchen garden for mess
- vii) To know about the different varieties of plants
- viii) Shutting down the fans and ACs of the campus for an hour or so

Assessment:

- 1. Attendance: 15
- 2. Assignment: 15
- 3. Posters : 15
- 4. Participation in events: 25
- 5. Assesment by Teacher: 40

Grading: >90% : O

80-90%: E
70-80%: A
60-70%: B
40-60%: C
Below 40%: D

Suggested Text/Reference Books

M.P. Poonia & S.C. Sharma, Environmental Studies, Khanna Publishing House, New Delhi, 2019

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Syllabus for B. Tech in Electronics & Communication Engineering
(Applicable from the academic session 2018-2019)

EC391	Electronics Devices Lab	0L:0T:2P	1 credits
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1. identifying and study of different components like resistor, capacitors, diodes, LED, Transistors, FET(JFET & MOSFET) etc
2. Study of different instruments used in the laboratories like, power supply, Oscilloscope, Multi-meter etc.
3. CHARACTERISTICS OF PN JUNCTION DIODE
 - a) To Plot the Volt Ampere Characteristics of PN Junction Diode under Forward and Reverse Bias Conditions.
 - b) To find the Cut-in voltage, Static Resistance, Dynamic Resistance for Forward Bias & Reverse Bias
4. CHARACTERISTICS OF ZENER DIODE & LOAD REGULATION
 - a) To Obtain the Forward Bias and Reverse Bias characteristics of a Zener diode.
 - b) Find out the Zener Break down Voltage from the Characteristics.
 - c) To Obtain the Load Regulation Characteristics.
5. COMMON BASE BIPOLAR TRANSISTOR CHARACTERISTICS
 - a) To plot the Input and Output characteristics of a transistor connected in Common Base Configuration and to find the h – parameters from the characteristics.
6. COMMON EMITTER BIPOLAR TRANSISTOR CHARACTERISTICS
 - a) To plot the Input and Output characteristics of a transistor connected in Common Emitter Configuration and to find the h – parameters from the characteristics
7. DESIGN SELF BIAS BJT CIRCUIT
8. JFET DRAIN & TRANSFER CHARACTERISTICS (COMMON SOURCE)
 - a) Drain characteristics
 - b) Transfer Characteristics.
 - c) To find r_d , g_m , and μ from the characteristics.
9. Study Characteristics of Photo transistor
10. Study Characteristics of LED & LDR

Course Outcome

- a) An ability to verify the working of different diodes, transistors, CRO probes and measuring instruments. Identifying the procedure of doing the experiment.
- b) Ability to understand the characteristics of BJT and FET and how to Determine different parameters for designing purpose..
- c) Ability to understand properties of photoelectric devices
- d) Ability to measure and record the experimental data, analyze the results, and prepare a formal laboratory report.

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(Applicable from the academic session 2018-2019)

EC392	Digital System Design Lab	0L:0T:2P	1 credits
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1. Introduction to Digital Electronics Lab- Nomenclature of Digital ICs, Specifications, Study of the Data Sheet, Concept of Vcc and Ground, Verification of the Truth Tables of Logic Gates using TTL ICs.
2. Implementation of the Given Boolean Function using Logic Gates in Both Sop and Pos Forms.
3. Verification of State Tables of Rs, J-k, T and D Flip-Flops using NAND & NOR Gates
4. Implementation and Verification of Decoder/De-Multiplexer and Encoder using Logic Gates.
5. Implementation of 4x1 Multiplexer using Logic Gates.
6. Implementation of 4-Bit Parallel Adder Using 7483 IC.
7. Design , and Verify the 4- Bit Synchronous Counter
8. Design, and Verify the 4-Bit Asynchronous Counter.
9. Simulation of MOS Inverter with different loads using PSPICE software
10. Simulation of CMOS Inverter for different parameters K_n , K_p as a design variable in suitable circuit simulator software.
11. Design of a 4-bit Multiplexer using VHDL\Verilog
12. Design of a decade counter using VHDL\Verilog.
13. Design of a 3-input NAND gate and its simulation using suitable logic simulator

Book List

1. Douglas L.Perry, "VHDL: Programming by Example", McGraw-Hill, 2002.
2. Charles H. Roth, Lizy Kurian John, "Digital systems design using VHDL", Thomson, 2008.

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ES-CS391	Data Structure & Algorithm Lab.	0L:0T:2P	1 credits
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Experiments should include but not limited to :

Implementation of array operations:

Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements

Merging Problem : Evaluation of expressions operations on Multiple stacks & queues :

Implementation of linked lists: inserting, deleting, and inverting a linked list. Implementation of stacks & queues using linked lists:

Polynomial addition, Polynomial multiplication

Sparse Matrices : Multiplication, addition.

Recursive and Nonrecursive traversal of Trees

Threaded binary tree traversal. AVL tree implementation

Application of Trees. Application of sorting and searching algorithms

Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.

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Semester-IV

EC401	Analog Communication	3L:0T:0P	3 credits
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Mod-1 Introduction to Analog Communication: **8L**
Elements of communication system - Transmitters, Transmission channels & receivers (1), Concept of modulation, its needs (1).

Continuous Wave Linear Modulation:

- a) Amplitude modulation(AM-DSB/TC): Time domain representation of AM signal (expression derived using a single tone message), modulation index, frequency domain (spectral) representations, illustration of the carrier and side band components; transmission bandwidth for AM; Phasor diagram of an AM signal; Calculation of Transmitted power & sideband power & Efficiency; concept of under, over and critical modulation of AM-DSB-TC.
- b) Other Amplitude Modulations: Double side band suppressed carrier (DSBSC) modulation: time and frequency domain expressions, bandwidth and transmission power for DSB. Single side band modulation (SSB) both TC & SC and only the basic concept of VSB, Spectra and band-width.

Mod-2 Generation & Detection of Amplitude Modulation: **8L**
a) Generation of AM: Concept of i) Gated and ii) Square law modulators, Balanced Modulator.
b) Generation of SSB: Filter method, Phase shift method and the Third method
Demodulation for Linear Modulation:
Demodulation of AM signals: Detection of AM by envelope detector, Synchronous detection for AM-SC, Effects of Frequency & Phase mismatch, Corrections. Principle of Super heterodyne receivers: Super heterodyning principle, intermediate frequency, Local oscillator frequency, image frequency.

Mod-3 Angle Modulation: **8L**
a) Frequency Modulation (FM) and Phase Modulation (PM): Time and Frequency domain representations, Spectral representation of FM and PM for a single tone message, Bessel's functions and Fourier series. ; Phasor diagram ;
b) Generation of FM & PM: Narrow and Wide-band angle modulation, Basic block diagram representation of generation of FM & PM, Concept of VCO & Reactance modulator
c) Demodulation of FM and PM: Concept of frequency discriminators, Phase Locked Loop

Mod - 4 Multiplexing **8L**
a) Frequency Division Multiplexing, Time Division Multiplexing, (FDM)
b) Stereo - AM and FM: Basic concepts with block diagrams
c) Random Signals and Noise in Communication System:

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- i) Noise in Communication systems - Internal & External noise, Noise Temperature, Signal-to-Noise ratio, White noise, thermal noise, Figure of Merit.
- ii) Noise performance in Analog Communication systems: SNR calculation for DSB/TC, DSB-SC, SSB-TC, SSB-SC & FM
- d) Conditional probability, communication example, joint probability, statistical independence, random variable-continuous and discrete, cumulative distribution function, probability density function – Gaussian, Rayleigh and Rician.

Text Books:

- 7. Taub and Schilling, “Principles of Communication Systems”, 2nd ed., Mc-Graw Hill
- 8. B.P.Lathi -Communication Systems- BS Publications
- 9. V Chandra Sekar - Analog Communication- Oxford University Press

References:

- 1. Carlson—Communication System, 4/e, Mc-Graw Hill
- 2. Proakis & Salehi Fundamentals of Communication Systems- Pearson
- 3. Singh & Sapre—Communication Systems: 2/e, TMH
- 4. P K Ghosh- Principles of Electrical Communications- University Press
- 5. L.W.Couch II, “Digital and Analog Communication Systems”, 2^e, Macmillan Publishing
- 6. Blake, Electronic Communication Systems- Cengage Learning
- 7. S Sharma, Analog Communication Systems- Katson Books

Learning outcome:

Module - 1: The learner must be able to appreciate the need for modulation and calculate the antenna size for different carrier frequencies.

From the functional representation of the modulated carrier wave, the learner must be able to identify the type of modulation, calculate the side-band frequencies, identify the modulating and carrier frequencies, decide the type of generation method to be adopted. Solve problems.

Module - 2: After understanding the basic concepts the learner must be able to compare between the different demodulation methods, design an envelope detector, calculate the IF and image frequencies for the superheterodyne receivers given the carrier and modulating frequencies, calculate the oscillator frequency.

Module - 3: From the functional representation of the modulated carrier wave, the learner must be able to identify the type of modulation, calculate the side-band frequencies, identify the modulating and carrier frequencies, decide the type of generation method to be adopted. Solve problems.

Module - 4: Appreciate the importance of Multiplexing, find out their application areas. The learner must be able to calculate the Noise temperature & SNR for different systems, also compare between the performance of the different modulation methods by comparing their SNR. Also Understand the statistical analysis of Communication System.

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EC402	Analog circuits	3L:0T:0P	3 credits
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Module I

10L

Diode Circuits: Rectifiers, Clipper, Clamper

Amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier.

Biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications, low frequency analysis of multistage amplifiers.

Module II

6L

High frequency transistor models, frequency response of single stage and multistage amplifiers, cascode amplifier. Various classes of operation (Class A, B, AB, C etc.), Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc.,

Module III

6L

Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators(phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), Multivibrators (Monostable, Astable and Bistable)

Current mirror: Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (V_{ON}), maximum usable load.

Module IV

10L

Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR.

OP-AMP: Basic structure and characteristics, inverting and non-inverting amplifiers

OP-AMP applications: Integrator and differentiator, summing amplifier, Log-Antilog amplifiers, , Schmitt trigger and its applications.

Active filters: Low pass, high pass, band pass and band stop, design guidelines.

Text/Reference Books:

1. J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988.
2. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.
3. P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press, 1989.
4. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College11 Publishing, Edition IV
6. Paul R. Gray and Robert G.Meyer, Analysis and Design of Analog Integrated Circuits, John Wiley, 3rd Edition
7. A.K. Maini, Analog Electronics, Khanna Publishing House, New Delhi, AICTE Recommended-2018.

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Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the characteristics of diodes and transistors
2. Design and analyze various rectifier and amplifier circuits
3. Design sinusoidal and non-sinusoidal oscillators
4. Understand the functioning of OP-AMP and design OP-AMP based circuits

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EC403	Microprocessor & Microcontroller	3L:0T:0P	3 credits
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Module I

10L

Microprocessors 8085 and 8086- Pin description, memory, data structure/ access. Overview of microcomputer systems and their building blocks, memory interfacing, concepts of interrupts and Direct Memory Access (DMA), instruction sets of microprocessors (with examples of 8085 and 8086

Module II

8L

Interfacing with peripherals- timer, serial I / O, parallel I / O, A/D and D/A converters; Arithmetic coprocessors, System level interfacing design.

Module III

8L

Concepts of virtual memory, Cache memory; Advanced coprocessor architectures- 286, 486, Pentium; Microcontrollers 8051 systems- pin and port description.

Module IV

6L

Introduction to RISC processors; ARM microcontrollers interface design.

Text/Reference Books:

1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996
2. D A Patterson and J H Hennessy, "Computer Organization and Design The hardware and software interface. Morgan Kaufman Publishers.
3. Douglas Hall, Microprocessors Interfacing, Tata McGraw Hill, 1991.
4. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publishing, 1996.
5. Keneth Ayala, keneth. J. Ayala- The 8086 Microprocessor: Programming and interfacing the PC- West Pub.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Do assembly language programming
2. Do interfacing design of peripherals like, I/O, A/D, D/A, timer etc.
3. Develop systems using different microcontrollers
4. Understand RSIC processors and design ARM microcontroller based systems

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ES-CS401	Design and Analysis of Algorithm	3L:0T:0P	3 credits
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Objectives of the course

- Analyze the asymptotic performance of algorithms.
- Write rigorous correctness proofs for algorithms.
- Demonstrate a familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis. synthesise efficient algorithms in common engineering design situations.

Detailed contents:

Module 1:

8L

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds - best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

Module 2:

8L

Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branch-and-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knapsack TSP. Heuristics - characteristics and their application domains.

Module 3:

6L

Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

Module 4:

6L

Tractable and Intractable Problems: Computability of Algorithms, Computability classes - P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.

Module 5:

4L

Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP - PSPACE

Suggested books:

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms - E. Horowitz et al.
3. Design & Analysis of Algorithms – Gajendra Sharma, Khanna Publishing House.

Suggested reference books

1. Algorithm Design, 1ST Edition, Jon Kleinberg and Éva Tardos, Pearson.
2. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
3. Algorithms—A Creative Approach, 3RD Edition, Udi Manber, Addison-Wesley, Reading, MA.

Course Outcomes

1. For a given algorithms analyze worst-case running times of algorithms based on

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asymptotic analysis and justify the correctness of algorithms .

2. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.
3. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.
4. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and develop the dynamic programming algorithms, and analyze it to determine its computational complexity.
5. For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.
6. Explain the ways to analyze randomized algorithms (expected running time, probability of error).
7. Explain what an approximation algorithm is. Compute the approximation factor of an approximation algorithm (PTAS and FPTAS).

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BS-M401	Numerical Methods (BS)	2L:0T:0P	2 credits
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Module I

10L

Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors.

Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation.

Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.

Module II

8L

Numerical solution of a system of linear equations:

Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method.

Numerical solution of Algebraic equation: Bisection method, Regula-Falsi method, Newton-Raphson method.

Module III

4L

Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method.

(6)

Text Books:

1. C.Xavier: C Language and Numerical Methods.
2. R.S. Salaria, Computer Oriented Numerical Methods, Khanna Publishing House.
3. Dutta & Jana: Introductory Numerical Analysis.
4. J.B.Scarborough: Numerical Mathematical Analysis.
5. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).

References:

1. Balagurusamy: Numerical Methods, Scitech.
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
5. Srimanta Pal: Numerical Methods, OUP.

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Syllabus for B. Tech in Electronics & Communication Engineering
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BS-B401	Biology for Engineers	2L:1T:0P	3 credits
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Module 1.

2 hours

Introduction

Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry

Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.

Module 2.

3 hours

Classification

Purpose: To convey that classification *per se* is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted.

Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on

(a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes.
(c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion - aminotelic, uricotelic, ureotelic (e) Habitata- aquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus

Module 3.

4 hours

Genetics

Purpose: To convey that “Genetics is to biology what Newton’s laws are to Physical Sciences”

Mendel’s laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.

Module 4.

4 hours

Biomolecules

Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine

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Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.

Module 5.

4 Hours

Enzymes

Purpose: To convey that without catalysis life would not have existed on earth

Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyze reactions. Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.

Module 6.

4 hours

Information Transfer

Purpose: The molecular basis of coding and decoding genetic information is universal. Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

Module 7.

5 hours

Macromolecular analysis

Purpose: How to analyse biological processes at the reductionistic level

Proteins- structure and function. Hierarchy in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

Module 8.

4 hour

Metabolism

Purpose: The fundamental principles of energy transactions are the same in physical and biological world.

Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergonic reactions. Concept of K_{eq} and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to $CO_2 + H_2O$ (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge

Module 9.

3 hours

Microbiology

Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and

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media compositions. Growth kinetics.

References:

- 1) Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
- 2) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
- 3) Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
- 4) Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
- 5) Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

Course Outcomes

After studying the course, the student will be able to:

- Describe how biological observations of 18th Century that lead to major discoveries.
- Convey that classification *per se* is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological
- Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring
- Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine
- Classify enzymes and distinguish between different mechanisms of enzyme action.
- Identify DNA as a genetic material in the molecular basis of information transfer.
- Analyse biological processes at the reductionistic level
- Apply thermodynamic principles to biological systems.
- Identify and classify microorganisms.

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EC491	Analog Communication Lab	0L:0T:2P	1 credits
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1. Measurement of modulation index of an AM signal.
2. Measurement of output power with varying modulation index an AM signal(for both DSB- & SSB).
3. Measurement of distortion of the demodulated output with varying modulation index of an AM signal (for both DSB-SC & SSB).
4. Measurement of power of different frequency components of a frequency modulated signal & the measurement of the bandwidth.
5. Design and set up a PLL using VCO & to measure the lock frequency.
6. Design and set up a FM demodulator using PLL.
7. Measurement of SNR of a RF amplifier.
8. Measurement of selectivity, sensitivity, fidelity of a superheterodyne receiver.
9. One innovative experiment.

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EC492	Analog Electronic Circuits Lab	0L:0T:2P	1 credits
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1. Conduct experiment to test diode clipping (single/double ended) and clamping circuits (positive/negative).
2. Design and set up the following rectifiers with and without filters and to determine ripple factor and rectifier efficiency:
(a). Full Wave Rectifier (b). Bridge Rectifier
3. Design and set up the BJT common emitter amplifier using voltage divider bias with and without feedback and determine the gain- bandwidth product from its frequency response.
4. Set-up and study the working of complementary symmetry class B push pull power amplifier and calculate the efficiency
5. Realize BJT Darlington Emitter follower with and without bootstrapping and determine the gain, input and output impedances
6. Conduct an experiment on Series Voltage Regulator using Zener diode and power transistor to determine line and load regulation characteristics.
7. Design and set-up the following tuned oscillator circuits using BJT, and determine the frequency of oscillation.
R-C Phase shift Oscillator/Wien Bridge Oscillator
8. Plot the transfer and drain characteristics of n-channel MOSFET and calculate its parameters, namely; drain resistance, mutual conductance and amplification factor.
9. Design, setup and plot the frequency response of Common Source JFET/MOSFET amplifier and obtain the bandwidth.

Course Outcome:

Students will be able to:

- CO1: Design and test rectifiers, clipping circuits, clamping circuits and voltage regulators.
- CO2: Compute the parameters from the characteristics of JFET and MOSFET devices.
- CO3: Design, test and evaluate BJT amplifiers in CE configuration.
- CO4: Design and test JFET/MOSFET amplifiers.
- CO5: Design and test a power amplifier.
- CO6: Design and test various types of oscillators.

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EC493	Microprocessor & Microcontroller Lab	0L:0T:2P	1 credits
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1. Familiarization with 8085 & 8051 simulator on PC.
2. Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical) on the KIT. Assignments based on above
3. **Programming using kit and simulator for:**
 - i) Table look up
 - ii) Copying a block of memory
 - iii) Shifting a block of memory
 - iv) Packing and unpacking of BCD numbers
 - v) Addition of BCD numbers
 - vi) Binary to ASCII conversion
 - vii) String Matching, Multiplication using shift and add method and Booth's Algorithm
4. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit e.g. subroutine for delay, reading switch state and glowing LEDs accordingly.
5. Study of timing diagram of an instruction on oscilloscope..
6. Interfacing of 8255: Keyboard and Multi-digit Display with multiplexing using 8255
7. Study of 8051 Micro controller kit and writing programs as mentioned in S/L3. Write programs to interface of Keyboard, DAC and ADC using the kit.
8. Serial communication between two trainer kits

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BS-M491	Numerical Methods Lab (BS)	0L:0T:2P	1 credits
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Assignments on Newton forward /backward, Lagrange's interpolation.

2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.
3. Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations.
4. Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.
5. Assignments on ordinary differential equation: Euler's and Runge-Kutta methods.
6. Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica.

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Semester-V

EC501	Electromagnetic Waves	3L:0T:0P	3 credits
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Module 1

6Hrs

Basics of Vectors, Vector calculus, Maxwell's Equations, Basic laws of Electromagnetic, Poynting Vector, Boundary conditions at Media Interface.

Module II

8Hrs

Uniform Plane Wave- Uniform plane wave, Propagation of wave, Wavepolarization, Poincare's Sphere, Wave propagation in conducting medium, phase and group velocity, Surface current and power loss in a conductor

Plane Waves at a Media Interface- Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting boundary.

Module III

8Hrs

Transmission Lines- Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.

Module IV

6Hrs

Wave propagation in parallel planewaveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide.

Module V

6Hrs

Radiation: Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna,

Text/Reference Books:

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005
2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India

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3. Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.
4. David Cheng, Electromagnetics, Prentice Hall

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand characteristics and wave propagation on high frequency transmission lines
2. Carryout impedance transformation on TL
3. Use sections of transmission line sections for realizing circuit elements
4. Characterize uniform plane wave
5. Calculate reflection and transmission of waves at media interface
6. Analyze wave propagation on metallic waveguides in modal form
7. Understand principle of radiation and radiation characteristics of an antenna

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EC502	Computer Architecture	3L:0T:0P	3 credits
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Basic Structure of Computers, Functional units, software, performance issues software, machine instructions and programs, Types of instructions, Instruction sets: Instruction formats, Assembly language, Stacks, Ques, Subroutines.

Processor organization, Information representation, number formats.

Multiplication & division, ALU design, Floating Point arithmetic, IEEE 754 floatingpoint formats

Control Design, Instruction sequencing, Interpretation, Hard wired control - Design methods, and CPU control unit. Microprogrammed Control - Basic concepts, minimizing microinstruction size, multiplier control unit. Microprogrammed computers - CPU control unit

Memory organization, device characteristics, RAM, ROM, Memory management, Concept of Cache & associative memories, Virtual memory.

System organization, Input - Output systems, Interrupt, DMA, Standard I/O interfaces

Concept of parallel processing, Pipelining, Forms of parallel processing, interconnect network

Text/Reference Books:

1. V.Carl Hammacher, "Computer Organisation", Fifth Edition.
2. A.S.Tanenbum, "Structured Computer Organisation", PHI, Third edition
3. Y.Chu, "Computer Organization and Microprogramming", II, Englewood Chiffs, N.J., Prentice Hall Edition
4. M.M.Mano, "Computer System Architecture", Edition
5. C.W.Gear, "Computer Organization and Programming", McGraw Hill, N.V. Edition
6. Hayes J.P, "Computer Architecture and Organization", PHI, Second edition

Course Outcomes

At the end of this course students will demonstrate the ability to

1. learn how computers work
2. know basic principles of computer's working
3. analyze the performance of computers
4. know how computers are designed and built
5. Understand issues affecting modern processors (caches, pipelines etc.).

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EC503	Digital Communication & Stochastic Process	3L:1T:0P	3.5 credits
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Mod-1

8L

Introduction to Stochastic Processes (SPs):

Definition and examples of SPs, classification of random processes according to state space and parameter space, elementary problems. Stationary and ergodic processes, correlation coefficient, covariance, auto correlation function and its properties, random binary wave, power spectral density.

Definition and examples of Markov Chains, transition probability matrix, ChapmanKolmogorov equations; calculation of n-step transition probabilities.

Mod-2

6L

Signal Vector Representation:

Analogy between signal and vector, distinguishability of signal, orthogonality and orthonormality, basis function, orthogonal signal space, message point, signal constellation, geometric interpretation of signals, likelihood functions, Schwartz inequality, Gram-Schmidt orthogonalization procedure, response of the noisy signal at the receiver, maximum likelihood decision rule, decision boundary, optimum correlation receiver; probability of error, error function, complementary error function, Type-I and Type-II errors.

Mod-3

10L

Digital Data Transmission:

Concept of sampling, Pulse Amplitude Modulation (PAM), interlacing and multiplexing of samples, Pulse Code Modulation (PCM), quantization, uniform and non-uniform quantization, quantization noise, binary encoding, A-Law and μ -law companding, differential PCM, delta modulation and adaptive delta modulation.

Digital transmission components, source, multiplexer, line coder, regenerative repeater, concept of line coding – polar/unipolar/bipolar NRZ and RZ, Manchester, differential encoding and their PSDs, pulse shaping, Inter Symbol Interference (ISI), Eye pattern, Nyquist criterion for zero ISI, equalizer, zero forcing equalizer, timing extraction

Mod-4

10L

Digital Modulation Techniques:

Types of Digital Modulation, coherent and non-coherent Binary Modulation Techniques, basic digital carrier modulation techniques: ASK, FSK and PSK,

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Coherent Binary Phase Shift Keying (BPSK), geometrical representation of BPSK signal; error probability of BPSK, generation and detection of BPSK Signal, power spectrum of BPSK. Concept of M-ary Communication, M-ary phase shift keying, the average probability of symbol error for coherent M-aryPSK, power spectra of MPSK, Quadrature Phase Shift Keying (QPSK), error probability of QPSK signal, generation and detection of QPSK signals, power spectra of QPSK signals, Offset Quadrature Phase shift Keying (OQPSK), Coherent Frequency Shift Keying (FSK), Binary FSK, error probability of BFSK signals, generation and detection of Coherent Binary FSK signals, power spectra of BFSK signal, Minimum Shift Keying (MSK), signal constellation of MSK waveforms, error probability of MSK signal, Gaussian Minimum Shift Keying: GMSK, basic concept of OFDM, constellation diagram,

Some performance issues for different digital modulation techniques - Error Vector Magnitude (EVM), Eye Pattern and Relative Constellation Error (RCE), Conceptual idea for Vector Signal Analyzer (VSA)

Text Books:

- 1) Digital Communications, S. Haykin, Wiley India.
- 2) Principles of Communication Systems, H. Taub and D.L.Schilling, TMH Publishing Co.
- 3) Wireless Communication and Networks : 3G and Beyond, I. SahaMisra, TMH Education.
- 4) Digital Communications, J.G.Proakis, TMH Publishing Co.
- 5) S.M. Ross, Stochastic Processes, 2nd Edition, Wiley, 1996 (WSE Edition).

References:

- 1) Digital Communications Fundamentals and Applications, B. Sklar and P.K.Ray, Pearson.
- 2) Modern Digital and Analog Communication Systems, B.P.Lathi and Z.Ding, Oxford University Press.
- 3) Digital Communication, A. Bhattacharya, TMH Publishing Co.
- 4) J. Medhi, Stochastic Processes, 3rd Edition, New Age International, 2009.

Course Outcome: At the end of this course students will demonstrate the ability to

1. understand the concept of Stochastic Process in Communication System
2. represent various signals in different mathematical forms
3. analyze baseband transmission mode of digital data
4. analyze different carrier modulation techniques considering noise aspects

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EC504	Digital Signal Processing	3L:0T:0P	3 credits
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Module I

8Hrs

Discrete time signals: Sequences; representation of signals on orthogonal basis; Sampling and reconstruction of signals; Discrete systems attributes, Z-Transform and ROC, Analysis of LSI systems, frequency Analysis, Inverse Systems, Discrete Fourier Transform (DFT), Fast Fourier Transform Algorithm, Implementation of Discrete Time Systems

Module II

8Hrs

Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low pass, Band pass, Band stop and High pass filters.

Module III

10Hrs

Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multirate signal processing. Application of DSP.

Module IV

8Hrs

Origin of Wavelets, Classification(CWT & DWT), Filter Bank

Text/Reference Books:

1. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
3. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, 1997.
4. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.
5. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.
6. D.J.DeFatta, J. G. Lucas and W.S.Hodgkiss, Digital Signal Processing, John Wiley & Sons, 1988.

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Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Represent signals mathematically in continuous and discrete time and frequency domain
2. Get the response of an LSI system to different signals
3. Design of different types of digital filters for various applications

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EC591	Electromagnetic Wave Laboratory	0L:0T:2P	1 credits
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[At least THREE experiments from Module I and FOUR experiments from Module II]

Module I:

1. Plotting of Standing Wave Pattern along a transmission line when the line is open-circuited, short-circuited and terminated by a resistive load at the load end.
2. Input Impedance of a terminated coaxial line using shift in minima technique.
3. Study of Smith chart on Matlab platform.
4. Simulation study of Smith chart - Single and double stub matching.

Module II:

5. Radiation Pattern of dipole antenna.
6. Radiation Pattern of a folded-dipole antenna.
7. Radiation pattern of a 3-element Yagi-Uda Antenna.
8. Beam width, gain and radiation pattern of a 3-element, 5-element and 7-element. Yagi-Uda antenna - Comparative study.
9. Radiation pattern, Gain, Directivity of a Pyramidal Horn Antenna.

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EC592	Digital Communication Laboratory	0L:0T:2P	1 credits
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- Design, implementation and study of all the properties of 7-length and 15-length pn sequences using shift register.
- Study of PAM and demodulation.
- Study of PCM and demodulation.
- Study of line coders: polar/unipolar/bipolar NRZ ,RZ and Manchester.
- Study of delta modulator and demodulator.
- Study of adaptive delta modulator and demodulator.
- Study of BPSK modulator and demodulator.
- Study of BFSK modulator and demodulator.
- Study of ASK modulator and demodulator.
- Study of QPSK modulator and demodulator.
- Simulation study of probability of symbol error for BPSK modulation.
- Simulation study of probability of symbol error for BFSK modulation.

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EC593	Digital Signal Processing Laboratory	0L:0T:2P	1 credits
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Simulation Laboratory using standard Simulator:

1. Sampled sinusoidal signal, various sequences and different arithmetic operations.
2. Convolution of two sequences using graphical methods and using commands verification of the properties of convolution.
3. Z-transform of various sequences - verification of the properties of Z-transform.
4. Twiddle factors - verification of the properties.
5. DFTs / IDFTs using matrix multiplication and also using commands.
6. Circular convolution of two sequences using graphical methods and using commands, differentiation between linear and circular convolutions.
7. Verifications of the different algorithms associated with filtering of long data sequences and Overlap-add and Overlap-save methods.
8. Butterworth filter design with different set of parameters.
9. FIR filter design using rectangular, Hamming and Blackman windows.

Hardware Laboratory using DSP Processor and Xilinx FPGA:

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MC-HU581	Effective Technical Communication	0L:0T:3P	0 credits
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COURSE OBJECTIVES:

- Build confidence in listening, speaking, reading and writing English professionally.
- Enable the students to think and speak effectively on everyday topics, including topics related to technical concepts
- Equip students with the basics of Academic writing
- Developing industry-ready attitude towards professional communication.
- Prepare for competitive exams like TOEFL, IELTS

The classes need to be taken in ICT enabled classrooms, as well as in the Language lab.

Module-I:

Conversational Skills(6hours)

1. General Conversation

- **Warm-up sessions**

Basics of Communication, verbal and non-verbal communication how to be a good speaker, effective body language.

Practice sessions on:

- ✓ Introducing oneself
- ✓ Debates on topics like Is India really developing, Indian culture VS western culture, whether robots will overtake humans one day.
- ✓ Just a Minute Sessions (JAMS)
- ✓ Situational Dialogues and Role play : where students can enact everyday situations in their personal and professional lives

Module-II: (6hours)

Intensive Practice Sessions

- 2.1 **Group Discussion** on topics like dangers of social media, is internet killing the print media, *Artificial Intelligence, IOT, Cloud Computing, Cyber security*

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Module-III:

Organisational Writing(4 hours)

- Job application letter and CV writing
- E-Mail writing

Academic Writing(8 hours)

- *Techniques for good Technical Writing: Academic Writing and Thesis writing*
- Avoiding plagiarism
- Project Proposal
- Statement of Purpose
- Journal Articles

Module-IV: (6 hours)

4.1 Principles and practices of Personal Interview: (Practice sessions)

- Do's and Don'ts of facing an interview.
- SWOC Analysis
- Rigorous practices of mock-interviews

Module-V:

Presentations(4 hours)

- Fundamentals of presentation skills
- Presentation sessions on Technical topics

Module-VI:(6hours)

Preparation for T.O.E.F.L. and IELTS (Guidance and Practice sessions)

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References:

1. Technical Communication: Principles and Practice, Meenakshi Raman and Sangeeta Sharma, Oxford University Press, 2015
2. Thesis Writing: A Manual for Researches , F. Abdul Rahim, New Age International Limited, 1996
3. Professional Presentation, Malcolm Goodale, Cambridge University Press, 2005
4. Academic Writing: a Practical Guide for Students, Stephen Bailey London: Routledge Falmer
5. Barron's TOEFL IBT 2016 Guide(with DVD) Pamela J.Sharpe, New Delhi: Galgotia, 2013.

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PE-EC505A	Nano Electronics	3L:0T:0P	3 credits
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Introduction to nanotechnology, meso structures, Basics of Quantum Mechanics: Schrodinger equation, Density of States. Particle in a box Concepts, Degeneracy. Band Theory of Solids. KronigPenney Model. Brillouin Zones.

Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.),

Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Bandstructure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation

Text/ Reference Books:

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Material and Novel Devices), Wiley-VCH, 2003.
3. K.E. Drexler, Nanosystems, Wiley, 1992.
4. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.
5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand various aspects of nano-technology and the processes involved in making nano components and material.
2. Leverage advantages of the nano-materials and appropriate use in solving practical problems.
3. Understand various aspects of nano-technology and the processes involved in making nano components and material.
4. Leverage advantages of the nano-materials and appropriate use in solving practical problems

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PE-EC505B	Speech and Audio Processing	3L:0T:0P	3 credits
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Introduction- Speech production and modeling - Human Auditory System; General structure of speech coders; Classification of speech coding techniques - parametric, waveform and hybrid ; Requirements of speech codecs -quality, coding delays, robustness.

Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters, convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

Linear Prediction of Speech- Basic concepts of linear prediction; Linear Prediction Analysis of nonstationary signals -prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.

Speech Quantization- Scalar quantization-uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization - distortion measures, codebook design, codebook types.

Scalar Quantization of LPC- Spectral distortion measures, Quantization based on reflection coefficient and log area ratio, bit allocation; Line spectral frequency - LPC to LSF conversions, quantization based on LSF.

Linear Prediction Coding- LPC model of speech production; Structures of LPC encoders and decoders; Voicing detection; Limitations of the LPC model.

Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search - state-save method, zero-input zero-state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP.

Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729 standards

Text/Reference Books:

1. "Digital Speech" by A.M.Kondoz, Second Edition (Wiley Students' Edition), 2004.
2. "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", W.C. Chu, Wiley Inter science, 2003.

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PE-EC505C	Power Electronics	3L:0T:0P	3 credits
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Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT- Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based). Concept of fast recovery and schottky diodes as freewheeling and feedback diode.

Controlled Rectifiers: Single phase: Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current- Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.

Choppers: Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control techniques for choppers - TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper

Single-phase inverters: Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source inverter

Switching Power Supplies: Analysis of fly back, forward converters for SMPS, Resonant converters - need, concept of soft switching, switching trajectory and SOAR, Load resonant converter - series loaded half bridge DC-DC converter.

Applications: Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS. Separately excited DC motor drive. P M Stepper motor Drive.

Text /Reference Books:

1. Muhammad H. Rashid, "Power electronics" Prentice Hall of India.
2. Ned Mohan, Robbins, "Power electronics", edition III, John Wiley and sons.
3. P.C. Sen., "Modern Power Electronics", edition II, Chand & Co.
4. V.R. Moorthi, "Power Electronics", Oxford University Press.
5. Cyril W., Lander, "Power Electronics", edition III, McGraw Hill.
6. G K Dubey, S R Doradla, "Thyristorised Power Controllers", New Age International Publishers. SCR manual from GE, USA.

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Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Build and test circuits using power devices such as SCR
2. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters,
3. Learn how to analyze these inverters and some basic applications.
4. Design SMPS.

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PE-EC505D	Scientific Computing	3L:0T:0P	3 credits
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Introduction: Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy

Computer Arithmetic: Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, FloatingPoint Arithmetic, Cancellation

System of liner equations: Linear Systems, Solving Linear Systems, Gaussian elimination, Pivoting, Gauss-Jordan, Norms and Condition Numbers, Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for Linear Systems

Linear least squares: Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting

Eigenvalues and singular values: Eigenvalues and Eigenvectors, Methods for Computing All Eigenvalues, Jacobi Method, Methods for Computing Selected Eigenvalues, Singular Values Decomposition, Application of SVD

Nonlinear equations: Fixed Point Iteration, Newton's Method, Inverse Interpolation Method
 Optimization: One-Dimensional Optimization, Multidimensional Unconstrained Optimization, Nonlinear Least Squares

Interpolation: Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial Interpolation

Numerical Integration And Differentiation: Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule, Finite Difference Approximation,

Initial Value Problems for ODES, Euler's Method, Taylor Series Method, Runge-Kutta Method, Extrapolation Methods, Boundary Value Problems For ODES, Finite Difference Methods, Finite Element Method, Eigenvalue Problems

Partial Differential Equations, Time Dependent Problems, Time Independent Problems, Solution for Sparse Linear Systems, Iterative Methods

Fast Fourier Transform, FFT Algorithm, Limitations, DFT, Fast polynomial Multiplication, Wavelets, Random Numbers And Simulation, Stochastic Simulation, Random Number Generators, Quasi-Random Sequences

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Text/ Reference Books:

1. Heath Michael T., “Scientific Computing: An Introductory Survey”, McGraw-Hill, 2nd Ed., 2002
2. Press William H., Saul A. Teukolsky, Vetterling William T and Brian P. Flannery, Numerical Recipes: The Art of Scientific Computing”, Cambridge University Press, 3rd Ed., 2007
3. Xin-she Yang (Ed.), “Introduction To Computational Mathematics”, World Scientific Publishing Co., 2nd Ed., 2008
4. Kiryanov D. and Kiryanova E., “Computational Science”, Infinity Science Press, 1st Ed., 2006
5. Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, “Scientific Computing With MATLAB And Octave”, Springer, 3rd Ed., 2010

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the significance of computing methods, their strengths and application areas.
2. Perform the computations on various data using appropriate computation tools.

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OE-EC506A	Soft Skill and Interpersonal Communication	3L:0T:0P	3 credits
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UNIT I - SELF ANALYSIS **2 hours**

SWOT Analysis, Who am I, Attributes, Importance of Self Confidence, Self Esteem.

UNIT II - CREATIVITY **3 hours**

Out of box thinking, Lateral Thinking.

UNIT III - ATTITUDE **3 hours**

Factors influencing Attitude, Challenges and lessons from Attitude, Etiquette.

UNIT IV - MOTIVATION **2 hours**

Factors of motivation, Self talk, Intrinsic & Extrinsic Motivators.

UNIT V - GOAL SETTING **4 hours**

Wish List, SMART Goals, Blue print for success, Short Term, Long Term, Life Time Goals.

Time management

Value of time, Diagnosing Time Management, Weekly Planner To do list, Prioritizing work.

UNIT VII - INTERPERSONAL SKILLS **6 hours**

Gratitude

Understanding the relationship between Leadership Networking & Team work. Assessing Interpersonal Skills Situation description of Interpersonal Skill.

Team Work: Necessity of Team Work Personally, Socially and Educationally

UNIT VIII - LEADERSHIP **2 hours**

Skills for a good Leader, Assessment of Leadership Skills

UNIT IX - STRESS MANAGEMENT **4 hours**

Causes of Stress and its impact, how to manage & distress, Circle of control, Stress Busters.

Emotional Intelligence

What is Emotional Intelligence, emotional quotient why Emotional Intelligence matters, Emotion Scales. Managing Emotions.

UNIT X - CONFLICT RESOLUTION **2 hours**

Conflicts in Human Relations – Reasons Case Studies, Approaches to conflict resolution.

UNIT V - DECISION MAKING **4 hours**

Importance and necessity of Decision Making, Process and practical way of Decision Making,

Weighing Positives & Negatives

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OE-EC506B	Cyber Law & Intellectual Property Rights	3L:0T:0P	3 credits
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Cyber World :

An Overview, The internet and online resources ,Security of information, Digital signature

An Overview Cyber Law:

Introduction about the cyber space , Regulation of cyber space – introducing cyber law Scope of Cyber laws – ecommerce; online contracts; IPRs (copyright, trademarks and software patenting); e-taxation; e-governance and cyber crimes, Cyber law in India with special reference to Information Technology (Amendment) Act, 2008

IPR:

Introduction : Origin and Genesis of IPR , Theories of IPR – Locke’s, Hegel andMarxian Ethical, moral andhuman rights perspectives of IPR, Intellectual PropertyRights: International Relevance, Internationalization of IP protection – ParisConvention, Berne Convention, TRIPS Agreement – basic principles and minimum standards – limits of one-size-fit for all flexibilities under TRIPS

Intellectual Property: Issues and Challenges:

Geographical Indications, Layout designs of Integrated Circuits and Protection of Plant Varieties and Farmers' Rights. Copyright protection with reference to performers rights and Artist rights, Global governance towards Patents , Trade Marks: Legal recognition, Comparative analysis in India, EU and USA, Trade secrets : Legal recognition, Comparative analysis in India, EU and USA

Intellectual Property: Contemporary Trends

Benefit sharing and contractual agreements – International Treaty on Plant Genetic Resources for Food and Agriculture – issues on patent policy and farmers’ rights- CBD, Nagoya Protocol and Indian law, UNESCO – protection of folklore/cultural expressions Developments in WIPO on traditional knowledge and traditional cultural expressions

Text Book

1. Duggal Pavan, Cyber Law - An exhaustive section wise Commentary on The Information Technology Act along with Rules, Regulations, Policies, Notifications etc. UNIVERSAL LAW PUBLISHING CO. PVT. LTD. C-FF-1A, Dilkhush Industrial Estate, (Near Azad Pur Metro Station) G. T. Karnal Road, Delhi -110033, INDIA2014

Reference Book

1. Intellectual Property Rights in India : General Issues and ImplicationsPrankrishnaPal
2. JonathanRosenoer, “Cyberlaw: the Law of the Internet”, Springer-verlag, 1997.

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3. W. Cornish & Llewelyn – Intellectual Property: Patent, Copyrights, Trade Marks & Allied Rights”, London Sweet & Maxwell.
4. Nard Madison- The Intellectual Property, Asian Publication.
5. Carlosm Correa- Oxford commentaries on GATT/ WTO Agreements trade Related aspects of Intellectual Property Rights, Oxford University Press.
6. Cornish William – Intellectual Property. Cambridge University Press.

Course Outcome: At the end of the course, the students will be able to :

1. understand the role of intellectual property rights
2. identify the main types of intellectual property rights
3. understand the steps for successful registration and protection of intellectual property rights at national, regional and international levels
4. search patent and trademark databases
5. understand the legal aspects for intellectual property protection

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OE-EC506C	Human Resource Management	3L:0T:0P	3 credits
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UNIT-1-Human Resource Management :

Meaning & Definition, Functions, Scope & Objectives, Qualities of a HR Manager

UNIT-2-Human Resource Planning :

Meaning & Definition, Importance of HRP, HRP Process. Barriers of HRP, Factors of sound HRP. Recruitment – Meaning & Definition, Sources of Recruitment, Recruitment Process, Effective Recruitment.

Training & Performance Appraisal- Definition & Objective ,Areas of Training, Meaning & Definition of Performance Appraisal, process, Effective principles of performance Appraisal.

UNIT-3- Industrial Relations :

Concept & Meaning, Objective & Importance, Reasons of poor Industrial Relation. Industrial Disputes- Meaning & Definition, Causes of Industrial Dispute, Prevention of Industrial Dispute, Conditions for good Industrial Relation.

UNIT-4- Workers Participation in Management :

Meaning & Need, Forms of Participation, Scheme of participation ,Merits & Demerits. Collective Bargain- Meaning & Definition, Objective & Importance, Process of Collective Bargain, Effective Condition. Employee Discipline-Guidelines for action, Penalties & Punishment, Rewards of Discipline.

Text Book

1. Human Resource Management. P. Subba Rao, Himalaya Publishing House, 2012.
2. Human Resource Management. K. Aswathappa. Mc GRAW HILL Education, 2013.

Reference Book

1. Human Resource Development Management . A. M. Seikh S. Chand, 2003.
2. Human Resource Management . S. S. Khanka, S. Chand, 2014.

Course Outcome : At the end of the course the students will be able to :

1. know the professional and personal qualities of a HR manager.
2. learn different methods of selecting human resources through recruitment, training and performance appraisal system.
3. know how to develop a favourable working environment in an organisation through participation in management and maintain a good industrial relation for benefit of the society.
4. know about consequence of industrial dispute and employee indiscipline of an organization.

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Semester-VI

EC601	Control System and Instrumentation	3L:0T:0P	3 credits
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Introduction to control problem- Industrial control examples, Transfer function, open loop and closed loop (Feedback) control systems, Block diagram and Signal Flow Graph (SFG) analysis.

[6L].

Feedback control systems- Stability concept- relative stability, Routh stability criteria, steady state error (SE), steady state accuracy, disturbance rejection, insensitivity and robustness, proportional (P), integral (I) and derivative (D) controller, Realization of PID controllers with op-amp and digital implementation. Feed forward and multi loop control configurations.

[6L].

Time response of second order systems, Steady state Error (SE) and error constants, Performance specifications in time domain. Root locus method of design. Lead and Lag compensations.

[4L].

Frequency response analysis- Polar plots, Bode plot, stability in frequency domain, Nyquist plots. Nyquist stability criterion. Performance specifications in frequency domain.

[6 L].

State Variable Analysis- Concepts of state, state variable, State Transition Matrix (STM), Solution for state variable of homogeneous and nonhomogeneous state equations, Transfer function with state space approach, Concepts of controllability and observability of systems.

[4 L].

Nonlinear control systems- Basic concepts and analysis- Describing function. Introduction to optimal control problem, regulator problem, output regulator, tracking problem.

[2 L].

CRO- measurement with it and its function with block diagram representation. Wave and Spectrum analyzers- requirements of these instruments and their functions with block diagrams. LVDT. DC and AC servomotors, tachogenerators, electro hydraulic valves, hydraulic servomotors, electro pneumatic valves, pneumatic actuators.

[6L].

Text Books :

1. Automatic Control System: Benjamin Kuo, PHI
2. Modern Control Engineering, Katsuhiko Ogata, PHI, 5e
3. A.D. Helfrick and W. D. Cooper., "Modern Electronic Instrumentation and Measurement Techniques", PHI (EEE).

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Reference

1. Ernest O. Doebelin., “Measurement Systems” , MGH.
2. Control System Engineering, I.J.Nagrath, M.Gopal, New Age, 5e
3. Design of Feedback Control System, Raymond T Stepfani, Oxford University Press, 4e

Course Outcomes (CO):

At the end of this course students will demonstrate the ability to:

1. Characterize a system and find its steady state behavior.
2. Investigate stability of a system using different tests.
3. Design various controllers.
4. Solve linear, non linear and optimal control problems.
5. Study with CRO, Wave analyzer, Spectrum analyzer knowing their functional details.

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EC602	Computer Network	3L:0T:0P	3 credits
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Module I

Overview of Data Communication and Networking: [4L]

Introduction; Data communications: components, data representation (ASCII, ISO etc.), direction of data flow (simplex, half duplex, full duplex); network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN, WAN); Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.

Physical Level: [6L]

Overview of data (analog & digital), signal (analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus; Telephone Network;

Module II

Data link Layer: [5L]

Types of errors, framing (character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back-N ARQ, Selective repeat ARQ, HDLC;

Medium Access sub layer: [5L]

Point to Point Protocol, LCP, NCP, Token Ring; Reservation, Polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Traditional Ethernet, fast Ethernet (in brief);

Module III

Network layer: [8L]

Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing : IP addressing, subnetting; Routing : techniques, static vs. dynamic routing , Unicast Routing Protocols: RIP, OSPF, BGP; Other Procols: ARP, IP, ICMP, IPV6,;

Transport layer: [4L]

Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm,

Module IV

Application Layer [5L]

Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography (Public, Private Key based), Digital Signature, Firewalls.

Modern topics: [5L]

ISDN services & ATM, DSL technology, Cable Modem:

Architecture & Operation in brief Wireless LAN: IEEE 802.11,

Introduction to blue-tooth.

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Text Books:

1. B. A. Forouzan - "Data Communications and Networking (3rd Ed.)" - TMH
2. A. S. Tanenbaum - "Computer Networks (4th Ed.)" - Pearson Education/PHI
3. W. Stallings - "Data and Computer Communications (5th Ed.)" - PHI/ Pearson Education
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
5. Black, Data & Computer Communication, PHI
6. Miller, data Communication & Network, Vikas
7. Miller, Digital & Data Communication, Jaico
8. Shay, Understanding Data Communication & Network, Vikas

Reference Books:

1. Kurose and Rose - "Computer Networking -A top down approach featuring the internet" - Pearson Education
2. Leon, Garica, Widjaja - "Communication Networks" - TMH
3. Walrand - "Communication Networks" - TMH.
4. Comer - "Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.)" - Pearson Education/PHI

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HS-HU 601	Economics for Engineers	3L:0T:0P	3 credits
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Module-I

1. Economic Decisions Making - Overview, Problems, Role, Decision making process.
2. Engineering Costs & Estimation - Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - PerUnit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits.

Module-II

3. Cash Flow, Interest and Equivalence: Cash Flow - Diagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal & Effective Interest.
4. Cash Flow & Rate Of Return Analysis - Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate Of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity And Breakeven Analysis. Economic Analysis In The Public Sector - Quantifying And Valuing Benefits & drawbacks.

Module-III

5. Inflation And Price Change - Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates.
6. Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.
7. Uncertainty In Future Events - Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options.

Module-IV

8. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances.
9. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems.
10. Accounting - Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.

Readings

1. James L.Riggs, David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , Tata McGraw-Hill
2. Donald Newnan, Ted Eschembach, Jerome Lavelle : Engineering Economics Analysis, OUP
3. John A. White, Kenneth E. Case, David B. Pratt : Principle of Engineering Economic Analysis, John Wiley

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4. Sullivan and Wicks: Engineering Economy, Pearson
5. R.Paneer Seelvan: Engineering Economics, PHI
6. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub

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EC692	Computer Network Lab	0L:0T:2P	1 credits
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- IPC (Message queue)
- NIC Installation & Configuration (Windows/Linux)
- Familiarization with
 - o Networking cables (CAT5, UTP)
 - o Connectors (RJ45, T-connector)
 - o Hubs, Switches
- TCP/UDP Socket Programming
- Multicast & Broadcast Sockets
- Implementation of a Prototype Multithreaded Server
- Implementation of
 - o Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)
 - o Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)
 - o Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)

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EC691	Control and Instrumentation Laboratory	0L:0T:2P	1 credits
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1. Familiarization with MATLAB control system toolbox and representation of pole zero and transfer function of control system.
2. Determination of transfer function of a given system from its state model and its vice-versa.
3. Determination of impulse & step response for 2nd order under damped system on CRO & calculation of control system specifications for variation of system design.
4. Determination of root Locus from transfer function and evaluation of system parameters like marginal value of gain, frequency etc. of a given control system.
5. Drawing of Nyquist plot and Bode plot from transfer function of a control system and estimation of relative system parameters like gain margin, phase margin etc.
6. Design PI, PD and PID controller for specified system requirements.
7. Study of static (accuracy, precision, repeatability, linearity) and dynamic (fidelity, speed of response) characteristics of a measuring instrument.
8. Design and study of Instrumentation Amplifier.
9. Study and analysis of electrical signal with CRO.

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EC681	Mini Project/ Electronic Design Workshop	0L:0T:4P	2 credits
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Guidelines:

1. The mini-project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
2. The mini project may be a complete hardware or a combination of hardware and software. The software part in mini project should be less than 50% of the total work.
3. Mini Project should cater to a small system required in laboratory or real life.
4. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.
5. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project.
6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
8. Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.
9. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.
10. The tutorial sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.
2. Design, implement and test the prototype/algorithm in order to solve the conceived problem.
3. Write comprehensive report on mini project work.

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MC681	Universal Human Values	2L:0T:0P	0 credits
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Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration-what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

Module 2: Understanding Harmony in the Human Being - Harmony in Myself!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

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Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.

3. READINGS:

3.1 Text Book

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

3.2 Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

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5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

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PE-EC603A	Introduction to MEMS	3L:0T:0P	3 credits
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Introduction and Historical Background,

Scaling Effects.

Micro/Nano Sensors, Actuators and Systems overview: Case studies. Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography (LIGA), and Etching. Micromachining: Surface Micromachining, sacrificial layer processes, Stiction;

Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding. Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending; Energy methods, Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems.

Text/Reference Book:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.
2. S. E. Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano-and Microengineering (Vol. 8). CRC press, (2005).
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.
4. M. Madou, Fundamentals of Microfabrication, CRC Press, 1997.
5. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, 1998.
6. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, New York, 2000.

Course Outcomes:

At the end of the course the students will be able to

1. Appreciate the underlying working principles of MEMS and NEMS devices.
2. Design and model MEM devices.

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PE-EC603B	Bio-Medical Electronics	3L:0T:0P	3 credits
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Brief introduction to human physiology.

Biomedical transducers: displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases. Bio-electrodes and bio-potential amplifiers for ECG, EMG, EEG, etc.

Measurement of blood temperature, pressure and flow. Impedance plethysmography. Ultrasonic, X-ray and nuclear imaging.

Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped. Safety aspects.

Text/Reference Books:

1. W.F. Ganong, Review of Medical Physiology, 8th Asian Ed, Medical Publishers, 1977.
2. J.G. Webster, ed., Medical Instrumentation, Houghton Mifflin, 1978.
3. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, 1982.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the application of the electronic systems in biological and medical applications.
2. Understand the practical limitations on the electronic components while handling bio-substances.
3. Understand and analyze the biological processes like other electronic processes.

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PE-EC603C	CMOS VLSI Design	3L:0T:0P	3 credits
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VLSI Methodologies: Introduction to VLSI design, Moore's Law, VLSI Design flow, Design hierarchy, VLSI

Design style: Full custom, Gate array, standard-cell, Macro cell based design, Field programmable devices, design quality.

MOSFET: Electrical characteristics of MOSFET, Threshold voltage, Body effect, current expression (gradual channel approximation method), Channel length modulation, MOSFET scaling: constant field and constant voltage scaling, Short-channel effects.

Unit process in VLSI and IC fabrication: Unit process in VLSI: Wafer preparation, Oxidation, Diffusion, Ion implantation, Deposition, Metallization, Etching and Lithography. nMOS fabrication, n-well and p-well process .

CMOS Logic Circuits: General CMOS logic structure, VTC of inverter, noise margin, Different types of inverter (resistive load, enhancement and depletion nMOS load and CMOS), Switching characteristic (propagation delay and parasitic capacitance estimation), NAND, NOR and other complex CMOS logic circuits, Sizing of CMOS logic circuits, CMOS Power: static and dynamic power dissipation, latch-up, sizing for large capacitive load,. Dynamic CMOS logic circuits, charge leakage and charge sharing problem, dynamic gate cascading problem, Domino and NORA logic, Introduction of sequential CMOS logic circuits, Stick diagram. Layout and Layout design rules.

Physical Design Automation: Objectives and goals of partitioning, floor planning and placement, Global routing.

Text Book

1. CMOS Digital Integrated Circuits – S. Mo. Kang and Yusuf Leblebici, 3rd Ed, TMH 314

Reference Book

1. Digital Integrated Circuits A Design Perspective -Jan M. Rabaey, Prentice-Hall Publication, 2nd Edition.
2. VLSI Design and EDA Tools – Angsuman Sarkar, Swapnadip De & Chandan Kumar Sarkar, Scitech Publication(India) PVT, LTD
3. Basic VLSI Design – D. Pucknell & Eshraghian _PHI, 3rd Edition.
4. Principle of CMOS VLSI Design – Neil H. E. Weste – Pearson Edition, 2nd Edition.
5. CMOS Circuit Design – R. Jacob Baker, Harry W. Li, David E. Boyce – PHI,2003.

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PE-EC603D	Information Theory and Coding	3L:0T:0P	3 credits
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Basics of information theory, entropy for discrete ensembles; Shannon's noiseless coding theorem; Encoding of discrete sources.

Markov sources; Shannon's noisy coding theorem and converse for discrete channels; Calculation of channel capacity and bounds for discrete channels; Application to continuous channels.

Techniques of coding and decoding; Huffman codes and uniquely detectable codes; Cyclic codes, convolutional arithmetic codes.

Text/Reference Books:

1. N. Abramson, Information and Coding, McGraw Hill, 1963.
2. M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.
3. R.B. Ash, Information Theory, Prentice Hall, 1970.
4. Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the concept of information and entropy
2. Understand Shannon's theorem for coding
3. Calculation of channel capacity
4. Apply coding techniques

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OE-EC604A	Electronic Measurement & Measuring Instruments	3L:0T:0P	3 credits
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UNIT I:

Block Schematics of Measuring Systems:

Performance characteristics, Static characteristics, Accuracy, Precision, Resolution, Types of Errors, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag;

Measuring Instruments: DC Voltmeters, D' Arsonval Movement, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Specifications of Instruments.

UNIT II:

Signal Analyzers: AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Capacitance-Voltage Meters, Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary waveform Generator.

UNIT III:

Oscilloscopes: CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes, High Frequency CRO Considerations, Delay lines, Applications: Measurement of Time, Period and Frequency.

Special Purpose Oscilloscopes: Dual Trace, Dual Beam CROs, Sampling Oscilloscopes, Storage Oscilloscopes, Digital Storage CROs.

UNIT IV:

Transducers: Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros, Special Resistance Thermometers, Piezoelectric Transducers, Magnetostrictive Transducers.

UNIT V:

Bridges: Wheat Stone Bridge, Kelvin Bridge, and Maxwell Bridge.

Measurement of Physical Parameters: Flow Measurement, Displacement Meters, Liquid level Measurement, Measurement of Humidity and Moisture, Velocity, Pressure

-High Pressure,

Vacuum level, Temperature

-Measurements, Data Acquisition Systems.

TEXTBOOKS:

1. Electronic instrumentation: H.S. Kalsi, TMH, 2nd Edition 2004.

2. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbins, W.D. Cooper: PHI, 5th Edition, 2003

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REFERENCES:

1. Electronic Instrumentation and Measurements, David A. Bell, Oxford Univ. Press, 1997.
2. Electronic Measurements and Instrumentation: B. M. Oliver, J. M. Cage TMH Reprint.
3. Measurement Systems, Ernest O. Doebelin and Dhanesh N Manik, 6th Ed., TMH.
4. Electronic Measurements and Instrumentations by K. Lal Kishore, Pearson Education, 2010.
5. Industrial Instrumentation: T. R. Padmanabham Spiriger 2009.

OUTCOMES

Upon a successful completion of this course, the student will be able to:

1. Describe the fundamental concepts and principles of instrumentation
 2. Explain the operation of various instruments required in measurements
 3. Apply the measurement techniques for different types of tests
 4. To select specific instruments for specific measurement function.
 5. Understand principle of operation and working of different electronic instruments
- Students will understand functioning, specification and application of signal analyzing instruments

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OE-EC604B	Operating System	3L:0T:0P	3 credits
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Introduction:

Operating system and functions, Evolution of operating system, Batch, Interactive, Time Sharing, Real Time System, Multi-Threading System.

Operating System Structure:

System Components, System structure, Operating System Services.

Concurrent Processes:

Process concept, Principle of Concurrency, Critical Section problem, Semaphores, Classical problems in Concurrency, Inter Process Communication, Introduction to monitor, Process Generation, Process Scheduling.

CPU Scheduling:

Scheduling Concept, Performance Criteria Scheduling Algorithm, Evolution, Multiprocessor Scheduling.

Deadlock:

System Model, Deadlock Characterization, Prevention, Avoidance and Detection, Recovery from deadlock combined, approach.

Memory Management:

Resident monitor, Multiprogramming with fixed partition, Multiprogramming with variable partition, Multiple base register, Paging, Segmentation, Virtual memory concept, Demand paging, Performance, Page replacement algorithms, Allocation of frames, Thrashing.

I/O Management & Disk Scheduling:

I/O devices and organization of I/O function, I/O Buffering, DISK I/O, Operating System Design Issues.

File System:

File Concept, File Organization and Access Mechanism, File Directories, File Sharing, Implementation Issues.

Operating system Protection & Security:

Introduction to distributed operating system, Case Studies - The UNIX operating system

Text Book

1. Operating System Concepts, A. Silverschwatz, P. Galvin & G.Gange , Willey

Reference Book

1. Operating System Concepts, Milenekovic, McGraw Hill
2. An introduction to operating system, Dietel, Addison Wesley

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Course Outcome: At the end of the course, the students will be able to:

1. understand the difference between different types of modern operating systems, virtual machines and their structure of implementation and applications.
2. understand the difference between process & thread, issues of scheduling of user-level processes / threads and their issues & use of locks, semaphores, monitors for synchronizing multiprogramming with multithreaded systems and implement them in multithreaded programs.
3. understand the concepts of deadlock in operating systems and how they can be managed / avoided and implement them in multiprogramming system.
4. understand the design and management concepts along with issues and challenges of main memory, virtual memory and file system.
5. understand the types of I/O management, disk scheduling, protection and security problems faced by operating systems and how to minimize these problems.

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OE-EC604C	Object Oriented Programming	3L:0T:0P	3 credits
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paradigm:

Evolution of programming paradigm, structured versus object-oriented development, Introduction to Object oriented programming concepts: Objects, classes, encapsulation and abstraction, inheritance, polymorphism, dynamic binding, message passing.

Moving from C to C++:

Introduction to C++, streams based I/O, name space, scope resolution operator (::), variable declaration at the point of use, variable aliases-reference variables, strict type checking, parameter passing by reference, inline function, function overloading, default arguments.

Object and Classes:

Specifying and using classes, access specifiers: private, public, functions and data members, default arguments, function overloading, friend functions, static members.

Objects: memory considerations for objects, new and delete operators.

Constructors - default constructor, parameterized constructor, constructor with dynamic allocation, copy constructor, destructors.

Operator overloading- overloading through friend and member functions
Binary operators: arithmetic, relational, assignment, insertion, extraction
Unary operators: unary minus, post and pre-increment, post and pre-decrement, Conversion functions: class to basic, basic to class, class to class.

Inheritance:

Derived and base classes, Class hierarchies, public, private, and protected derivations, constructors in derived classes, destructors in derived classes, constructors invocation and data members initialization in derived classes, classes within classes, virtual base class.

Polymorphism:

Pointer to objects, pointer to derived class object, this pointer, run time and compile time polymorphism, virtual functions, pure virtual functions, abstract class, virtual destructor.

Files and Streams:

Introduction to file handling, hierarchy of file stream classes, opening and closing of files, file modes, file pointers and their manipulators, sequential access, random access.

Exception handling and Templates :

Introduction to exception handling, throw point outside try, Multiple catch, Catch-all, throwing objects. Introduction to templates, class templates, function templates

Text Book

1. Object Oriented Programming with C++, E. Balaguruswamy, 6th Edition, 2013 TMG Hill

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Reference Book

1. Object Oriented Programming with C++, Reema Thareja, OXFORD University Press, 1st Edition, 2015.
2. C++ completes reference, Herbert Schildt, TMG Hill, 4th Edition, 2002.
3. C++ How to Program, Deitel and Deitel, Pearson Education Asia, 8th Edition, 2011.
4. Object Oriented Programming with Ansi and Turbo C++, Ashok N Kamthane, Pearson Education, 1st Edition, 2003.
5. Object-Oriented Programming in C++, Robert Lafore, CourseSams Publishing, 4th Edition

Course Outcome: At the end of the course, the students will be able to :

1. differentiate between structures oriented programming and object oriented programming.
2. use object oriented programming language like C++ and associated libraries to develop object oriented programs.
3. understand and apply various object oriented features like inheritance, data abstraction, encapsulation and polymorphism to solve various computing problems using C++ language.
4. apply concepts of operator-overloading, constructors and destructors.
5. apply exception handling and use built-in classes from STL.

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Semester-VII

HS-HU701	Principles of Management	2L:0T:0P	2 credits
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Module-I

1. Basic concepts of management: Definition - Essence, Functions, Roles, Level.
2. Functions of Management: Planning - Concept, Nature, Types, Analysis, Management by objectives; Organisation Structure -Concept, Structure, Principles, Centralization, Decentralization, Span of Management; Organisational Effectiveness.

Module-II

3. Management and Society - Concept, External Environment, CSR, Corporate Governance, Ethical Standards.
4. People Management - Overview, Job design, Recruitment & Selection, Training & Development, Stress Management.
5. Managerial Competencies - Communication, Motivation, Team Effectiveness, Conflict Management, Creativity, Entrepreneurship.

Module-III

6. Leadership: Concept, Nature, Styles.
7. Decision making: Concept, Nature, Process, Tools & techniques.
8. Economic, Financial & Quantitative Analysis - Production, Markets, National Income Accounting, Financial Function & Goals, Financial Statement & Ratio Analysis, Quantitative Methods - Statistical Interference, Forecasting, Regression Analysis, Statistical Quality Control.

Module-IV

9. Customer Management - Market Planning & Research, Marketing Mix, Advertising & Brand Management.
10. Operations & Technology Management - Production & Operations Management, Logistics & Supply Chain Management, TQM, Kaizen & Six Sigma, MIS.

References:

1. Management: Principles, Processes & Practices - Bhat, A & Kumar, A (OUP).

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2. Essentials for Management - Koontz, Revised edition, Tata McGraw Hill (TMH)
3. Management - Stoner, James A. F. (Pearson)
4. Management - Ghuman, Tata McGraw Hill (TMH)

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PE-EC701A	Microwave Theory and Technique	3L:0T:0P	3 credits
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Introduction to Microwaves-History of Microwaves, Microwave Frequency bands; Applications of Microwaves: Civil and Military, Medical, EMI/ EMC.

Mathematical Model of Microwave Transmission-Concept of Mode, Features of TEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission.

Analysis of RF and Microwave Transmission Lines- Coaxial line, Rectangular waveguide, Circular waveguide, Strip line, Micro strip line.

Microwave Network Analysis- Equivalent voltages and currents for non-TEM lines, Network parameters for microwave circuits, Scattering Parameters.

Passive and Active Microwave Devices- Microwave passive components: Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator. Microwave active components: Diodes, Transistors, Oscillators, Mixers. Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes. Microwave Tubes: Klystron, TWT, Magnetron.

Microwave Design Principles-Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power Amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design.

Microwave Antennas-Antenna parameters, Antenna for ground based systems, Antennas for airborne and satellite borne systems, Planar Antennas.

Microwave Measurements- Power, Frequency and impedance measurement at microwave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure. Measurement of Microwave antenna parameters.

Microwave Systems- Radar, Terrestrial and Satellite Communication, Radio Aid to Navigation, RFID, GPS. Modern Trends in Microwaves Engineering- Effect of Microwaves on human body, Medical and Civil applications of microwaves, Electromagnetic interference and Electromagnetic Compatibility (EMI & EMC), Monolithic Microwave ICs, RFMEMS for microwave components, Microwave Imaging.

Text/Reference Books:

1. R.E. Collins, Microwave Circuits, McGraw Hill
2. K.C. Gupta and I.J. Bahl, Microwave Circuits, Artech house

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand various microwave system components their properties.

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2. Appreciate that during analysis/ synthesis of microwave systems, the different mathematical treatment is required compared to general circuit analysis.
3. Design microwave systems for different practical application.

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PE-EC701B	Satellite Communication	3L:0T:0P	3 credits
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Introduction to Satellite Communication: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication.

Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.

Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc.

Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.
Satellite link budget

Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

Modulation and Multiple Access Schemes: Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA.

Text /Reference Books:

1. Timothy Pratt Charles W. Bostian, Jeremy E. Allnutt: Satellite Communications: Wiley India. 2nd edition 2002
2. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009
3. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill, 2009

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Visualize the architecture of satellite systems as a means of high speed, high range communication system.
2. State various aspects related to satellite systems such as orbital equations, sub-systems in a satellite, link budget, modulation and multiple access schemes.
3. Solve numerical problems related to orbital motion and design of link budget for the given parameters and conditions.

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PE-EC701C	Mobile Communication and Networks	3L:0T:0P	3 credits
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Cellular concepts-Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 2G and 3G cellular standards.

Signal propagation-Propagation mechanism- reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing. Fading channels-Multipath and small scale fading- Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate.

Capacity of flat and frequency selective channels. Antennas-Antennas for mobile terminal-monopole antennas, PIFA, base station antennas and arrays.

Multiple access schemes-FDMA, TDMA, CDMA and SDMA. Modulation schemes- BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM.

Receiver structure- Diversity receivers- selection and MRC receivers, RAKE receiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity-Alamouti scheme.

MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing tradeoff. Performance measures- Outage, average snr, average symbol/bit error rate. System examples- GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA.

Text/Reference Books:

1. WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990.
2. WCY Lee, Mobile Communications Design Fundamentals, Prentice Hall, 1993.
3. Raymond Steele, Mobile Radio Communications, IEEE Press, New York, 1992.
4. AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley, 1995.
5. VK Garg & JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall, 1996.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the working principles of the mobile communication systems.
2. Understand the relation between the user features and underlying technology.
3. Analyze mobile communication systems for improved performance

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PE-EC702A	Adaptive Signal Processing	3L:0T:0P	3 credits
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General concept of adaptive filtering and estimation, applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices.

Optimal FIR (Wiener) filter, Method of steepest descent, extension to complexvalued The LMS algorithm (real, complex), convergence analysis, weight errorcorrelation matrix, excess mean square error and mis-adjustment

Variants of the LMS algorithm: the sign LMS family, normalized LMSalgorithm, block LMS and

FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering.

Signal space concepts - introduction to finite dimensional vectorspace theory, subspace, basis,

dimension, linear operators, rank and nullity, inner product space, orthogonality, Gram-Schmidt orthogonalization, concepts of orthogonal projection,orthogonal decomposition of vector spaces.

Vector space of random variables, correlation as inner product, forward andbackward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

Introduction to recursive least squares (RLS), vector space formulation of RLSeestimation, pseudoinverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.

Text/Reference Books:

1. S. Haykin, Adaptive filter theory, Prentice Hall, 1986.
2. C.Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 1984.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the non-linear control and the need and significance of changing the control parameters w.r.t. real-time situation.
2. Mathematically represent the ‘adaptability requirement’.
3. Understand the mathematical treatment for the modeling and design of the signal processing systems.

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PE-EC702B	Digital Image and Video Processing	3L:0T:0P	3 credits
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Digital Image Fundamentals-Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels - neighborhood, adjacency, connectivity, distance measures.

Image Enhancements and Filtering-Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters - linear and order-statistics, pixel-domain sharpening filters - first and second derivative, two-dimensional DFT and its inverse, frequency domain filters -low-pass and high-pass.

Color Image Processing-Color models-RGB, YUV, HSI; Color transformations- formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.

Image Segmentation- Detection of discontinuities, edge linking and boundary detection, thresholding - global and adaptive, region-based segmentation.

Wavelets and Multi-resolution image processing- Uncertainty principles of Fourier Transform, Time-frequency localization, continuous wavelet transforms, wavelet bases and multi-resolution analysis, wavelets and Subband filter banks, wavelet packets.

Image Compression-Redundancy-inter-pixel and psycho-visual; Lossless compression - predictive, entropy; Lossy compression-predictive and transform coding; Discrete Cosine Transform; Still image compression standards-JPEG and JPEG-2000.

Fundamentals of Video Coding-Inter-frame redundancy, motion estimation techniques - full-search, fast search strategies, forward and backward motion prediction, frame classification - I, P and B; Video sequence hierarchy-Group of pictures, frames, slices, macro-blocks and blocks; Elements of a video encoder and decoder; Video coding standards - MPEG and H.26X.

Video Segmentation-Temporal segmentation-shot boundary detection, hard-cuts and soft-cuts; spatial segmentation-motion-based; Video object detection and tracking.

Text/Reference Books:

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India. 2nd edition 2004
3. Murat Tekalp, Digital Video Processing" Prentice Hall, 2nd edition 2015

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Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Mathematically represent the various types of images and analyze them.
2. Process these images for the enhancement of certain properties or for optimized use of the resources.
3. Develop algorithms for image compression and coding

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PE-EC702C	Neural Network and Fuzzy Logic Control	3L:0T	3 credits
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Neural Networks and Pattern Association:

Differences between biological and artificial neural networks – Typical architecture – Common activation functions– McCulloch – Pitts neuron – Simple neural nets for pattern classification – Linear separability – Hebb net –Perceptron – Adaline – Madaline – Architecture – Algorithm and simple applications – Training algorithms for pattern association – Hebb rule and delta rule – Hetero associative – Auto associative and iterative auto associative net – Bidirectional associative memory – Architecture – Algorithm – Simple applications.

Neural Networks based on Competition:

Kohonen self organising maps – Learning vector quantization – Counter propagation – Architecture – Algorithm and applications

Adaptive Resonance and Backpropagation Neural Networks:

ART1 and ART2 – Basic operation and algorithm – Standard back propagation architecture – Derivation of learning rules – Boltzmann machine learning – Architecture – Algorithm and simple applications

Fuzzy sets and Membership Functions:

Properties and operations on classical and fuzzy sets – Crisp and fuzzy relations – Cardinality – properties and operations – Composition – Tolerance and equivalence relations – Simple problems –Features of membership function – Standard forms and boundaries – Fuzzification – Membership value assignments – Fuzzy to crisp conversions – Lambda cuts for fuzzy sets and relations –Defuzzification methods.

Applications of Neural networks and Fuzzy logic:

Applications of neural networks – Pattern recognition – Image compression – Communication – Control systems

Applications of fuzzy logic – Fuzzy pattern recognition – Fuzzy image compression – Fuzzy logic controllers

Text Book

1. Fundamentals of Neural Networks, Laurene Fausett, 2004, Pearson Education.
2. Fuzzy Logic with Engineering Applications, Timothy Ross, 1998, McGraw-Hill.

Reference Book

1. Introduction to Neural Networks Using Matlab 6.0, Sivanandam, S.N., Sumathi, S. and Deepa, S.N, 2005, TMH.
2. Fundamentals of Artificial Neural Networks, Mohammad H. Hassoun, 1st edition, 2010, PHI
3. Neural Networks and Fuzzy Systems, Bark Kosko, 1st edition, PHI

Course Outcome

1. analyze and classify neural networks and its implementation algorithms.

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2. apply suitable algorithms on different cases.
3. apply fuzzy logic and neural networks.
4. analyze the applications of Neural Network and Fuzzy logic in image processing.

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PE-EC703A	Embedded System	3L:0T:0P	3 credits
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Overview of Embedded System: Embedded System, Embedded Processor in System, Components of Embedded System, Brief introduction to Embedded software in system, Design Process in Embedded System.

Embedded Hardware:

Processor & Memory: Brief overview of 8051 Architecture and real world interfacing, Introduction to advanced Processor Architectures-ARM, Processor and Memory organization, Parallelism in instruction level, Processor and memory selection.

I/O Types: Serial and Parallel communication Ports, Timer and Counting devices, Watchdog timers, real time clock, Serial bus Communication Protocols- I2C, CAN, and Parallel Communication Protocol- ISA.

Interrupt Service Mechanism: Concept of ISR, different interrupt sources, Interrupt handling Mechanism, Multiple Interrupts, Interrupt Latency and deadline.

Embedded Software Development-

Software Development: Programming concept in ALP (assembly language programming) and High level language-C, Processor directives, functions and macros and other programming elements, Embedded C++ concept only.

RTOS(Real time operating System)- OS overview, Process, Interrupt and memory management, RTOS overview, Basic Design rule using RTOS, Task scheduling using Priority based scheduling, cyclic scheduling and round robin scheduling.

Embedded system Design using PIC microcontroller: Introduction to Microchip PIC16 family, PIC16F873

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processor architecture- features, memory organization, on chip peripherals, Watchdog timer, ADC, Data EEPROM, Asynchronous serial port, SPI mode, I2C mode, Interfacing with LCD, ADC, sensors, stepper motor, key board, DAC.

Case study of different types of Embedded System: Design of Automated Chocolate Vending Machine, Digital Camera.

Text Book

1. Microcontrollers Theory and Application, Ajay V. Deshmukh, TMH, 2011.
2. Embedded Systems: Architecture, Programming & Design, Raj Kamal, TMH, 2011
319

Reference Book

1. Embedded System Design: A unified Hardware/ Software Introduction, by Frank Vahid, Willey, 2011.
2. Design with PIC Microcontrollers , J. B. Peatman, Pearson India,2008

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PE-EC703B	Wireless Sensor Networks	3L:0T	3 credits
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Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee,

Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.

Single-node architecture, Hardware components & design constraints,

Operating systems and execution environments, introduction to TinyOS and nesC.

Text/Reference Books:

1. Waltenegus Dargie , Christian Poellabauer, “Fundamentals Of Wireless Sensor Networks Theory And Practice”, By John Wiley & Sons Publications ,2011
2. Sabrie Soloman, “Sensors Handbook" by McGraw Hill publication. 2009
3. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier Publications,2004
4. Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inter science
5. Philip Levis, And David Gay "TinyOS Programming" by Cambridge University Press 2009

Course Outcomes:

At the end of the course the students will be able to

1. Design wireless sensor networks for a given application
2. Understand emerging research areas in the field of sensor networks
3. Understand MAC protocols used for different communication standards used in WSN
4. Explore new protocols for WSN

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PE-EC703C	Wavelet Transforms	3L:0T	3 credits
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Introduction:

- Origin of wavelets and its history
- Different communities of wavelet
- Classification: continuous and discrete wavelet transforms
- Developments in wavelet theory applications

Continuous Wavelet Transform:

- Introduction
- Continuous time wavelets
- Definition of CWT
- Constant Q factor filtering interpretation and Time Frequency Resolution
- CWT as an operator
- Inverse CWT

Introduction to the Discrete Wavelet Transform and orthogonal Wavelet decomposition:

- Approximations of vectors in nested linear vector subspaces
- Multi-resolution Analysis of $L^2(\mathbb{R})$
- Haar Scaling function
- Haar wavelet
- Haar wavelet decomposition.
- Haar wavelet packets and application.

MRA Ortho -normal wavelets and their relationships to filter banks:

- Construction of an ortho-normal MRA
- Wavelet basis for the MRA
- Digital filtering interpretation
- Examples of orthogonal basis generating wavelets
- Interpreting ortho-normal MRA for discrete time signals
- Generating scaling functions and wavelets from filter coefficients.

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Bi-orthogonal Wavelets:

- Bi-orthogonal Wavelet bases
- Filtering relationship for Bi-orthogonal filters
- Bi-orthogonal scaling functions and wavelets
- Two dimensional wavelets
- Non separable Multi-dimensional wavelet
- Wavelet Packets.

Wavelength Transform and applications:

- Transform coding
- DTWT for image compression, audio compression
- Wavelet based audio coding, video coding and multi resolution Techniques
- Wavelet de-noising, Speckle removal, Edge detection and
- object isolation
- •Image fusion, Object detection, discrete wavelet multi-tone
- modulation.

Beyond Wavelet:

- Ridge lets and curve lets: Ridge let transform and Digital Curve let transform
- Curve let construction
- Properties and applications.

Reference Books:

1. Raguveer M. Rao and Ajit S. Bopardikar - Wavelet Transforms – Introduction and applications - Pearson Education, 2008
2. K.P Soman, K.I. Ramachandran – Insight into Wavelets from Theory to practice, PHI 2006

Course Outcome:

After successfully completion of this course, students should be able to –

1. Classify various wavelet transform and explain importance of it.
2. Describe Continuous Wavelet Transform (CWT) and Discrete Wavelet Transform (DWT).
3. Explain the properties and application of wavelet transform.

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4. Develop and realize computationally efficient wavelet based algorithms for signal and image processing.
5. Explain brief features and strength of transform beyond wavelet.

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OE-EC704A	Web Technology	3L:0T:0P	3 credits
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Web Development:

HTML, Structure, Tags, Lists, Table, Link and it's types ,Images, Form, Frame, Style sheets and it's type

Introduction to Java:

Java and Java applications, Java Virtual Machine(JVM), Java Runtime Environment(JRE)Java Development Kit(JDK,) Byte code, Java characteristics, Object oriented Programming, Simple java programs, Data types, Operators, Expressions, control statements, Selection statements, Iteration statements, Jump statements

Classes, Inheritance :

Classes in java, Declaring a class, Creating instances of class, Constructors, Argument Passing, use of static keyword, Inner class. Method overloading, Inheritance, use of super keyword ,Method overriding, Abstract class, Dynamic method dispatch, use of final keyword

Interface, Package:

Package, Access control mechanism, Interface, Dynamic Method look up

Exception Handling:

Java Exception Handling Mechanism, try, catch, throw, throws and finally, Exception types, Built in Exceptions: checked and unchecked exceptions, User defined Exceptions

String Handling:

String and String Buffer, Constructors, String operations : character extractions, String comparisons, searching, strings, modifying a string. To String() and valueOf() methods, String Buffer operations

Java I/O Stream:

I/O basics, Byte stream, Character stream, Reading console input, Writing console output, Reading and writing files

Java Utility package:

Collection overview, Collection interfaces, Collection classes: ArrayList, LinkedList, Accessing a collection using, iterator and for-Each statement

Applet:

Applet class, Applet architecture, Applet Skeleton, Life cycle methods, setForeground() and setBackground() methods, Using the status window, HTML Applet tag, Passing parameters to an applet, GetCodebase() and Get Documentbase() methods.

Event Handling and AWT:

Delegation Event Model, Event classes, Sources of Events, Event Listener interfaces, Event handling using adapter class, Inner and anonymous class, AWT classes: Label, Button, TextField etc.

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Text Book

1. Java-The Complete Reference, Herbert Schildt, 9th Edition, McGraw Hill Education 2014

Reference Book

1. HTML- Complete Reference, Powell, 3rd Edition, TMH 2007
2. Core Java-An Integrated Approach, Dr. R.Nageswara Rao, Dreamtech 2015

Course Outcome: At the end of the course, the students will be able to:

1. design good web pages using different tags, tables, forms, frames and style sheets supported by HTML.
2. implement, compile, test and run Java programs, comprising more than one class, to address a particular software problem.
3. demonstrate the ability to employ various types of selection statements and iteration statements in a Java program.
4. be able to leverage the object-oriented features of Java language using abstract class and interface.
5. be able to handle errors in the program using exception handling techniques of Java.
6. design applets as per the requirements with event handling facility.

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OE-EC704B	Optimization Technique	3L:0T:0P	3 credits
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Introduction: Optimal problem formulation, Design variables constraints, Objective function, Variable bounds, Engineering optimization problems, Optimization algorithms.

Single-variable Optimization Algorithm: Optimality Criteria, Bracketing methods: Exhaustive search methods, Region-Elimination methods; Interval halving method, Fibonacci search method, Point estimation method; Successive quadratic estimation method.

Gradient-based Methods: Newton-Raphson method, Bisection method, Secant method, Computer programmes.

Multivariable Optimization Algorithm: Optimality criteria, unidirectional search, Direct search methods: Evolutionary optimization method, Simplex search method, Hooke-Jeeves pattern search method, Cauchy's (Steepest descent) method, Newton's method, multi-objective optimization, Pareto optimization.

Constrained Optimization Algorithm: Characteristics of a constrained problem. Direct methods: The complex method, Cutting plane method, Indirect method: Transformation Technique, Basic approach in the penalty function method, Interior penalty function method, Convex method.

Advanced Optimization Algorithms: Genetic Algorithm (GA), working principles, GA operators, selection methods, advanced GAs, computer programmes, simulated annealing. Particle swarm optimization (PSO), differential evolution (DE) algorithm, bacterial foraging algorithm, ant colony optimization algorithm.

Text Book

1. Optimization for Engineering Design-Algorithms & Examples – K. Deb, PHI, 2nd Ed., 2012.
2. Multi-objective Optimization Using Evolutionary Algorithms-K. Deb, John Wiley & Sons, 1st Ed., 2001.

Reference Book

1. Optimization: Theory and Applications - S.S. Rao, Wiley Eastern Ltd, 2nd Ed., 1979.

Course Outcome: At the end of the course, the students will be able to :

1. formulate fitness functions and cost functions for engineering optimization problems and specify the constraints as required.
2. implement different single variable optimization algorithms including the gradient based methods.
3. analyze and implement different multi variable optimization algorithms and a multi objective optimization techniques based on Pareto-Fronts.
4. implement Bio-inspired optimization algorithms for solving complex engineering problems.

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OE-EC704C	Entrepreneurship	3L:0T:0P	3 credits
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UNIT-I :

New Industrial Policy of 1991, Meaning and Definition of Entrepreneurship, Incentives and benefits available to SSI Units and New Entrepreneurs. Dearth of entrepreneurial talent in India, Growth of SSI in India. Procedures to start SSIs.

UNIT-II :

Market survey and research pricing and techniques, Distribution Channel, Sales promotion activities. Raising Finance and enterprise launching.

UNIT-III :

Financial Management, Working Capital Management, Costing, Book Keeping, Break-Even-Analysis. Taxation: Income Tax, Excise duty, Sales tax and VAT.

UNIT-IV :

Decision making – Types, Forecasting- Qualitative and Quantitative methods, Personal Management, Motivation and theories of motivation. Preliminary Project Report (PPR), Detailed Project Report (DPR) writing.

Text Book

1. Entrepreneurial Development. S.S. Khanka. S.Chand, 2007.

Reference Book

1. Industrial Organisation and Engg. Economics. Sharma & Banga. Khanna Publication, 2003.
2. Entrepreneurship New Venture Creation. David H. Holt. Prentice Hall .PHI, 2013.

Course outcome : At the end of the course the students will be able to :

1. know the contribution of an entrepreneur and role of SSI units in growth and development of socioeconomic condition of our country.
2. learn market survey, sales promotions and management of working capital through costing and book keeping.
3. know different decision making technique and benefit of personal management system as well as motivational methods of an enterprise.
4. learn how to prepare a project report and knowledge about different tax system of an enterprise.

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EC782	Project Stage I	L:0T:8P	4 credits
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The object of Project Work I is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility;
4. Preparing a Written Report on the Study conducted for presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental committee.

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Semester-VIII

PE-EC801A	Antennas and Propagation	3L:0T	3 credits
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Fundamental Concepts- Physical concept of radiation, Radiation pattern, near-and-far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.

Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop.

Aperture and Reflector Antennas-Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas.

Broadband Antennas- Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas.

Micro strip Antennas- Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas.

Antenna Arrays-Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, synthesis of antenna arrays using Schelkunoff polynomial method, Woodward-Lawson method.

Basic Concepts of Smart Antennas-Concept and benefits of smart antennas, fixed weight beam forming basics, Adaptive beam forming.

Different modes of Radio Wave propagation used in current practice.

Text/Reference Books:

1. J.D. Kraus, Antennas, McGraw Hill, 1988.
2. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 1982.
3. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
4. R.C. Johnson and H. Jasik, Antenna Engineering Handbook, McGraw Hill, 1984.
5. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.
6. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill, 2005
7. R.E. Crompton, Adaptive Antennas, John Wiley

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the properties and various types of antennas.
2. Analyze the properties of different types of antennas and their design.
3. Operate antenna design software tools and come up with the design of the antenna of required specifications.

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PE-EC801B	Fiber Optic Communication	3L:0T	3 credits
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Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model.

Different types of optical fibers, Modal analysis of a step index fiber.

Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and measurement techniques like OTDR.

Optical sources - LEDs and Lasers, Photo-detectors - pin-diodes, APDs, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties.

Optical switches - coupled mode analysis of directional couplers, electro-

optical switches. Optical amplifiers - EDFA, Raman amplifier.

WDM and DWDM systems. Principles of WDM networks.

Nonlinear effects in fiber optic links. Concept of self-phase modulation, group velocity dispersion and soliton based communication.

Text/Reference Books

1. J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).
2. T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.
3. J. Gowar, Optical communication systems, Prentice Hall India, 1987.
4. S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, Academic Press, 1979.
5. G. Agrawal, Nonlinear fibre optics, Academic Press, 2nd Ed. 1994.
6. G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1997
7. F.C. Allard, Fiber Optics Handbook for engineers and scientists, McGraw Hill, New York (1990).

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the principles fiber-optic communication, the components and the bandwidth advantages.
2. Understand the properties of the optical fibers and optical components.
3. Understand operation of lasers, LEDs, and detectors
4. Analyze system performance of optical communication systems
5. Design optical networks and understand non-linear effects in optical fibers

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PE-EC801C	Error Correcting Codes	3L:0T	3 credits
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Linear block codes: Systematic linear codes and optimum decoding for the binary symmetric channel; Generator and Parity Check matrices, Syndrome decoding on symmetric channels; Hamming codes; Weight enumerators and the McWilliams identities; Perfect codes, Introduction to finite fields and finite rings; factorization of (X^n-1) over a finite field; Cyclic Codes.

BCH codes; Idempotents and Mattson-Solomon polynomials; Reed-Solomon codes, Justen codes, MDS codes, Alterant, Goppa and generalized BCH codes; Spectral properties of cyclic codes. ;Decoding of BCH codes: Berlekamp's decoding algorithm, Massey's minimum shift register synthesis technique and its relation to Berlekamp's algorithm. A fast Berlekamp - Massey algorithm. Convolution codes; Wozencraft's sequential decoding algorithm, Fann's algorithm and other sequential decoding algorithms; Viterbi decoding algorithm.

Text/Reference Books:

1. F.J. McWilliams and N.J.A. Sloane, The theory of error correcting codes, 1977.
2. R.E. Balahut, Theory and practice of error control codes, Addison Wesley, 1983.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the error sources
2. Understand error control coding applied in digital communication

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PE-EC802A	Mixed Signal Design	3L:0T	3 credits
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Analog and discrete-time signal processing, introduction to sampling theory; Analog continuous-time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform.

Switched-capacitor filters- Nonidealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications.

Basics of data converters; Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.

Mixed-signal layout, Interconnects and data transmission; Voltage-mode signaling and data transmission; Current-mode signaling and data transmission.

Introduction to frequency synthesizers and synchronization; Basics of PLL, Analog PLLs; Digital PLLs; DLLs.

Text/Reference Books:

1. R. Jacob Baker, CMOS mixed-signal circuit design, Wiley India, IEEE press, reprint 2008.
2. Behzad Razavi, Design of analog CMOS integrated circuits, McGraw-Hill, 2003.
3. R. Jacob Baker, CMOS circuit design, layout and simulation, Revised second edition, IEEE press, 2008.
4. Rudy V. dePlassche, CMOS Integrated ADCs and DACs, Springer, Indian edition, 2005.
5. Arthur B. Williams, Electronic Filter Design Handbook, McGraw-Hill, 1981.
6. R. Schauman, Design of analog filters by, Prentice-Hall 1990 (or newer additions).
7. M. Burns et al., An introduction to mixed-signal IC test and measurement by, Oxford university press, first Indian edition, 2008.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the practical situations where mixed signal analysis is required.
2. Analyze and handle the inter-conversions between signals.
3. Design systems involving mixed signals

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PE-EC802B	Industrial Automation and Control	3L:0T	3 credits
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Sensors: Displacement sensors, Force sensors, Ultrasonic sensors, Temperature sensors, Pressure sensors etc

Actuators: Dc motors, Servo motors, Stepper motors, Piezo electric actuators, Pneumatic actuators etc.

Signal Conditioning: Filtering, Amplifying, Isolation, ADC, DAC, Sensor protection circuits, Signal transmission and noise suppression, Estimation of errors and calibration.

Controller tuning:

PI controller, PD controller, PID controller and tuning methods: *Ziegler-Nichols tuning method*, *Cohen coon tuning method*, Implementation of PID controllers (digital and analog).

Automation:

PLC (Programmable logic controllers): Overview, operation and architecture, PLC programming, Application examples.

DCS (Distributed control systems): Overview, Advantages, Functional requirements of Distributed control systems, Communication for distributed control, Application examples.

SCADA (supervisory control and data acquisition): Introduction to SCADA, SCADA system components, architecture and communication, SCADA applications.

Advanced control techniques: Feed forward control, Ratio control, Cascade control, Adaptive control, Duplex or split range control, Override control, internal mode control.

Text book

1. Computer-Based Industrial Control, Krishna Kant, 2nd edition Prentice Hall of India Ltd.
2. Chemical Process Control – Theory and Practice, Stephanopoulos, Prentice Hall of India Ltd, 1984.
3. Fundamentals of Industrial Instrumentation and Process Control, William C. Dunn, TataMcGrawHill, 2009.

Course Outcome : At the end of the course, the students will be able to :

1. select suitable sensor to measure industrial parameters and the different types of actuators and its working. They will be able to design proper signal conditioning circuit to the transducer.
2. determine the effect of proportional gain, integral time, derivative gain constant on the system performance and will be able to tune the controller using tuning methods, implement PID using electronic , digital, pneumatic and hydraulic methods.
3. design the ladder logic to implement any process with given problem statement.
4. analyze DCS hardware and its merits/demerits in an industrial automation
5. analyze SCADA hardware and software and its merits/demerits in industrial automation.
6. design the complex control scheme to a particular process.

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PE-EC802C	VLSI Design Automation	3L:0T	3 credits
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Unit-I: Introduction to VLSI Design methodologies

Review of Data structures and algorithms - Review of VLSI Design automation tools -
Algorithmic Graph Theory and Computational Complexity - Tractable and Intractable problems
- general purpose methods for combinatorial optimization.

Unit-II: Layout Compaction, Placement & Partitioning

Layout Compaction: Design rules - problem formulation - algorithms for constraint graph
compaction – *Placement & Partitioning:* Circuit representation - Placement algorithms -
partitioning

Unit-III: Floorplanning & Routing

Floor planning concepts: Terminologies, floorplan representation, shape functions and floorplan
sizing *Routing:* Types of local routing problems - Area routing - channel routing - global routing
- algorithms for global routing.

Unit-IV: VLSI Simulation

Gate-level modeling and simulation - Switch-level modeling and simulation - Combinational
Logic Synthesis - Binary Decision Diagrams - Two Level Logic Synthesis- High level Synthesis.

Unit-V: High Level Synthesis

Hardware models - Internal representation - Allocation assignment and scheduling - Simple
scheduling algorithm - Assignment problem – High level transformations.

REFERENCE BOOKS

1. S.H. Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons, 2002.
2. N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwer Academic Publishers, 2002

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OE-EC803A	Internet of Things(IoT)	3L:0T:0P	3 credits
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Introduction:

The Internet of Things: an Overview:

The flavour of the Internet of Things, The "Internet" of "Things", The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things?

Design Principles for Connected Devices:

Calm and Ambient Technology, Magic as Metaphor, Privacy, Web Thinking for Connected Devices, Affordances.

Internet Principles:

Internet Communications: An Overview (IP, TCP, The IP Protocol Suite (TCP/IP), UDP), IP Addresses (DNS, Static IP Address Assignment, Dynamic IP Address Assignment, IPv6), MAC Addresses, TCP and UDP Ports, Application Layer Protocols.

Prototyping:

Thinking About Prototyping: Sketching, Familiarity, Costs versus Ease of Prototyping, Prototypes and Production, Open Source versus Closed Source, Tapping into the Community.

Prototyping Embedded Devices:

Electronics, Embedded Computing Basics, Developing on the Arduino, Raspberry Pi, Beaglebone Black, Electric Imp, Mobile Phone and Tablets, Plug Computing: Always-on Internet of Things.

Prototyping the Physical Design:

Preparation, Sketch, Iterate, and Explore, Non-digital Methods, Laser Cutting, 3D Printing, CNC Milling, Repurposing/Recycling.

Prototyping Online Components:

Getting Started with an API, Writing a New API, Real-Time Reactions, Other Protocols.

Techniques for Writing Embedded Code:

Memory Management, Performance and Battery Life, Libraries, Debugging.

Prototype to Reality:

Business Models: A Short History of Business Models, The Business Model Canvas, Who Is The Business Model

For Models, Funding an Internet of Things Startup, Lean Startups.

Moving to Manufacture:

What Are You Producing?, Designing Kits, Designing Printed Circuit Boards, Manufacturing Printed Circuit Boards, Mass-Producing the Case and Other Fixtures, Certification, Costs, Scaling Up Software,

Ethics:

Characterizing the Internet of Things, Privacy, Control, Environment, Solutions.

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Text Book

1. Adrian McEwen, Hakim Cassimally, “Designing the Internet of Things”, Wiley publication, 1st Edition, November 2013.

Course Outcome : At the end of the course, the students will be able to :

1. understand the application areas of IOT.
2. realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.
3. understand building blocks of Internet of Things and characteristics.

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OE-EC803B	Big Data Analysis	3L:0T:0P	3 credits
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COURSE OBJECTIVES :

- Understand the Big Data Platform and its Use cases
- Provide an overview of Apache Hadoop
- Provide HDFS Concepts and Interfacing with HDFS
- Understand Map Reduce Jobs
- Provide hands on Hadoop Eco System
- Apply analytics on Structured, Unstructured Data.
- Exposure to Data Analytics with R.

COURSE OUTCOMES: The students will be able to:

- Identify Big Data and its Business Implications.
- List the components of Hadoop and Hadoop Eco-System
- Access and Process Data on Distributed File System
- Manage Job Execution in Hadoop Environment
- Develop Big Data Solutions using Hadoop Eco System
- Analyze Infosphere BigInsights Big Data Recommendations.
- Apply Machine Learning Techniques using R.

Pre- requisites : Should have knowledge of one Programming Language (Java preferably), Practice of SQL (queries and sub queries), exposure to Linux Environment.

UNIT I : INTRODUCTION TO BIG DATA AND HADOOP

Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.

UNIT II : HDFS(Hadoop Distributed File System) The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

UNIT III : Map Reduce Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

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Unit IV : Hadoop Eco System Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL : Introduction

UNIT V : Data Analytics with R Machine Learning : Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.

Text Books

- Tom White “ Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012.
- Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

References

- Michael Berthold, David J. Hand, "Intelligent Data Analysis”, Springer, 2007.
- Jay Liebowitz, “Big Data and Business Analytics” Auerbach Publications, CRC press (2013)
- Tom Plunkett, Mark Hornick, “Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop”, McGraw-Hill/Osborne Media (2013), Oracle press.
- Anand Rajaraman and Jeffrey David Ulman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
- Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.
- Glen J. Myat, “Making Sense of Data”, John Wiley & Sons, 2007
- Pete Warden, “Big Data Glossary”, O’Reily, 2011.
- Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
- ArvindSathi, “BigDataAnalytics: Disruptive Technologies for Changing the Game”, MC Press, 2012
- Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.

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OE-EC803C	Cyber Security	3L:0T:0P	3 credits
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Introduction:

Cyber Security – Cyber Security policy – Domain of Cyber Security Policy – Laws and Regulations – Enterprise Policy – Technology Operations – Technology Configuration - Strategy Versus Policy – Cyber Security Evolution – Productivity – Internet – E commerce – Counter Measures Challenges. Botnets.

Cyber security objectives and guidance

Cyber Security Metrics – Security Management Goals – Counting Vulnerabilities – Security Frameworks – E Commerce Systems – Industrial Control Systems – Personal Mobile Devices – Security Policy Objectives – Guidance for Decision Makers – Tone at the Top – Policy as a Project – Cyber Security Management – Arriving at Goals – Cyber Security Documentation – The Catalog Approach – Catalog Format – Cyber Security Policy Taxonomy.

Cyber governance issues

Cyber Governance Issues – Net Neutrality – Internet Names and Numbers – Copyright and Trademarks – Email and Messaging - Cyber User Issues - Malvertising - Impersonation – Appropriate Use – Cyber Crime – Geo location – Privacy - Cyber Conflict Issues – Intellectual property Theft – Cyber Espionage – Cyber Sabotage – Cyber Welfare.

Cyber infrastructure issues

Cyber Infrastructure Issue – economics ,finance and banking – Health care – Industrial Control systems. Cyber insurance, cyber security in international relations.

Text Book

1. Jennifer L. Bayuk, J. Healey, P. Rohmeyer, Marcus Sachs , Jeffrey Schmidt, Joseph Weiss “Cyber Security Policy Guidebook” John Wiley & Sons 2012.

Reference Book

1. Rick Howard “Cyber Security Essentials” Auerbach Publications 2011.
2. B.G Raggad, “ Information Security Management”, CRC Press, Taylor Francis, 2015

Course Outcome : At the end of the course, the students will be able to :

1. understand the concept of cyber security

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OE-EC804A	Artificial Intelligence	3L:0T:0P	3 credits
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Introduction:

Overview; Foundation; History; The State of Art.

Intelligent Agents:

Agents and environment; Rationality; The nature of environment; The structure of agents.

Solving Problems by Searching:

Problem-solving agents; Well defined problems & solutions; Formulating problems; Searching for solution; Uninformed search strategies: (BFS, DFS, DLS, IDDFS, Bidirectional Search)

Informed Search and Exploration:

Informed search strategies; Heuristic functions; On-line search agents and unknown environment.

Constraint Satisfaction Problems:

Constraint satisfaction problems; Backtracking search for CSPs; Local search for CSPs.

Adversarial search:

Games; Optimal decisions in games; Alpha-Beta pruning.

Logical Agents:

Knowledge-based agents; The wumpus world as an example world; Logic: Propositional logic Reasoning patterns in propositional logic.

First-order Logic:

Syntax and semantics of first-order logic; Use of first-order logic.

Text Book

1. Artificial Intelligence: A Modern Approach – Stuart Russel, Peter Norvig, 3rd Edition, Pearson Education,

Reference Book

1. Artificial Intelligence - Elaine Rich, Kevin Knight and Shivashankar B Nair, 3rd Edition, Tata McGraw Hill, 2008.
2. Artificial Intelligence: A new Synthesis – Nils J. Nilsson, 1st Edition, Elsevier, 1997.
3. Introduction to Artificial Intelligence and Expert Systems- Dan W. Patterson 2nd Edition, PHI, 2009.

Course Outcome: At the end of the course, the students will be able to:

1. understand the modern view of AI as the study of agents that receive percepts from the environment and perform actions.
2. demonstrate awareness of the major challenges facing AI and the complex of typical problems within the field.

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3. exhibit strong familiarity with a number of important AI techniques, including in particular search, knowledge representation, planning and constraint management.
4. asses critically the techniques presented and to apply them to real world problems.

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OE-EC804B	Microwave Integrated Circuits	3L:0T:0P	3 credits
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Introduction: Introduction to Microwave Integrated Circuits (MIC) and Monolithic Microwave Integrated Circuits (MMICs), their advantages over discrete circuits, MMIC fabrication techniques, Thick and Thin film technologies and materials, encapsulation and mounting of active devices in MIC and MMIC.

Planar Transmission Lines-I: Strip line & microstrip line, field configurations, quasi-TEM mode in microstrip line, analysis of microstrip transmission line, concept of effective dielectric constant, impedance of Strip line & microstrip line, dispersion and losses in microstrip line, discontinuities in microstrip.

Planar Transmission Lines-II: Slot Line, approximate analysis and field distribution of slot line, transverse resonance method and evaluation of slot line impedance, comparison with microstrip line. Fin lines & Coplanar Lines, analysis of Fin lines by transverse resonance method, conductor loss in Fin lines, coplanar wave guide (CPW).

Parallel-coupled Microstrip Lines and Power Dividers: Coupled microstrip lines, even mode and odd mode characteristic impedances, semi-empirical formulae for coupled line parameters, coupled-region length, coupler directivity, crosstalk between microstrip lines, design of microstrip branch-line power divider and rat-race ring power divider.

MIC Measurement, Testing and Applications: MIC measurement system, microwave test fixtures and probes, measurement techniques of S- parameters, noise measurement.

Text Book

1. Microstrip Lines and Slot Lines - K.C. Gupta, R. Garg. , I. Bahl, P. Bhartia, Artech House, 2nd Ed., 1996.
2. Foundation for Microstrip Circuit Design-T. C. Edwards, John Wiley & Sons Ltd, 2nd Ed., 1992.

Reference Book

1. Stripline-like Transmission lines for Microwave Integrated Circuits, B. Bhat, S. K. Koul, Wiley Eastern Ltd, 1st Ed., 1989.
2. Microwave Integrated Circuits, K.C. Gupta and A. Singh, Wiley Eastern Limited, 1st Ed., 1975.

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Course Outcome: At the end of the course, the students will be able to :

1. analyze the fabrication techniques of MIC and MMIC , use of active devices with MIC and MMIC, differentiate between MIC and MMIC.
2. analyze and design strip lines and micro strip lines, and model the discontinuities in those lines.
3. analyze and design slot lines, fin lines, coplanar lines and coplanar wave-guides
4. design parallel coupled lines for couplers and power divider circuits.
5. differentiate between various measurement techniques associated with planar transmission lines.

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OE-EC804C	Organizational Behavior	3L:0T:0P	3 credits
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UNIT-1-Introduction to Organization and Organizational Behaviour :

Meaning and definition of organization, features and principles of organization, Organizational structures and nature of organizational behavior.

UNIT-2-Personality :

Meaning of Personality, Personality Development, Determinants of personality, Application of personality in the organizational level. Motivation-concept of motivation, motivation and behavior, Theories of motivation, Need theory, Hygiene theory, Theory X and Theory Y, Elements of sound motivational system, Motivation in Indian organization.

UNIT-3-Leadership :

Meaning, Theory of leadership, Trait theory, Behavioural theory, Leadership styles, Leadership in Indian Organisation. Group Dynamics-Concept of Group Dynamic, Types of Group, Group Behaviour, Group Decisions, Techniques to improve group decision, merits and de-merits of group decision.

UNIT-4- Organizational Change :

Meaning and Nature of organizational change, Factors of organizational change, Resistance to change, Factors in resistance, Overcoming resistance to change, Organizational Development-Concept, Objectives and process of organization development.

Text Book

1. ORGB, An innovative Approach to Learning and Teaching ,Organizational Behaviour, Nelson, Quick, Khandelwal, Cengage Learning, 2012.

Reference Book

1. Organizational Behaviour Dr S.S.Khanka, S.Chand, 2014.
2. Organisational Behaviour. Arun Kumar and N.Meenaskshi .Vikas Publishing House, 2009.
3. Managing Organisational Behaviour, Moorhead & Griffin. CENGAGE Learning, 2014.
4. Human Behaviour at Work. Keith Davies, 2002.

Course Outcome : At the end of the course the students will be able to:

1. know about organisational structure, organisational behaviour and personality development.
2. learn about motivational techniques and skill required to work in a group and the process of group decision making.
3. know various leadership styles and the role of leader in achievement of organisational objective.

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4. learn about the reasons organizational change and its development.

EC881	Project Stage II	L:0T:15P	7.5 credits
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The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under EC P1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned in the light of the Report prepared under EC P1;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar Presentation before a Departmental Committee.

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3rd Semester**Theory:**

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 301	Electric Circuit Theory	3	1	0	4	4
2	PC-EE 302	Analog Electronics	3	0	0	3	3
3	PC-EE 303	Electromagnetic field theory	3	0	0	3	3
4	ES-ME 301	Engineering Mechanics	3	0	0	3	3
5	BS-M 301	Mathematics-III	3	0	0	3	3
6	BS-EE301	Biology for Engineers	3	0	0	3	3
7	MC-EE 301	Indian Constitution	3	0	0	3	0
		TOTAL OF SEMESTER:				22	19

Practical / Sessional:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 391	Electric Circuit Theory Laboratory	0	0	2	2	1
2	PC-EE 392	Analog Electronics laboratory	0	0	2	2	1
3	PC-CS 391	Numerical Methods laboratory	0	0	2	2	1
		Total of Practical / Sessional				06	3
		TOTAL OF SEMESTER:				28	22

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4th Semester**Theory:**

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 401	Electric machine-I	3	0	0	3	3
2	PC-EE 402	Digital Electronic	3	0	0	3	3
3	PC-EE 403	Electrical and Electronics Measurement	3	0	0	3	3
4	ES-EE 401	Thermal Power Engineering	3	0	0	3	3
5	HM-EE401	Values and Ethics in profession	3	0	0	3	3
6	MC- EE401	Environmental Science	3	0	0	3	0
TOTAL OF SEMESTER:						18	15

Practical / Sessional:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 491	Electric Machine-I laboratory	0	0	2	2	1
2	PC-EE 492	Digital Electronics laboratory	0	0	2	2	1
3	PC-EE 493	Electrical and electronic measurement laboratory	0	0	2	2	1
4	ES-ME 491	Thermal Power Engineering laboratory	0		2	2	1
		Total of Practical / Sessional				08	4
TOTAL OF SEMESTER:						26	19

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5th Semester**Theory:**

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 501	Electric machine-II	3	0	0	3	3
2	PC-EE 502	Power System-I	3	0	0	3	3
3	PC-EE 503	Control system	3	0	0	3	3
4	PC-EE 504	Power Electronics	3	0	0	3	3
5	PE-EE 501 A/B/C	Elective I	3	0	0	3	3
6	OE 501 A/B/C	Elective II(Open Elective)	3	0	0	3	3
		TOTAL OF SEMESTER:				18	18

Practical / Sessional:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 591	Electric Machine-II laboratory	0	0	2	2	1
2	PC-EE 592	Power system-I laboratory	0	0	2	2	1
3	PC-EE 593	Control system laboratory	0	0	2	2	1
4	PC-EE 594	Power Electronics laboratory	0	0	2	2	1
		Total of Practical / Sessional				08	4
		TOTAL OF SEMESTER:				26	22

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Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 601	Power System-II	3		0	3	3
2	PC-EE-602	Micro processor & micro controller	3	0	0	3	3
3	PE-EE 601A/B/C	Digital control system/HVDC Transmission/Electrical Machine Design	3	0	0	3	3
4	PE-EE 602A/B/C	Electrical And Hybrid Vehicle/ Power Quality And Facts/ Industrial Electrical Systems	3	0	0	3	3
5	OE-EE 601A/B/C	Digital Signal Processing/ Communication Engineering/ VLSI And Micro Electronics	3	0	0	3	3
6	HM-EE-601	Economics For Engineers	3	0	0	3	3
		TOTAL OF SEMESTER:				18	18

Practical / Sessional:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 691	Power system-II laboratory	0	0	2	2	1
2	PC-EE692	Micro processor & microcontroller laboratory	0	0	2	2	1
2	PC-EE 681	Electrical & Electronic design laboratory	1	0	4	5	3
		Total of Practical / Sessional				09	05
		TOTAL OF SEMESTER:				27	23

Summer Internship of 3-week duration after 6th semester. Students will be assessed based on submission of report on internship and presentation in a seminar in 7th semester

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7th Semester

Theory:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 701	Electric Drive	3	0	0	3	3
2	PE-EE 701		3	0	0	3	3
3	OE-701		3	0	0	3	3
4	OE-702		3		0	3	3
5	HM-701		3	0	0	3	3
		TOTAL OF SEMESTER:				15	15

Practical / Sessional:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 791	Electric Drive laboratory	0	0	2	2	1
2	PW-EE 781	Project stage-I	0	0	4	4	2
3	PW-EE782	Seminar	0	0	0	0	1
		Total of Practical / Sessional				06	04
TOTAL OF SEMESTER:						21	19

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8th Semester**Theory:**

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 801	Utilization of Electric Power	3	0	0	3	3
2	PE- EE 801		3	0	0	3	3
3	OE-801		3	0	0	3	3
		TOTAL OF SEMESTER:				09	09

Practical / Sessional:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PW-EE 881	Project stage-II	0	0	16	16	8
		Total of Practical / Sessional				16	08
TOTAL OF SEMESTER:						25	17

1st Year Curriculum for B.Tech courses in Engineering & Technology

(Applicable from the academic session 2018-2019)



Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits

B. Range of credits :

A range of credits from 150 to 160 for a student to be eligible to get B.Tech Degree in Engineering. A student will be eligible to get B.Tech Degree *with Honours*, if he/she completes an additional 20 credits. These could be acquired through Massive Open Online Courses (MOOCs).

C. MOOCs for B. Tech Honours

The additional 20 credits (for obtaining B. Tech with Honours) are to be gained through MOOCs. The complete description of the MOOCs relevant for the first year course are given in *Annexure-I*. The courses for subsequent years of study will be posted subsequently.

D. Guidelines regarding Mandatory Induction Program for the new students

All concerned are requested to follow the guidelines given in *Annexure-II* (Notice dt.06/12/2017) concerning Mandatory Induction Program. The colleges/ Institute may also refer to the AICTE Model Curriculum for Undergraduate Degree Courses in Engineering & Technology (January 2018) -Volume I (Page No.31-38), if necessary.

E. Mandatory Additional Requirement for earning B. Tech Degree

All concerned are requested to follow the guidelines in *Annexure-III* concerning Mandatory Additional Requirements.

F. Group division:

Group-A:

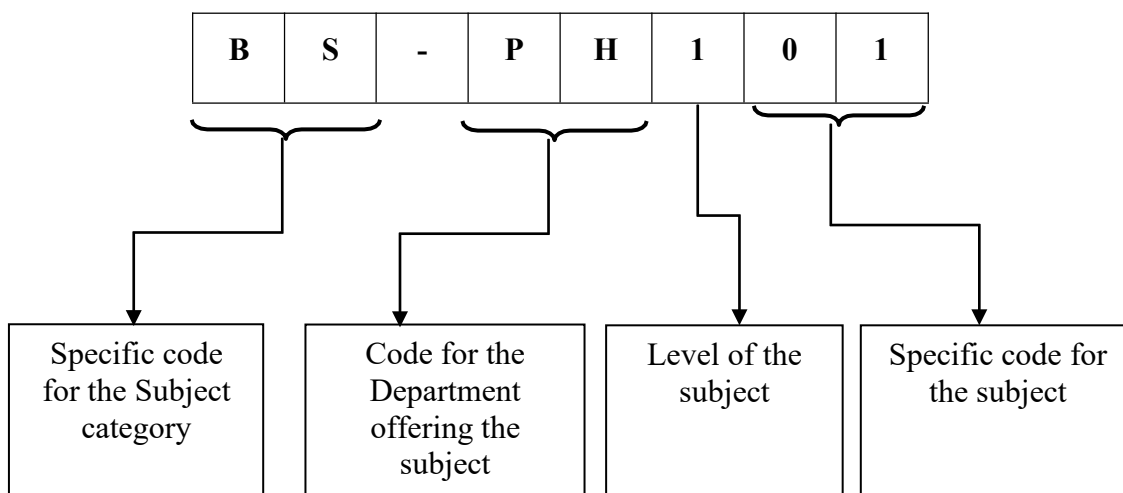
Chemistry based subjects: [Bio-Technology, Food Technology, Leather Technology, Textile Technology, Ceramic Technology, Chemical Engineering and any other Engineering that chooses to be Chemistry based] + Physics based subjects: [Mechanical Engineering, Production Engineering, Civil Engineering, Automobile Engineering, Marine Engineering, Apparel Production Engineering, Computer Science & Engineering, Information Technology.]

Group-B:

All Physics based subjects which are also Electrical & Electronics based [Electrical Engineering, Electronics & Communication Engineering, Applied Electronics & Instrumentation Engineering, Power Engineering, Electrical & Electronics Engineering, Bio-Medical Engineering, Instrumentation & Control Engineering]

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G. Subject Numbering Scheme:



List of Codes for Subject Category	
Code	Category Name
BS	Basic Science Courses
ES	Engineering Science Courses
HM	Humanities and Social Sciences including Management courses
PC	Professional core courses
PE	Professional Elective courses
OE	Open Elective courses
MC	Mandatory courses
PW	Project

List of Codes for Departments			
Code	Name of the Department	Code	Name of the Department
APM	Apparel Production Engineering	ECE	Electronics & Communication Engineering
AEIE	Applied Electronics & Instrumentation Engineering	FT	Food Technology
AUE	Automobile Engineering	IT	Information Technology
BME	Bio-Medical Engineering	ICE	Instrumentation & Control Engineering
BT	Bio-Technology	LT	Leather Technology
CT	Ceramic Technology	MRE	Marine Engineering
CHE	Chemical Engineering	ME	Mechanical Engineering
CE	Civil Engineering	PWE	Power Engineering
CSE	Computer Science & Engineering	PE	Production Engineering
EEE	Electrical & Electronics Engineering	TT	Textile Technology
EE	Electrical Engineering		

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First Year First Semester							
Mandatory Induction Program- 3 weeks duration							
Sl No.	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science course	BS-PH101/ BS-CH101	Physics-I (Gr-A)/ Chemistry-I(Gr-B)	3	1	0	4
2	Basic Science course	BS-M101/ BS-M102	Mathematics –IA*/ Mathematics –IB *	3	1	0	4
3	Engineering Science Courses	ES-EE101	Basic Electrical Engineering	3	1	0	4
	Total Theory			9	3	0	12
Practical							
1	Basic Science course	BS-PH191/ BS-CH191	Physics-I Laboratory (Gr-A)/ Chemistry-I Laboratory (Gr-B)	0	0	3	1.5
2	Engineering Science Courses	ES-EE191	Basic Electrical Engineering Laboratory	0	0	2	1
3	Engineering Science Courses	ES-ME191/ ES-ME192	Engineering Graphics & Design(Gr-B)/ Workshop/Manufacturing Practices(Gr-A)	1	0	4	3
	Total Practical			1		9	5.5
	Total of First Semester			10	3	9	17.5

* Mathematics –IA (BS-M101) - CSE & IT
 Mathematics –IB (BS-M102) - All stream except CSE & IT

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First Year Second Semester							
Sl No.	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science courses	BS-PH201/ BS-CH201	Physics-I (Gr-B)/ Chemistry-I (Gr-A)	3	1	0	4
2	Basic Science courses	BS-M201/ BS-M202	Mathematics –IIA [#] / Mathematics –IIB [#]	3	1	0	4
3	Engineering Science Courses	ES-CS201	Programming for Problem Solving	3	0	0	3
4	Humanities and Social Sciences including Management courses	HM-HU201	English	2	0	0	2
	Total Theory			11	2	0	13
Practical							
1	Basic Science courses	BS-PH291/ BS-CH291	Physics-I Laboratory (Gr-B)/ Chemistry-I Laboratory (Gr-A)	0	0	3	1.5
2	Engineering Science Courses	ES-CS291	Programming for Problem Solving	0	0	4	2
3	Engineering Science Courses	ES-ME291/ ES-ME292	Engineering Graphics & Design(Gr-A)/ Workshop/Manufacturing Practices(Gr-B)	1	0	4	3
4	Humanities and Social Sciences including Management courses	HM-HU291	Language Laboratory	0	0	2	1
	Total Practical			1	0	13	7.5
	Total of Second Semester			12	2	13	20.5

Mathematics –II (BS-M201) - CSE & IT
 Mathematics –II (BS-M202) - All stream except CSE & IT

	Group-A	Group-B
1 st Year 1 st Semester	Physics-I (BS-PH101); Workshop/Manufacturing Practices (ES-ME192)	Chemistry-I (BS-CH101); Engineering Graphics & Design (ES-ME191)
1 st Year 2 nd Semester	Chemistry-I (BS-CH201); Engineering Graphics & Design (ES-ME291)	Physics-I (BS-PH201); Workshop/Manufacturing Practices (ES-ME292)

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Course Code : BS-PH101/ BS-PH201	Category : Basic Science Courses
Course Title : Physics-I	Semester : First/ Second
L-T-P : 3-1-0	Credit:4
Pre-Requisites:	

Course objectives :

Basic concepts of mechanics, optics and its applications, electricity, magnetism and qualitative understanding of concepts of quantum physics and statistical mechanics.

1. Mechanics (7L)

Problems including constraints & friction. Basic ideas of vector calculus and partial differential equations. Potential energy function $F = -\text{grad } V$, equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy & momentum. Non-inertial frames of reference. Harmonic oscillator; Damped harmonic motion forced oscillations and resonance. Motion of a rigid body in a plane and in 3D. Angular velocity vector. Moment of inertia.

2. Optics (5L)

- Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits (only the expressions for max;min, & intensity and qualitative discussion of fringes); diffraction grating(resolution formulac only), characteristics of diffraction grating and its applications.
- Polarisation : Introduction, polarisation by reflection, polarisation by double reflection, scattering of light, circular and elliptical polarisation, optical activity.
- Lasers : Principles and working of laser : population inversion, pumping, various modes, threshold population inversion with examples .

3. Electromagnetism and Dielectric Magnetic Properties of Materials (8L)

- Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielecrrics, internal fields in a solid, Clausius- Mossotti equation(expression only), applications of dielectrics.
- Magnetisation , permeability and susceptibility, classificationof magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.

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4. Quantum Mechanics (16L)

- Introduction to quantum physics, black body radiation, explanation using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.

5. Statistical Mechanics (8L)

- Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics.

Course outcomes:

Students will be familiar with

- Basic concepts of mechanics
- Bragg's Law and introduction to the principles of lasers, types of lasers and applications.
- Various terms related to properties of materials such as, permeability, polarization, etc.
- Some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials.
- Simple quantum mechanics calculations.
-

Learning Resources:

1. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited
2. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker, Wiley
3. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press
4. Engineering Mechanics (In SI Units) (SIE), S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati, McGraw Hill Education
5. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education
6. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education
7. Engineering Mechanics, M.K. Harbola, Cengage India
8. An Introduction to Mechanics (SIE), David Kleppner, Robert Kolenkow, McGraw Hill Education
9. Principles of mechanics, John L. Synge and Byron A. Griffith, New York, McGraw-Hill
10. Mechanics (Dover Books on Physics), J. P. Den Hartog, Dover Publications Inc.
11. Engineering Mechanics: Dynamics, L.G. Kraige J.L. Meriam, Wiley
12. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, Robert Eisberg, Robert Resnick, Wiley
13. Introduction to Quantum Mechanics, J. Griffiths David, Pearson Education
14. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press
15. Optics, Hecht, Pearson Education
16. Optics, Ghatak, McGraw Hill Education India Private Limited
17. Fundamentals of Statistical and Thermal Physics, Reif, Sarat Book Distributors
18. Statistical Mechanics, Pathria, Elsevier
19. Statistical Physics, L.D. Landau, E.M. Lifshitz, Butterworth-Heinemann

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Course Code : BS-CH101/ BS-CH201	Category : Basic Science Courses
Course Title : Chemistry-I	Semester : First/ Second
L-T-P : 3-1-0	Credit:4
Pre-Requisites:	

Detailed contents

i) Atomic and molecular structure (10 lectures)

Schrodinger equation. Particle in a box solutions and their applications for simple sample. Molecular orbitals of diatomic molecules (e.g.H₂). Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

ii) Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

iii) Inter-molecular forces and potential energy surfaces (4 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena.

iv) Use of free energy in chemical equilibria (8 lectures)

First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

v) Periodic properties (4 Lectures)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

vi) Stereochemistry (4 lectures)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

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vii) Organic reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

Learning Resources:

1. Engineering Chemistry, Satyaprakash, Khanna Book Publishing, Delhi
2. University chemistry, by B. H. Mahan
3. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
4. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
5. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
6. Physical Chemistry, by P. W. Atkins
7. Spectroscopy of Organic Compounds, by P.S.Kalsi, New Age International Pvt Ltd Publishers
8. Physical Chemistry, P. C. Rakshit, Sarat Book House
9. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition
<http://bcs.whfreeman.com/vollhardtschore5e/default.asp>

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Course Code : BS-M101	Category : Basic Science Course
Course Title : Mathematics – I A	Semester : First (CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic	Lectures Hours
1	<i>Calculus (Integration):</i> Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	<i>Calculus (Differentiation):</i> Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	<i>Matrices:</i> Matrices, Vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.	7
4	<i>Vector Spaces:</i> Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem, composition of linear maps, Matrix associated with a linear map.	9
5	<i>Vector Spaces (Continued):</i> Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.	10

Course Outcomes:

The students will be able to:

Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

Understand the domain of applications of mean value theorems to engineering problems.

Learn different types of matrices, concept of rank, methods of matrix inversion and their applications.

Understand linear spaces, its basis and dimension with corresponding applications in the field of computer science.

Learn and apply the concept of eigen values, eigen vectors, diagonalisation of matrices and orthogonalization in inner product spaces for understanding physical and engineering problems

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Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. S.K. Mapa, Higher Algebra: Abstract and Linear, Sarat Book House Pvt.Ltd.
8. Hoffman and Kunze: Linear algebra, PHI.

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Course Code : BS-M102	Category : Basic Science Course
Course Title : Mathematics –I B	Semester : First (All stream except CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic	Lectures Hours
1	<i>Calculus (Integration):</i> Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	<i>Calculus (Differentiation):</i> Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	<i>Sequence and Series:</i> Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.	11
4	<i>Multivariate Calculus:</i> Limit, continuity and partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, Curl and Divergence.	9
5	<i>Matrices:</i> Inverse and rank of a matrix, Rank-nullity theorem; System of linear equations; Symmetric, Skew-symmetric and Orthogonal matrices; Determinants; Eigenvalues and Eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.	8

Course Outcomes:

After completing the course the student will be able to

Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

Understand the domain of applications of mean value theorems to engineering problems.

Learn the tools of power series and Fourier series to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.

Apply the knowledge for addressing the real life problems which comprises of several variables or attributes and identify extremum points of different surfaces of higher dimensions.

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Understand different types of matrices, their eigen values, eigen vectors, rank and also their orthogonal transformations which are essential for understanding physical and engineering problems.

Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.

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Course Code : ES-EE101	Category : Engineering Science Courses
Course Title : Basic Electrical Engineering	Semester : First
L-T-P : 3-1-0	Credit: 4
Pre-Requisites:	

Detailed contents:

Module 1: DC Circuits (8 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers (6 hours)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 hours)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters (6 hours)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

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Course Outcomes

To understand and analyze basic electric and magnetic circuits

To study the working principles of electrical machines and power converters.

To introduce the components of low voltage electrical installations

Learning Recourses:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Book Publishing Co. (P) Ltd., Delhi.
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
4. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
5. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
6. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

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Course Code : BS-PH191/ BS-PH291	Category : Basic Science course
Course Title : Physics-I Laboratory	Semester : First/ Second
L-T-P : 0-0-3	Credit:1.5
Pre-Requisites:	

Choose 10 experiments including at least one from Optics, Electricity and Magnetism and Quantum Mechanics and at least a total of six from these three groups.

Experiments in Optics

1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of a monochromatic light by Newton's ring
3. Determination of wavelength of a monochromatic light by Fresnel's bi-prism
4. Determination of wavelength of the given laser source by diffraction method

Electricity & Magnetism experiments

1. Determination of thermo electric power of a given thermocouple.
2. Determination of specific charge (e/m) of electron by J.J. Thompson's method.
3. Determination of dielectric constant of a given dielectric material.
4. Determination of Hall coefficient of a semiconductor by four probe method.
5. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.
6. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
7. Determination of unknown resistance using Carey Foster's bridge
8. Study of Transient Response in LR, RC and LCR circuits using expeyes
9. Generating sound from electrical energy using expeyes

Experiments in Quantum Physics

1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Lande-g factor using Electron spin resonance spectrometer.
4. Determination of Rydberg constant by studying Hydrogen spectrum.
5. Determination of Band gap of semiconductor.
6. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

Miscellaneous experiments

1. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure
2. Determination of bending moment and shear force of a rectangular beam of uniform cross-section
3. Determination of modulus of rigidity of the material of a rod by static method
4. Determination of rigidity modulus of the material of a wire by dynamic method
5. To determine the moment of inertia of a body about an axis passing through its centre of gravity and to determine the modulus of rigidity of the material of the suspended wire
6. Determination of coefficient of viscosity by Poiseuille's capillary flow method

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Course Code : BS-CH191/ BS-CH291	Category : Basic Science Courses
Course Title : Chemistry-I Laboratory	Semester : First/ Second
L-T-P : 0-0-3	Credit:1.5
Pre-Requisites:	

Choose 10 experiments from the following:

1. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
2. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
3. Determination of dissolved oxygen present in a given water sample.
4. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution)
5. Determination of surface tension and viscosity
6. Thin layer chromatography
7. Ion exchange column for removal of hardness of water
8. Determination of the rate constant of a reaction
9. Determination of cell constant and conductance of solutions
10. Potentiometry - determination of redox potentials and emfs
11. Saponification/acid value of an oil
12. Chemical analysis of a salt
13. Determination of the partition coefficient of a substance between two immiscible liquids
14. Adsorption of acetic acid by charcoal
15. Use of the capillary viscosimeters to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

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Course Code : ES-EE191	Category : Engineering Science Courses
Course Title : Basic Electrical Engineering Laboratory	Semester : First
L-T-P : 0-0-2	Credit: 1
Pre-Requisites:	

Choose 10 experiments from the following:

1. First activity: Introduction to basic safety precautions and mentioning of the do's and Don'ts. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about the modalities of evaluation.
2. Introduction and uses of following instruments :
 - (a) Voltmeter
 - (b) Ammeter
 - (c) Multimeter
 - (d) Oscilloscope

Demonstration of real life resistors, capacitors with color code , inductors and autotransformer.

3. Demonstration of cut-out sections of machines: DC machine, Induction machine, Synchronous machine and single phase induction machine.
4. Calibration of ammeter and Wattmeter.
5. Determination of steady state and transient response of R-L, R-C and R-L-C circuit to a step change in voltage.
6. Determination of steady state response of R-L and R-C and R-L-C circuit and calculation of impedance and power factor.
7. Determination of resonance frequency and quality factor of series and parallel R-L-C circuit.
8. (a) Open circuit and short circuit test of a single-phase transformer
(b) Load test of the transformer and determination of efficiency and regulation
9. Demonstration of three phase transformer connections. Voltage and current relationship, phase shifts between the primary and secondary side.
10. Measurement of power in a three phase unbalanced circuit by two wattmeter method.
11. Determination of Torque –Speed characteristics of separately excited DC motor.
12. Determination of Torque speed characteristics and observation of direction reversal by change of phase sequence of connection of Induction motor.
13. Determination of operating characteristics of Synchronous generator.
14. Demonstration of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter for speed control of an Induction motor
15. Demonstration of components of LT switchgear.

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Course Code : ES-ME191/ ES-ME 291	Category : Engineering Science Courses
Course Title : Engineering Graphics & Design	Semester : First/ Second
L-T-P : 1-0-4	Credit: 3
Pre-Requisites:	

Sl. No.	Content	Lecture (L)	Practical (P)
1	INTRODUCTION TO ENGINEERING DRAWING Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes.	1	4
2	LETTERING, DIMENSIONING, SCALES Plain scale, Diagonal scale and Vernier Scales.	1	4
3	GEOMETRICAL CONSTRUCTION AND CURVES Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Archimedian Spiral.	1	4
4	PROJECTION OF POINTS, LINES, SURFACES Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle, pentagon, Hexagon etc.) inclined Planes - Auxiliary Planes.	1	4
5	PROJECTION OF REGULAR SOLIDS Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).	1	4
6	COMBINATION OF REGULAR SOLIDS, FLOOR PLANS Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.	1	4
7	ISOMETRIC PROJECTIONS Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;	1	4

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8	SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)	1	4
9	OVERVIEW OF COMPUTER GRAPHICS, CUSTOMISATION & CAD DRAWING listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;	1	4
	ANNOTATIONS, LAYERING & OTHER FUNCTIONS applying dimensions to objects, applying annotations to drawings;		
10	Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;	2	8

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11	DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).	2	8
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Course Outcomes

The student will learn:

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling

General Instructions

1. In every topic some problems are to be done in the class and some are to be given to students as home assignment.
2. The problems for class work are to be prepared on drawing sheet of A1 size in the class/ using AutoCAD software.
3. The problems for home assignments are to be prepared on drawing copy/ using AutoCAD software.
4. Print out of every assignment is to be taken for CAD Drawings on Drawing sheets (A4 Sheets).
5. A title block must be prepared in each sheet/ assignment.

Following is the list of drawing instruments that required for making engineering drawings on paper with perfection.

1. Drawing Board
2. Mini drafter/ Set-squares (45°–45° & 60°–90°), T-square
3. Protractor (180°, 360°)
4. Scales (Plain, Diagonal)
5. Compass (Small and Large)
6. Divider (Small and Large)

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7. French Curves
8. Drawing paper (A1 Size)
9. Drawing pencil (H, HB, B)
10. Sharpener
11. Eraser
12. Drawing pins & clips
13. Duster or handkerchief etc.

Learning Resources:

1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House
2. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
5. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
6. Corresponding set of CAD Software Theory and User Manuals

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Course Code : ES-ME192/ ES-ME 292	Category : Engineering Science Courses
Course Title : Workshop/ Manufacturing Practices	Semester : First/ Second
L-T-P : 1-0-4	Credit:3
Pre-Requisites:	

(i) Lectures & videos:

Detailed contents:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Electrical & Electronics
5. Carpentry
6. Plastic moulding, glass cutting
7. Metal casting
8. Welding (arc welding & gas welding), brazing

(ii) Workshop Practice:

Machine shop (8 hours)

Typical jobs that may be made in this practice module:

To make a pin from a mild steel rod in a lathe.

To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Fitting shop (8 hours)

Typical jobs that may be made in this practice module:

To make a Gauge from MS plate.

Carpentry (8 hours)

Typical jobs that may be made in this practice module:

To make wooden joints and/or a pattern or like.

Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs))

Typical jobs that may be made in this practice module:

ARC WELDING (4 hours): To join two thick (approx 6mm) MS plates by manual metal arc welding.

GAS WELDING (4 hours): To join two thin mild steel plates or sheets by gas welding.

Casting (8 hours)

Typical jobs that may be made in this practice module:

One/ two green sand moulds to prepare, and a casting be demonstrated.

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Smithy (4 hours) ~ 4 hours

Typical jobs that may be made in this practice module:

A simple job of making a square rod from a round bar or like.

Plastic moulding & Glass cutting (4 hours)

Typical jobs that may be made in this practice module:

For plastic moulding, making at least one simple plastic component should be made.

For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made.

Electrical & Electronics (8 hours)

Familiarization with LT switchgear elements, making its sketches and noting down its specification. Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable.

Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point.

Simple wiring exercise to be executed to understand the basic electrical circuit.

Simple soldering exercises to be executed to understand the basic process of soldering.

Fabrication of a single-phase full wave rectifier with a step down transformer using four diodes and electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes

Upon completion of this laboratory course, students will be able to fabricate components with their own hands.

They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

By assembling different components, they will be able to produce small devices of their interest.

Learning Resources:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. and Steven S. Schmid, “Manufacturing Engineering and Technology”, 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu, “Manufacturing Technology – I” Pearson Education, 2008.
4. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4th edition, Prentice Hall India, 1998.
5. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGrawHill House, 2017.

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Course Code : BS-M201	Category : Basic Science Course
Course Title : Mathematics – II A	Semester : Second (CSE &IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics and BS-M101	

Module No.	Description of Topic	Lectures Hours
1	Basic Probability: Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the Multinomial distribution, Poisson approximation to the Binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.	11
2	Continuous Probability Distributions: Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities.	4
3	Bivariate Distributions: Bivariate distributions and their properties, distribution of sums and quotients, Conditional densities, Bayes' rule.	5
4	Basic Statistics: Measures of Central tendency, Moments, Skewness and Kurtosis, Probability distributions: Binomial, Poisson and Normal and evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.	8
5	Applied Statistics: Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	8
6	Small samples: Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	4

Course Outcomes:

The students will be able to:

Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.

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Understand the basic ideas of statistics with different characterisation of a univariate and bivariate data set.

Apply statistical tools for analysing data samples and drawing inference on a given data set.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
3. S. Ross, A First Course in Probability, Pearson Education India
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.
5. John E. Freund, Ronald E. Walpole, Mathematical Statistics, Prentice Hall.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
7. N.G. Das, Statistical Methods (Combined Volume), Tata-McGraw Hill.

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Course Code : BS-M202	Category : Basic Science Course
Course Title : Mathematics – II B	Semester : Second (All stream except CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics and BS-M102	

Module No.	Description of Topic	Lectures Hours
1	<i>Multivariate Calculus (Integration):</i> Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, change of variables (Cartesian to Polar), Applications: Areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.	11
2	<i>First order ordinary differential equations:</i> Exact, linear and Bernoulli's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.	5
3	<i>Ordinary differential equations of higher orders:</i> Second order linear differential equations with constant coefficients, Use of D-operators, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.	9
4	<i>Complex Variable – Differentiation</i> Differentiation of complex functions, Cauchy-Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithmic) and their properties; Conformal mappings, Mobius transformations and their properties.	6
5	<i>Complex Variable – Integration</i> Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, Zeros of analytic functions, Singularities, Laurent's series; Residues, Cauchy residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.	9

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Course Outcomes:

The students will be able to:

Learn the methods for evaluating multiple integrals and their applications to different physical problems.

Understand different techniques to solve first and second order ordinary differential equations with its formulation to address the modelling of systems and problems of engineering sciences.

Learn different tools of differentiation and integration of functions of a complex variable that are used with various other techniques for solving engineering problems.

Apply different types of transformations between two 2- dimensional planes for analysis of physical or engineering problems.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. E. L. Ince, Ordinary Differential Equations, Dover Publications.
8. J. W. Brown and R. V. Churchill, Complex Variables and Applications, Mc-Graw Hill.

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Course Code : ES-CS201	Category : Engineering Science Courses
Course Title : Programming for Problem Solving	Semester : Second
L-T-P : 3-0-0	Credit :3
Pre-Requisites:	

Detailed contents

Unit 1: Introduction to Programming (4 lectures)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - **(1 lecture)**.

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. **(1 lecture)**

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- **(2 lectures)**

Unit 2: Arithmetic expressions and precedence (2 lectures)

Unit 3: Conditional Branching and Loops (6 lectures)

Writing and evaluation of conditionals and consequent branching **(3 lectures)**

Iteration and loops **(3 lectures)**

Unit 4: Arrays (6 lectures)

Arrays (1-D, 2-D), Character arrays and Strings

Unit 5: Basic Algorithms (6 lectures)

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 6: Function (5 lectures)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Unit 7: Recursion (4 -5 lectures)

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 8: Structure (4 lectures)

Structures, Defining structures and Array of Structures

Unit 9: Pointers (2 lectures)

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Unit 10: File handling (only if time is available, otherwise should be done as part of the lab)

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Course Outcomes

The student will learn

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical errors.
- To implement conditional branching, iteration and recursion.
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- To apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.

Learning Resources:

1. R. S. Salaria, Computer Concepts and Programming in C, Khanna Publishers
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

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Course Code : ES-CS291	Category : Engineering Science Courses
Course Title : Programming for Problem Solving	Semester : Second
L-T-P : 0-0-4	Credit:2
Pre-Requisites:	

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

Tutorial 12: File handling:

Lab 12: File operations

Laboratory Outcomes

To formulate the algorithms for simple problems

To translate given algorithms to a working and correct program

To be able to correct syntax errors as reported by the compilers

To be able to identify and correct logical errors encountered at run time

To be able to write iterative as well as recursive programs

To be able to represent data in arrays, strings and structures and manipulate them through a program

To be able to declare pointers of different types and use them in defining self-referential structures.

To be able to create, read and write to and from simple text files.

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Course Code : HM-HU201	Category : Humanities and Social Sciences including Management courses
Course Title : English	Semester : Second
L-T-P : 2-0-0	Credit:2
Pre-Requisites:	

Detailed contents

1. Vocabulary Building

- 1.1 The concept of Word Formation: Compounding, Backformation, Clipping, Blending.
- 1.2 Root words from foreign languages and their use in English
- 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
- 1.4 Synonyms, antonyms, and standard abbreviations: Acronyms

2. Basic Writing Skills

- 2.1 Sentence Structures & Types: Simple, Compound, Complex
- 2.2 Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration
- 2.3 Importance of proper punctuation
- 2.4 Creating coherence: Arranging paragraphs & Sentences in logical order
- 2.5 Creating Cohesion: Organizing principles of paragraphs in documents
- 2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

- 3.1 Subject-verb agreement
- 3.2 Noun-pronoun agreement
- 3.3 Misplaced modifiers
- 3.4 Articles
- 3.5 Prepositions
- 3.6 Redundancies
- 3.7 Clichés

4. Nature and Style of sensible Writing

- 4.1 Describing
- 4.2 Defining
- 4.3 Classifying
- 4.4 Providing examples or evidence
- 4.5 Writing introduction and conclusion

5. Writing Practices

- 5.1 Comprehension
- 5.2 Précis Writing
- 5.3 Essay Writing
- 5.4 Business Letter, Cover Letter & CV; E-mail

Addendum

Some examples of English words with foreign roots

Greek Root/Affix	Examples
Anti	Antisocial, antiseptic

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Auto	Automatic, autograph
Anthropos	Anthropology, philanthropy
Bio	Biography
Chronos	Time
Di	Dilemma
Bio	Biology
Biblio	Bibliography
Chron	Chronology
Cracy	Contradiction
Geo	Geology
Hyper	Hyperactive
Mania	Kleptomania
Mega	Megaserial
Eu	Eulogy, euphoria
Geo	Geology
Graph	autograph, photograph
Hetero	Heterogeneous
Hyper	Hyperactive
Hypo	hypodermic, hypoglycemia
Macro	Macrocosm
Mega	megalomania
Micro	microcosm

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Mono	Monarch
Pan	Panorama
Pathos	Pathetic
Phobia	Hydrophobia
Pod (Gk), ped (Latin)	Pseudopodia
Poly	polyglot
Tele	Telephone
Theo	Theology, theist
Latin Root	Examples
Aud	Audible
Bene	Beneficial
Brev	abbreviate, brief
circum	Circulate
Contra	Contradict
Cred	Credible
Dict	Diction
Femina	Feminine
Inter	Internet, interval
Magna	Magnificent
Mal	Malnutrition
Multi	multinational
Nova	Novel
Multi	Multiple, multiplex
Non	Nonstop

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Pre	Previous, predicate
Re	Redo, rewind
Scrib	Scripture
Spect	Spectator
Trans	Transport
Uni	Unity
Omni	Omnipotent
Semi	Semicircle
Sub	Subway
somnus	Insomnia,
Super	Superman
Sym	Sympathy
scribe	Describe, scribble(write illegibly), inscribe
Trans	Transform
Un	Unnecessary
Uni	Universal

Learning Resources:

- (i) Kulbushan Kumar, R S Salaria, Effective Communication Skills, Khanna Publishing House, Delhi.
- (ii) Practical English Usage. Michael Swan. OUP. 1995.
- (iii) Remedial English Grammar. F.T. Wood. Macmillan. 2007
- (iv) On Writing Well. William Zinsser. Harper Resource Book. 2001
- (v) Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- (vi) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
- (vii) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
- (viii) Universal English Prof. Prasad Kataria Publications, 2019.
- (ix) "Communication Skills for Professionals"-Nira Konar, Prentice Hall of India 2nd edition, New Delhi, 2011
- (x) Gajendra Singh Chauhan, Smita Kashiramka and L. Thimmesha. Functional English. Cengage, 2019.

Course Outcomes

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

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Course Code : HM-HU291	Category : Humanities and Social Sciences including Management courses
Course Title : Language Laboratory	Semester : Second
L-T-P : 0-0-2	Credit:1
Pre-Requisites:	

- | | |
|---|----|
| 1) Honing 'Listening Skill' and its sub skills through Language Lab Audio device; | 3P |
| 2) Honing 'Speaking Skill' and its sub skills | 2P |
| 3) Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/
Voice modulation/ Stress/ Intonation/ Pitch & Accent) of connected speech | 2P |
| 4) Honing 'Conversation Skill' using Language Lab Audio –Visual input;
Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone &
Role Play Mode) | 2P |
| 5) Introducing 'Group Discussion' through audio –Visual input and acquainting them
with key strategies for success | 2P |
| 6) G D Practice Sessions for helping them internalize basic Principles
(turn- taking, creative intervention, by using correct body language, courtesies &
other soft skills) of GD | 4P |
| 7) Honing 'Reading Skills' and its sub skills using Visual / Graphics/
Diagrams /Chart Display/Technical/Non Technical Passages
Learning Global / Contextual / Inferential Comprehension; | 2P |
| 8) Honing 'Writing Skill' and its sub skills by using
Language Lab Audio –Visual input; Practice Sessions | 2P |

Course Outcomes

- The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

MOOCs for B. Tech Honours



Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal

Notice

1st May, 2018

MOOCs for B.Tech Honours (Applicable from the session 2018-2019)

Preamble

All India Council for Technical Education (AICTE) has introduced Model Curriculum for Bachelor of Technology programme with 160 credits in the entire programme of 4 years, and additional 20 credits will be required to be done for the degree of Bachelor of Technology with Honours. These additional 20 credits will have to be acquired with online courses (MOOCs) as per AICTE. So students will have to complete additional 20 credits through MOOCs within 4 years of time. This creates an excellent opportunity for students to acquire the necessary skill set for employability through massive online courses where the rare expertise of world famous experts from academics and industry are available. Maulana Abul Kalam Azad University of Technology, West Bengal (MAKAUT,WB) has thus decided to introduce AICTE model curriculum for its B.Tech Programmes and suggest baskets for MOOCs available year wise for the four-year long B.Tech programme from the sessions 2018-2019. The basket for MOOCs will be a dynamic one, as courses keep on updating with time. Few essential skill sets required for employability are also identified year wise by MAKAUT,WB. For MOOCs platforms where examination or assessment is absent (like SWAYAM) or where certification is costly (like Coursera or edX), faculty members of the Institutes are to audit the courses and prepare the examination question papers, for the courses undertaken by the students of respective Institutes, so that MAKAUT,WB can conduct examination for the course. The total of 20 credits that is required to be attained for B.Tech Honours degree are distributed over four years in the following way:

For first year	:	8 credits
For second year	:	4 credits
For third year	:	4 credits
For fourth year	:	4 credits

A student of first year has to cover courses from at least three skills :

1. Computer Programing with Python / R
2. Soft skill
3. Ethics

Courses are * marked in the above areas

If a student is unable to cover the credits assigned for the first year, he/she can do these courses in either of the subsequent years, but he/she has to choose the courses from the basket of MOOCs announced by MAKAUT,WB from time to time. The same rule will be applicable for the other years of the programme.

The basket for MOOCs for the 1st year B. Tech for the session 2018-2019 are made available herewith.

By order.

MOOCs for First Year, Engineering and Technology

Sl. No	Course	Provider	Duration	Credits	Name of University / Institution
1.	Presentation Skills: Designing Presentation Slides	Coursera *	4 weeks	1	Tomsk State University
2.	Effective Problem-Solving and Decision-Making	Coursera	4 weeks	1	University of California
3.	Communication in the 21st Century Workplace	Coursera *	4 weeks	1	University of California
4.	Psychology at Work	Coursera *	6 weeks	2	University of Western Australia
5.	Critical Thinking & Problem Solving	EdX *	3 weeks	3	Rochester Institute of Technology
6.	Successful Career Development	Coursera	7 weeks	2	University System of Georgia
7.	Working in Teams: A Practical Guide	edX	4 weeks	1	University of Queensland
8.	Communication theory: bridging academia and practice	Coursera	9 weeks	3	Higher School of Economics
9.	Speaking Effectively	NPTEL *	8 weeks	3	Indian Institute of Technology, Kharagpur
10.	Introduction to Philosophy	Coursera	5 weeks	1	University of Edinburgh
11.	Moralities of Everyday Life	Coursera	6 weeks	2	Yale University
12.	Introduction to Logic	Coursera *	10 weeks	3	Stanford University
13	Write Professional Emails in English	Coursera *	5 weeks	2	Georgia Institute of Technology
14	Technical Writing	Coursera	5 weeks	1	Moscow Institute of Physics and Technology
15	Learn to Program: The Fundamentals	Coursera	7 weeks	2	University of Toronto
16	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
17	Introduction to Problem Solving and Programming	NPTEL	12 weeks	4	NPTEL
18	The Science of Well Being	Coursera	6 weeks	2	Yale University
19	Developing Soft Skills and Personality	NPTEL	8 weeks	3	
20	Programming Basics	edX	9 weeks	3	IIT Bombay
21	Introduction to Python: Absolute Beginner	EdX *	5 weeks	2	Microsoft
22	Inferential Statistics	Coursera *	7 weeks	2	University of Amsterdam
23	Linear Regression and Modelling	Coursera	4 weeks	1	Duke University
24	Foundation of Data Structures	edX	6 weeks	2	IIT Bombay
25	Introduction to Logic	NPTEL	12 weeks	4	NPTEL
26	Introduction to Probability and Data	Coursera *	5 weeks	1	Duke University
27	Ethics	NPTEL *	12 weeks	4	
28	Science, Technology and Society	NPTEL	12 weeks	4	
29	Creating Innovation	Coursera	6 weeks	2	Macquarie University
30	Ethical Leadership Through Giving Voice to Values	Coursera *	4 weeks	2	University of Virginia
31	Creativity, Innovation, and Change	Coursera *	6 weeks	2	Pennsylvania State University
32	Interpersonal Communication for Engineering Leaders	Coursera	4 weeks	1	Rice University

33	Learn to Program: The Fundamentals	Coursera *	7 weeks	3	University of Toronto
34	Introduction to Mathematical Thinking	Coursera *	9 weeks	3	Stanford University
35	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
36	A Life of Happiness and Fulfillment	Coursera	6 weeks	2	Indian School of Business
37	Model Thinking	Coursera	12 weeks	4	University of Michigan
38	Introduction to Philosophy: God, Knowledge, and Consciousness	edX	12 weeks	4	MIT
39	Soft skills	NPTEL *	12 Weeks	4	IIT Roorkee
40	Developing Soft Skills and Personality	NPTEL *	8 weeks	3	IIT Kanpur
41	Indian Fiction in English	NPTEL	12 Weeks	4	IIT Madras
42	Development of Sociology in India	NPTEL	4 Weeks	1	IIT Kanpur
43	Intellectual Property	NPTEL	12 Weeks	4	IIT Madras
44	Essential Statistics for Data Analysis using Excel	EdX *	Self Paced	3	Microsoft
45	Ethics and Law in Data and Analytics	edX	Self Paced	4	Microsoft
46	Climate Change Mitigation in Developing Countries	Coursera *	6 weeks	3	University of Cape town
47	Web Design for Everybody (Basics of Web Development and Coding) Specialization	Coursera	15weeks	4	University of Michigan
48	Ecology: Ecosystem Dynamics and Conservation	Coursera	5 weeks	1	American Museum of Natural History, Howard Hughes Medical Institute
49	Environmental Studies: A Global Perspective	EdX *	Self Paced	4	Curtin University
50	Introduction to Computer Science and Programming Using Python	edX *	Self Paced	4	MIT, USA
51	Statistics and R	edX *	Self Paced	4	Harvard University
52	Introduction to Programming in C	Coursera *	4 weeks	4	Duke University
53	Java Programming: Solving Problems with Software	Coursera	4 weeks	4	Duke University
54	Grammar and Punctuation	Coursera	4 weeks	1	University of California
55	How to Write an Essay	Coursera *	5 weeks	1	University of California, Berkeley
56	Conversational English Skills	EdX *	10 weeks	3	Tsinghua University
57	Advanced Writing	Coursera *	4 weeks	1	University of California, Irvine
58	Speak English Professionally: In Person, Online & On the Phone	Coursera *	5 weeks	1	Georgia Institute of Technology
59	English for Science, Technology, Engineering, and Mathematics	Coursera	5 weeks	1	University of Pennsylvania
60	English Composition	edX	8 weeks	3	Arizona State University
61	Take Your English Communication Skills to the Next Level	Coursera *	4 weeks	1	Georgia Institute of Technology

Guidelines regarding Mandatory Induction Program for the new students



Maulana Abul Kalam Azad University of Technology, West Bengal
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Date: 06.12.2017

Maulana Abul Kalam Azad University of Technology, West Bengal

Guidelines regarding Induction Programme for the new students

(As per Model Curriculum for 1st Year UG degrees courses in Engineering & Technology, November 2017)

To be followed from the 2018-19 academic session

Preamble: Engineering education has evolved globally in a continuous manner to address the twin needs of industry and society. It is now an accepted fact that the institutions imparting technical education should aspire to create manpower who will possess strong technical knowledge and skill, have leadership qualities and be a team player, capable of coming up with innovative solutions and be alive to societal and community concerns.

The aim of the Induction Programme is to acclimatize the students to the environment of their engineering institution, give them a flavour of the exciting new world of education that they are entering, provide them with mentoring schemes, and make them aware of their neighbourhood, society and people. This will allow them to evolve as well rounded individuals.

The following schedule is laid down by the University to implement the three week long Induction Programme:

Week 1	1 st Half	Day 1	Overall introduction of the new students to the Institution, its different Departments & Faculty Members
	2 nd Half	Day 1	(a) Assignment of faculty mentors to the new students (b) Assessment and allotment for mentoring by senior students preferably from the second year
	2 hrs	Day 2, 3, 4, 5	Lectures by eminent personalities on different areas such as (a) Introduction to Engineering (b) Various topics of science and technology (c) Innovation and entrepreneurship (d) Creative and performing arts (e) Social issues
	2 hrs.	Day 2, 3, 4, 5	Participation in Games, Yoga, Meditation etc.
	2 hrs	Day 2, 3, 4, 5	Visit to the different Departments of the Institute
Week 2 (All Days)	2hrs		Scheduled class lectures as per time table.
	2hrs		Students to be conducted through proficiency modules to be prepared by respective Colleges for ascertaining English skills & Computer knowledge of the students

			and to prepare a report on the same
	2hrs		Participation in Games, Sports, Yoga, Creative arts etc.
Week 3	2hrs		Scheduled class lectures as per time table
		Day 1	Visits to neighbourhood locations
		Day 2	Visits to natural spots in adjoining areas to understand the effect of nature on society
		Day 3	Visits to Science Museum / laboratories
		Day 4	Visits to NGOs
		Day 5	

Any other activity, as deemed fit by the Director/Principal of the affiliated Colleges, may be proposed and discussed with the Academic Coordinator of the University, by sending email to the following address: academics.makaut@gmail.com.

Note: 1) If necessary, networking may be established with NGOs to facilitate the different components and aspects of the Induction Programme.

Mandatory Additional Requirement for earning B. Tech Degree



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Notice

Mandatory Additional Requirement for earning B.Tech Degree

Addressing the needs of the industry and the society: Globally, engineering education systems have continuously evolved, in order to address the needs of the industry and the society. It is becoming imperative that every University should create opportunities for the students to inculcate attributes, which are not restricted only to engineering knowledge and acumen. Industry needs professionals who can work successfully in teams, who have leadership qualities, who are alive to social and community needs and who can bring innovation and creativity to their work and who are also digitally proficient. Hence, in order to prepare its students to match these multiple requirements, MAKAUT, WB has created a unique mechanism of awarding 100 Activity Points over and above the academic grades. It is planned that the students at MAKAUT, WB will be able to reap benefits from these activities at their own pace and comfort. It is expected that by the time MAKAUT, WB's students reach their Final Year, they would have developed themselves so well both through their studies in the respective technological field and through their active participation in the co-curricular and extra-curricular activities as also through SAWYAM based learning activities that they would be well-prepared for contributing to building the India and the world of their dreams.

The additional requirement applies to: Every student, who is admitted to the 4 years B.Tech program from the academic year 2018-19 onwards, is required to earn minimum 100 Activity Points in addition to the required academic grades, for getting MAKAUT, WB's B.Tech degree. Similarly, it is mandatory to earn 75 Activity Points, in addition to the academic grades, for getting B.Tech degree by a student (Lateral Entry) who is admitted to the B.Tech program from the academic year 2018-19 onwards. *(Please see Table 1 for details.)* [Lateral Entry students will have a multiplying factor of 1.33 to bring uniformity in score].

Level of Entry in B.Tech Course	Total duration for earning Points	Minimum Points
1 st Year from the academic year 2018-19 onwards	1 st to 4 th Year	100
2 nd Year from the academic year 2018-19 onwards (Lateral Entry)	2 nd to 4 th Year	75

Table – I

For existing Students (except students in the 4th year): Every student, who is admitted to the 4 years B.Tech program prior to the academic year 2018-19, is required to earn minimum number of Activity Points as per Table II in addition to the required academic grades, for getting MAKAUT, WB's B.Tech degree.

Current Semester	Total Points to be earned During the full course
2 nd	100
4 th	75
6 th	50

Table –II

These points must be earned on the basis of active participation in co-curricular and extracurricular activities spanning through all the semesters of study. Every student may choose, as per his/her liking, activities in order to achieve the mandatory points (as per Table-III, depending on his/her entry level), before becoming eligible for award of the Degree. These activities can be spread over the years, as per convenience of the student.

Notes:

- **Current 4th year students who are going to sit for Final Semester examination in May-June, 2018 are outside the preview of this Mandatory Additional Requirement**
- Every student shall participate in the co-curricular and extra-curricular activities and produce documentary proof to the designated Faculty Members appointed by the Head of Department / Principal / Director in the respective college. Thereby the student should earn the required Points before *her* she appears for his/ her Final Examinations.
- A student's result of his/her Final Examinations will be withheld until he/she completes the minimum Activity Points by the end of his/her B.Tech Program.
- In every semester, every student is required to prepare a file containing documentary proofs of activities, done by him / her. This file will be duly verified and Activity Points will be assigned by the teachers as appointed above, at the end of every semester.
- The college will form a 3 members committee and finalize the Activity Points for each student before entering them into the Online Point Entry System (at the URL, as specified by the COE of the University).
- Every student has to earn at least 100 activity points. The points students has earned will be reflected in the student's marksheet.
- Activity points earned by Lateral Entry students will be multiplied by 1.33.

Table III provides a List of Activity Heads and Sub-Activity Heads along with their capping of the Activity Points that can be earned by the students during the entire B.Tech duration.

Sl. No.	Name of the Activity	Points	Maximum Points Allowed
1.	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) (per course)	20	40
2.	Tech Fest/Teachers Day/Freshers Welcome		
	Organizer	5	10
	Participants	3	6
5.	Rural Reporting	5	10
6.	Tree Plantation (per tree)	1	10
7.	Participation in Relief Camps	20	40
8.	Participation in Debate/Group Discussion/ Tech quiz	10	20
9.	Publication of Wall magazine in institutional level (magazine/article/internet)	10	20
10.	Publication in News Paper, Magazine & Blogs	10	20
11.	Research Publication (per publication)	15	30
12.	Innovative Projects (other than course curriculum)	30	60
13.	Blood donation	8	16
	Blood donation camp Organization	10	20
15.	Participation in Sports/Games		
	College level	5	10
	University Level	10	20
	District Level	12	24
	State Level	15	30
	National/International Level	20	20
21.	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20
22.	Member of Professional Society	10	20
23.	Student Chapter	10	20
24.	Relevant Industry Visit & Report	10	20
25.	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	5	10
26.	Participation in Yoga Camp (Certificate to be submitted)	5	10
27.	Self-Entrepreneurship Programme	20	20
28.	Adventure Sports with Certification	10	20
29.	Training to under privileged/Physically challenged	15	30
30.	Community Service & Allied Activities	10	20

Suggestions from the College Principals will be considered to append in the above Table-III.

Sd/-

Registrar(Acting)
MAKAUT,WB

Maulana Abul Kalam Azad University of Technology, West Bengal
Record of Activities for Mandatory Additional Requirement

Annexure-I
Rev:00

College Name (College Code):						Department:						
Student Name:				University Roll No:			Registration No:					
Sl No	Activity	Points	Max. Points Allowed	Points Earned								
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	Total
1	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) per course											
	For 12 weeks duration	20	40									
	For 8 weeks duration	16										
2	Tech Fest/Teachers Day/Freshers Welcome											
	Organizer	5	10									
	Participants	3	6									
3	Rural Reporting	5	10									
4	Tree Plantation and up keeping (per tree)	1	10									
5	Participation in Relief Camps	20	40									
6	Participation in Debate/Group Discussion/ Tech quiz	10	20									
7	Publication of Wall magazine in institutional level (magazine/article/internet)											
	Editor	10	20									
	Writer	6	12									
8	Publication in News Paper, Magazine & Blogs	10	20									
9	Research Publication (per publication)	15	30									
10	Innovative Projects (other than course curriculum)	30	60									
11	Blood donation	8	16									
	Blood donation camp Organization	10	20									

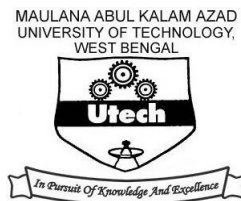
Maulana Abul Kalam Azad University of Technology, West Bengal
Record of Activities for Mandatory Additional Requirement

Annexure-I
Rev:00

Sl No	Activity	Points	Max. Points Allowed	Points Earned								Total
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	
12	Participation in Sports/Games											
	College level	5	10									
	University Level	10	20									
	District Level	12	24									
	State Level	15	30									
	National/International Level	20	20									
13	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20									
14	Member of Professional Society	10	20									
15	Student Chapter	10	20									
16	Relevant Industry Visit & Report	10	20									
17	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	5	10									
18	Participation in Yoga Camp (Certificate to be submitted)	5	10									
19	Self-Entrepreneurship Programme	20	20									
20	Adventure Sports with Certification	10	20									
21	Training to under privileged / Differently abled	15	30									
22	Community Service & Allied Activities	10	20									
Total Points												
Signature of Mentor												
Signature of HOD												
*Please abide strictly to the Notes at the end of the Notice by Registrar, MAKAUT, WB regarding Mandatory Additional Requirement for earning B.Tech Degree												
* <i>Annexure-I</i> is to be retained in the Institute records with all documentary proofs of activities (to be verified by the University as and when required).												

1st Year Curriculum for B.Tech courses in Engineering & Technology

(Applicable from the academic session 2018-2019)



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Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits

B. Range of credits :

A range of credits from 150 to 160 for a student to be eligible to get B.Tech Degree in Engineering. A student will be eligible to get B.Tech Degree *with Honours*, if he/she completes an additional 20 credits. These could be acquired through Massive Open Online Courses (MOOCs).

C. MOOCs for B. Tech Honours

The additional 20 credits (for obtaining B. Tech with Honours) are to be gained through MOOCs. The complete description of the MOOCs relevant for the first year course are given in *Annexure-I*. The courses for subsequent years of study will be posted subsequently.

D. Guidelines regarding Mandatory Induction Program for the new students

All concerned are requested to follow the guidelines given in *Annexure-II* (Notice dt.06/12/2017) concerning Mandatory Induction Program. The colleges/ Institute may also refer to the AICTE Model Curriculum for Undergraduate Degree Courses in Engineering & Technology (January 2018) -Volume I (Page No.31-38), if necessary.

E. Mandatory Additional Requirement for earning B. Tech Degree

All concerned are requested to follow the guidelines in *Annexure-III* concerning Mandatory Additional Requirements.

F. Group division:

Group-A:

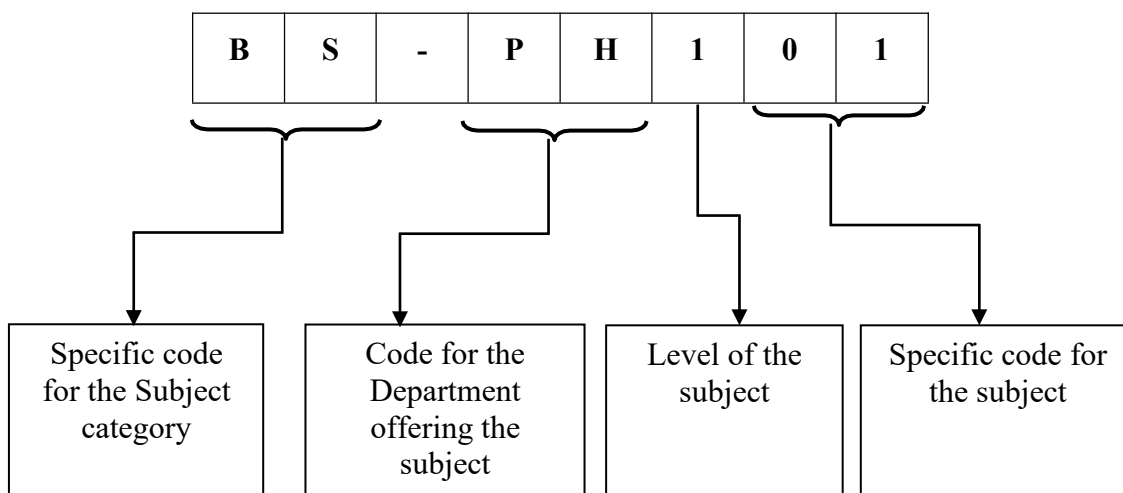
Chemistry based subjects: [Bio-Technology, Food Technology, Leather Technology, Textile Technology, Ceramic Technology, Chemical Engineering and any other Engineering that chooses to be Chemistry based] + Physics based subjects: [Mechanical Engineering, Production Engineering, Civil Engineering, Automobile Engineering, Marine Engineering, Apparel Production Engineering, Computer Science & Engineering, Information Technology.]

Group-B:

All Physics based subjects which are also Electrical & Electronics based [Electrical Engineering, Electronics & Communication Engineering, Applied Electronics & Instrumentation Engineering, Power Engineering, Electrical & Electronics Engineering, Bio-Medical Engineering, Instrumentation & Control Engineering]

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

G. Subject Numbering Scheme:



List of Codes for Subject Category	
Code	Category Name
BS	Basic Science Courses
ES	Engineering Science Courses
HM	Humanities and Social Sciences including Management courses
PC	Professional core courses
PE	Professional Elective courses
OE	Open Elective courses
MC	Mandatory courses
PW	Project

List of Codes for Departments			
Code	Name of the Department	Code	Name of the Department
APM	Apparel Production Engineering	ECE	Electronics & Communication Engineering
AEIE	Applied Electronics & Instrumentation Engineering	FT	Food Technology
AUE	Automobile Engineering	IT	Information Technology
BME	Bio-Medical Engineering	ICE	Instrumentation & Control Engineering
BT	Bio-Technology	LT	Leather Technology
CT	Ceramic Technology	MRE	Marine Engineering
CHE	Chemical Engineering	ME	Mechanical Engineering
CE	Civil Engineering	PWE	Power Engineering
CSE	Computer Science & Engineering	PE	Production Engineering
EEE	Electrical & Electronics Engineering	TT	Textile Technology
EE	Electrical Engineering		

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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

First Year First Semester							
Mandatory Induction Program- 3 weeks duration							
Sl No.	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science course	BS-PH101/ BS-CH101	Physics-I (Gr-A)/ Chemistry-I(Gr-B)	3	1	0	4
2	Basic Science course	BS-M101/ BS-M102	Mathematics –IA*/ Mathematics –IB *	3	1	0	4
3	Engineering Science Courses	ES-EE101	Basic Electrical Engineering	3	1	0	4
	Total Theory			9	3	0	12
Practical							
1	Basic Science course	BS-PH191/ BS-CH191	Physics-I Laboratory (Gr-A)/ Chemistry-I Laboratory (Gr-B)	0	0	3	1.5
2	Engineering Science Courses	ES-EE191	Basic Electrical Engineering Laboratory	0	0	2	1
3	Engineering Science Courses	ES-ME191/ ES-ME192	Engineering Graphics & Design(Gr-B)/ Workshop/Manufacturing Practices(Gr-A)	1	0	4	3
	Total Practical			1		9	5.5
	Total of First Semester			10	3	9	17.5

* Mathematics –IA (BS-M101) - CSE & IT
 Mathematics –IB (BS-M102) - All stream except CSE & IT

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First Year Second Semester							
Sl No.	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science courses	BS-PH201/ BS-CH201	Physics-I (Gr-B)/ Chemistry-I (Gr-A)	3	1	0	4
2	Basic Science courses	BS-M201/ BS-M202	Mathematics –IIA [#] / Mathematics –IIB [#]	3	1	0	4
3	Engineering Science Courses	ES-CS201	Programming for Problem Solving	3	0	0	3
4	Humanities and Social Sciences including Management courses	HM-HU201	English	2	0	0	2
	Total Theory			11	2	0	13
Practical							
1	Basic Science courses	BS-PH291/ BS-CH291	Physics-I Laboratory (Gr-B)/ Chemistry-I Laboratory (Gr-A)	0	0	3	1.5
2	Engineering Science Courses	ES-CS291	Programming for Problem Solving	0	0	4	2
3	Engineering Science Courses	ES-ME291/ ES-ME292	Engineering Graphics & Design(Gr-A)/ Workshop/Manufacturing Practices(Gr-B)	1	0	4	3
4	Humanities and Social Sciences including Management courses	HM-HU291	Language Laboratory	0	0	2	1
	Total Practical			1	0	13	7.5
	Total of Second Semester			12	2	13	20.5

Mathematics –II (BS-M201) - CSE & IT
 Mathematics –II (BS-M202) - All stream except CSE & IT

	Group-A	Group-B
1 st Year 1 st Semester	Physics-I (BS-PH101); Workshop/Manufacturing Practices (ES-ME192)	Chemistry-I (BS-CH101); Engineering Graphics & Design (ES-ME191)
1 st Year 2 nd Semester	Chemistry-I (BS-CH201); Engineering Graphics & Design (ES-ME291)	Physics-I (BS-PH201); Workshop/Manufacturing Practices (ES-ME292)

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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

Course Code : BS-PH101/ BS-PH201	Category : Basic Science Courses
Course Title : Physics-I	Semester : First/ Second
L-T-P : 3-1-0	Credit:4
Pre-Requisites:	

Course objectives :

Basic concepts of mechanics, optics and its applications, electricity, magnetism and qualitative understanding of concepts of quantum physics and statistical mechanics.

1. Mechanics (7L)

Problems including constraints & friction. Basic ideas of vector calculus and partial differential equations. Potential energy function $F = -\text{grad } V$, equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy & momentum. Non-inertial frames of reference. Harmonic oscillator; Damped harmonic motion forced oscillations and resonance. Motion of a rigid body in a plane and in 3D. Angular velocity vector. Moment of inertia.

2. Optics (5L)

- Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits (only the expressions for max;min, & intensity and qualitative discussion of fringes); diffraction grating(resolution formulac only), characteristics of diffraction grating and its applications.
- Polarisation : Introduction, polarisation by reflection, polarisation by double reflection, scattering of light, circular and elliptical polarisation, optical activity.
- Lasers : Principles and working of laser : population inversion, pumping, various modes, threshold population inversion with examples .

3. Electromagnetism and Dielectric Magnetic Properties of Materials (8L)

- Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielecrrics, internal fields in a solid, Clausius- Mossotti equation(expression only), applications of dielectrics.
- Magnetisation , permeability and susceptibility, classificationof magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.

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4. Quantum Mechanics (16L)

- Introduction to quantum physics, black body radiation, explanation using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.

5. Statistical Mechanics (8L)

- Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics.

Course outcomes:

Students will be familiar with

- Basic concepts of mechanics
- Bragg's Law and introduction to the principles of lasers, types of lasers and applications.
- Various terms related to properties of materials such as, permeability, polarization, etc.
- Some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials.
- Simple quantum mechanics calculations.
-

Learning Resources:

1. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited
2. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker, Wiley
3. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press
4. Engineering Mechanics (In SI Units) (SIE), S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati, McGraw Hill Education
5. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education
6. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education
7. Engineering Mechanics, M.K. Harbola, Cengage India
8. An Introduction to Mechanics (SIE), David Kleppner, Robert Kolenkow, McGraw Hill Education
9. Principles of mechanics, John L. Synge and Byron A. Griffith, New York, McGraw-Hill
10. Mechanics (Dover Books on Physics), J. P. Den Hartog, Dover Publications Inc.
11. Engineering Mechanics: Dynamics, L.G. Kraige J.L. Meriam, Wiley
12. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, Robert Eisberg, Robert Resnick, Wiley
13. Introduction to Quantum Mechanics, J. Griffiths David, Pearson Education
14. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press
15. Optics, Hecht, Pearson Education
16. Optics, Ghatak, McGraw Hill Education India Private Limited
17. Fundamentals of Statistical and Thermal Physics, Reif, Sarat Book Distributors
18. Statistical Mechanics, Pathria, Elsevier
19. Statistical Physics, L.D. Landau, E.M. Lifshitz, Butterworth-Heinemann

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Course Code : BS-CH101/ BS-CH201	Category : Basic Science Courses
Course Title : Chemistry-I	Semester : First/ Second
L-T-P : 3-1-0	Credit:4
Pre-Requisites:	

Detailed contents

i) Atomic and molecular structure (10 lectures)

Schrodinger equation. Particle in a box solutions and their applications for simple sample. Molecular orbitals of diatomic molecules (e.g.H₂). Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

ii) Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

iii) Inter-molecular forces and potential energy surfaces (4 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena.

iv) Use of free energy in chemical equilibria (8 lectures)

First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

v) Periodic properties (4 Lectures)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

vi) Stereochemistry (4 lectures)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

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vii) Organic reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

Learning Resources:

1. Engineering Chemistry, Satyaprakash, Khanna Book Publishing, Delhi
2. University chemistry, by B. H. Mahan
3. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
4. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
5. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
6. Physical Chemistry, by P. W. Atkins
7. Spectroscopy of Organic Compounds, by P.S.Kalsi, New Age International Pvt Ltd Publishers
8. Physical Chemistry, P. C. Rakshit, Sarat Book House
9. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition
<http://bcs.whfreeman.com/vollhardtschore5e/default.asp>

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Course Code : BS-M101	Category : Basic Science Course
Course Title : Mathematics – I A	Semester : First (CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic	Lectures Hours
1	<i>Calculus (Integration):</i> Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	<i>Calculus (Differentiation):</i> Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	<i>Matrices:</i> Matrices, Vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.	7
4	<i>Vector Spaces:</i> Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem, composition of linear maps, Matrix associated with a linear map.	9
5	<i>Vector Spaces (Continued):</i> Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.	10

Course Outcomes:

The students will be able to:

Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

Understand the domain of applications of mean value theorems to engineering problems.

Learn different types of matrices, concept of rank, methods of matrix inversion and their applications.

Understand linear spaces, its basis and dimension with corresponding applications in the field of computer science.

Learn and apply the concept of eigen values, eigen vectors, diagonalisation of matrices and orthogonalization in inner product spaces for understanding physical and engineering problems

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Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. S.K. Mapa, Higher Algebra: Abstract and Linear, Sarat Book House Pvt.Ltd.
8. Hoffman and Kunze: Linear algebra, PHI.

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Course Code : BS-M102	Category : Basic Science Course
Course Title : Mathematics –I B	Semester : First (All stream except CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic	Lectures Hours
1	<i>Calculus (Integration):</i> Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	<i>Calculus (Differentiation):</i> Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	<i>Sequence and Series:</i> Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.	11
4	<i>Multivariate Calculus:</i> Limit, continuity and partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, Curl and Divergence.	9
5	<i>Matrices:</i> Inverse and rank of a matrix, Rank-nullity theorem; System of linear equations; Symmetric, Skew-symmetric and Orthogonal matrices; Determinants; Eigenvalues and Eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.	8

Course Outcomes:

After completing the course the student will be able to

Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

Understand the domain of applications of mean value theorems to engineering problems.

Learn the tools of power series and Fourier series to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.

Apply the knowledge for addressing the real life problems which comprises of several variables or attributes and identify extremum points of different surfaces of higher dimensions.

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Understand different types of matrices, their eigen values, eigen vectors, rank and also their orthogonal transformations which are essential for understanding physical and engineering problems.

Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.

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Course Code : ES-EE101	Category : Engineering Science Courses
Course Title : Basic Electrical Engineering	Semester : First
L-T-P : 3-1-0	Credit: 4
Pre-Requisites:	

Detailed contents:

Module 1: DC Circuits (8 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers (6 hours)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 hours)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters (6 hours)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

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Course Outcomes

To understand and analyze basic electric and magnetic circuits

To study the working principles of electrical machines and power converters.

To introduce the components of low voltage electrical installations

Learning Recourses:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Book Publishing Co. (P) Ltd., Delhi.
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
4. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
5. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
6. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

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Course Code : BS-PH191/ BS-PH291	Category : Basic Science course
Course Title : Physics-I Laboratory	Semester : First/ Second
L-T-P : 0-0-3	Credit:1.5
Pre-Requisites:	

Choose 10 experiments including at least one from Optics, Electricity and Magnetism and Quantum Mechanics and at least a total of six from these three groups.

Experiments in Optics

1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of a monochromatic light by Newton's ring
3. Determination of wavelength of a monochromatic light by Fresnel's bi-prism
4. Determination of wavelength of the given laser source by diffraction method

Electricity & Magnetism experiments

1. Determination of thermo electric power of a given thermocouple.
2. Determination of specific charge (e/m) of electron by J.J. Thompson's method.
3. Determination of dielectric constant of a given dielectric material.
4. Determination of Hall coefficient of a semiconductor by four probe method.
5. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.
6. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
7. Determination of unknown resistance using Carey Foster's bridge
8. Study of Transient Response in LR, RC and LCR circuits using expeyes
9. Generating sound from electrical energy using expeyes

Experiments in Quantum Physics

1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Lande-g factor using Electron spin resonance spectrometer.
4. Determination of Rydberg constant by studying Hydrogen spectrum.
5. Determination of Band gap of semiconductor.
6. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

Miscellaneous experiments

1. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure
2. Determination of bending moment and shear force of a rectangular beam of uniform cross-section
3. Determination of modulus of rigidity of the material of a rod by static method
4. Determination of rigidity modulus of the material of a wire by dynamic method
5. To determine the moment of inertia of a body about an axis passing through its centre of gravity and to determine the modulus of rigidity of the material of the suspended wire
6. Determination of coefficient of viscosity by Poiseuille's capillary flow method

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Course Code : BS-CH191/ BS-CH291	Category : Basic Science Courses
Course Title : Chemistry-I Laboratory	Semester : First/ Second
L-T-P : 0-0-3	Credit:1.5
Pre-Requisites:	

Choose 10 experiments from the following:

1. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
2. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
3. Determination of dissolved oxygen present in a given water sample.
4. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution)
5. Determination of surface tension and viscosity
6. Thin layer chromatography
7. Ion exchange column for removal of hardness of water
8. Determination of the rate constant of a reaction
9. Determination of cell constant and conductance of solutions
10. Potentiometry - determination of redox potentials and emfs
11. Saponification/acid value of an oil
12. Chemical analysis of a salt
13. Determination of the partition coefficient of a substance between two immiscible liquids
14. Adsorption of acetic acid by charcoal
15. Use of the capillary viscosimeters to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

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Course Code : ES-EE191	Category : Engineering Science Courses
Course Title : Basic Electrical Engineering Laboratory	Semester : First
L-T-P : 0-0-2	Credit: 1
Pre-Requisites:	

Choose 10 experiments from the following:

1. First activity: Introduction to basic safety precautions and mentioning of the do's and Don'ts. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about the modalities of evaluation.
2. Introduction and uses of following instruments :
 - (a) Voltmeter
 - (b) Ammeter
 - (c) Multimeter
 - (d) Oscilloscope

Demonstration of real life resistors, capacitors with color code , inductors and autotransformer.

3. Demonstration of cut-out sections of machines: DC machine, Induction machine, Synchronous machine and single phase induction machine.
4. Calibration of ammeter and Wattmeter.
5. Determination of steady state and transient response of R-L, R-C and R-L-C circuit to a step change in voltage.
6. Determination of steady state response of R-L and R-C and R-L-C circuit and calculation of impedance and power factor.
7. Determination of resonance frequency and quality factor of series and parallel R-L-C circuit.
8. (a) Open circuit and short circuit test of a single-phase transformer
(b) Load test of the transformer and determination of efficiency and regulation
9. Demonstration of three phase transformer connections. Voltage and current relationship, phase shifts between the primary and secondary side.
10. Measurement of power in a three phase unbalanced circuit by two wattmeter method.
11. Determination of Torque –Speed characteristics of separately excited DC motor.
12. Determination of Torque speed characteristics and observation of direction reversal by change of phase sequence of connection of Induction motor.
13. Determination of operating characteristics of Synchronous generator.
14. Demonstration of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter for speed control of an Induction motor
15. Demonstration of components of LT switchgear.

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Course Code : ES-ME191/ ES-ME 291	Category : Engineering Science Courses
Course Title : Engineering Graphics & Design	Semester : First/ Second
L-T-P : 1-0-4	Credit: 3
Pre-Requisites:	

Sl. No.	Content	Lecture (L)	Practical (P)
1	INTRODUCTION TO ENGINEERING DRAWING Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes.	1	4
2	LETTERING, DIMENSIONING, SCALES Plain scale, Diagonal scale and Vernier Scales.	1	4
3	GEOMETRICAL CONSTRUCTION AND CURVES Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Archimedian Spiral.	1	4
4	PROJECTION OF POINTS, LINES, SURFACES Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle, pentagon, Hexagon etc.) inclined Planes - Auxiliary Planes.	1	4
5	PROJECTION OF REGULAR SOLIDS Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).	1	4
6	COMBINATION OF REGULAR SOLIDS, FLOOR PLANS Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.	1	4
7	ISOMETRIC PROJECTIONS Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;	1	4

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8	SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)	1	4
9	OVERVIEW OF COMPUTER GRAPHICS, CUSTOMISATION & CAD DRAWING listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;	1	4
	ANNOTATIONS, LAYERING & OTHER FUNCTIONS applying dimensions to objects, applying annotations to drawings;		
10	Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;	2	8

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11	DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).	2	8
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Course Outcomes

The student will learn:

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling

General Instructions

1. In every topic some problems are to be done in the class and some are to be given to students as home assignment.
2. The problems for class work are to be prepared on drawing sheet of A1 size in the class/ using AutoCAD software.
3. The problems for home assignments are to be prepared on drawing copy/ using AutoCAD software.
4. Print out of every assignment is to be taken for CAD Drawings on Drawing sheets (A4 Sheets).
5. A title block must be prepared in each sheet/ assignment.

Following is the list of drawing instruments that required for making engineering drawings on paper with perfection.

1. Drawing Board
2. Mini drafter/ Set-squares (45°–45° & 60°–90°), T-square
3. Protractor (180°, 360°)
4. Scales (Plain, Diagonal)
5. Compass (Small and Large)
6. Divider (Small and Large)

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7. French Curves
8. Drawing paper (A1 Size)
9. Drawing pencil (H, HB, B)
10. Sharpener
11. Eraser
12. Drawing pins & clips
13. Duster or handkerchief etc.

Learning Resources:

1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House
2. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
5. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
6. Corresponding set of CAD Software Theory and User Manuals

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Course Code : ES-ME192/ ES-ME 292	Category : Engineering Science Courses
Course Title : Workshop/ Manufacturing Practices	Semester : First/ Second
L-T-P : 1-0-4	Credit:3
Pre-Requisites:	

(i) Lectures & videos:

Detailed contents:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Electrical & Electronics
5. Carpentry
6. Plastic moulding, glass cutting
7. Metal casting
8. Welding (arc welding & gas welding), brazing

(ii) Workshop Practice:

Machine shop (8 hours)

Typical jobs that may be made in this practice module:

To make a pin from a mild steel rod in a lathe.

To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Fitting shop (8 hours)

Typical jobs that may be made in this practice module:

To make a Gauge from MS plate.

Carpentry (8 hours)

Typical jobs that may be made in this practice module:

To make wooden joints and/or a pattern or like.

Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs))

Typical jobs that may be made in this practice module:

ARC WELDING (4 hours): To join two thick (approx 6mm) MS plates by manual metal arc welding.

GAS WELDING (4 hours): To join two thin mild steel plates or sheets by gas welding.

Casting (8 hours)

Typical jobs that may be made in this practice module:

One/ two green sand moulds to prepare, and a casting be demonstrated.

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Smithy (4 hours) ~ 4 hours

Typical jobs that may be made in this practice module:

A simple job of making a square rod from a round bar or like.

Plastic moulding & Glass cutting (4 hours)

Typical jobs that may be made in this practice module:

For plastic moulding, making at least one simple plastic component should be made.

For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made.

Electrical & Electronics (8 hours)

Familiarization with LT switchgear elements, making its sketches and noting down its specification. Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable.

Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point.

Simple wiring exercise to be executed to understand the basic electrical circuit.

Simple soldering exercises to be executed to understand the basic process of soldering.

Fabrication of a single-phase full wave rectifier with a step down transformer using four diodes and electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes

Upon completion of this laboratory course, students will be able to fabricate components with their own hands.

They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

By assembling different components, they will be able to produce small devices of their interest.

Learning Resources:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. and Steven S. Schmid, “Manufacturing Engineering and Technology”, 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu, “Manufacturing Technology – I” Pearson Education, 2008.
4. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4th edition, Prentice Hall India, 1998.
5. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGrawHill House, 2017.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

Course Code : BS-M201	Category : Basic Science Course
Course Title : Mathematics – II A	Semester : Second (CSE &IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics and BS-M101	

Module No.	Description of Topic	Lectures Hours
1	Basic Probability: Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the Multinomial distribution, Poisson approximation to the Binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.	11
2	Continuous Probability Distributions: Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities.	4
3	Bivariate Distributions: Bivariate distributions and their properties, distribution of sums and quotients, Conditional densities, Bayes' rule.	5
4	Basic Statistics: Measures of Central tendency, Moments, Skewness and Kurtosis, Probability distributions: Binomial, Poisson and Normal and evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.	8
5	Applied Statistics: Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	8
6	Small samples: Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	4

Course Outcomes:

The students will be able to:

Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.

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Understand the basic ideas of statistics with different characterisation of a univariate and bivariate data set.

Apply statistical tools for analysing data samples and drawing inference on a given data set.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
3. S. Ross, A First Course in Probability, Pearson Education India
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.
5. John E. Freund, Ronald E. Walpole, Mathematical Statistics, Prentice Hall.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
7. N.G. Das, Statistical Methods (Combined Volume), Tata-McGraw Hill.

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

Course Code : BS-M202	Category : Basic Science Course
Course Title : Mathematics – II B	Semester : Second (All stream except CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics and BS-M102	

Module No.	Description of Topic	Lectures Hours
1	<i>Multivariate Calculus (Integration):</i> Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, change of variables (Cartesian to Polar), Applications: Areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.	11
2	<i>First order ordinary differential equations:</i> Exact, linear and Bernoulli's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.	5
3	<i>Ordinary differential equations of higher orders:</i> Second order linear differential equations with constant coefficients, Use of D-operators, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.	9
4	<i>Complex Variable – Differentiation</i> Differentiation of complex functions, Cauchy-Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithmic) and their properties; Conformal mappings, Mobius transformations and their properties.	6
5	<i>Complex Variable – Integration</i> Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, Zeros of analytic functions, Singularities, Laurent's series; Residues, Cauchy residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.	9

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Course Outcomes:

The students will be able to:

Learn the methods for evaluating multiple integrals and their applications to different physical problems.

Understand different techniques to solve first and second order ordinary differential equations with its formulation to address the modelling of systems and problems of engineering sciences.

Learn different tools of differentiation and integration of functions of a complex variable that are used with various other techniques for solving engineering problems.

Apply different types of transformations between two 2- dimensional planes for analysis of physical or engineering problems.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. E. L. Ince, Ordinary Differential Equations, Dover Publications.
8. J. W. Brown and R. V. Churchill, Complex Variables and Applications, Mc-Graw Hill.

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Course Code : ES-CS201	Category : Engineering Science Courses
Course Title : Programming for Problem Solving	Semester : Second
L-T-P : 3-0-0	Credit:3
Pre-Requisites:	

Detailed contents

Unit 1: Introduction to Programming (4 lectures)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - **(1 lecture)**.

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. **(1 lecture)**

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- **(2 lectures)**

Unit 2: Arithmetic expressions and precedence (2 lectures)

Unit 3: Conditional Branching and Loops (6 lectures)

Writing and evaluation of conditionals and consequent branching **(3 lectures)**

Iteration and loops **(3 lectures)**

Unit 4: Arrays (6 lectures)

Arrays (1-D, 2-D), Character arrays and Strings

Unit 5: Basic Algorithms (6 lectures)

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 6: Function (5 lectures)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Unit 7: Recursion (4 -5 lectures)

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 8: Structure (4 lectures)

Structures, Defining structures and Array of Structures

Unit 9: Pointers (2 lectures)

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Unit 10: File handling (only if time is available, otherwise should be done as part of the lab)

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Course Outcomes

The student will learn

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical errors.
- To implement conditional branching, iteration and recursion.
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- To apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.

Learning Resources:

1. R. S. Salaria, Computer Concepts and Programming in C, Khanna Publishers
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
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Course Code : ES-CS291	Category : Engineering Science Courses
Course Title : Programming for Problem Solving	Semester : Second
L-T-P : 0-0-4	Credit:2
Pre-Requisites:	

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

Tutorial 12: File handling:

Lab 12: File operations

Laboratory Outcomes

To formulate the algorithms for simple problems

To translate given algorithms to a working and correct program

To be able to correct syntax errors as reported by the compilers

To be able to identify and correct logical errors encountered at run time

To be able to write iterative as well as recursive programs

To be able to represent data in arrays, strings and structures and manipulate them through a program

To be able to declare pointers of different types and use them in defining self-referential structures.

To be able to create, read and write to and from simple text files.

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Course Code : HM-HU201	Category : Humanities and Social Sciences including Management courses
Course Title : English	Semester : Second
L-T-P : 2-0-0	Credit:2
Pre-Requisites:	

Detailed contents

1. Vocabulary Building

- 1.1 The concept of Word Formation: Compounding, Backformation, Clipping, Blending.
- 1.2 Root words from foreign languages and their use in English
- 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
- 1.4 Synonyms, antonyms, and standard abbreviations: Acronyms

2. Basic Writing Skills

- 2.1 Sentence Structures & Types: Simple, Compound, Complex
- 2.2 Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration
- 2.3 Importance of proper punctuation
- 2.4 Creating coherence: Arranging paragraphs & Sentences in logical order
- 2.5 Creating Cohesion: Organizing principles of paragraphs in documents
- 2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

- 3.1 Subject-verb agreement
- 3.2 Noun-pronoun agreement
- 3.3 Misplaced modifiers
- 3.4 Articles
- 3.5 Prepositions
- 3.6 Redundancies
- 3.7 Clichés

4. Nature and Style of sensible Writing

- 4.1 Describing
- 4.2 Defining
- 4.3 Classifying
- 4.4 Providing examples or evidence
- 4.5 Writing introduction and conclusion

5. Writing Practices

- 5.1 Comprehension
- 5.2 Précis Writing
- 5.3 Essay Writing
- 5.4 Business Letter, Cover Letter & CV; E-mail

Addendum

Some examples of English words with foreign roots

Greek Root/Affix	Examples
Anti	Antisocial, antiseptic

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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Auto	Automatic, autograph
Anthropos	Anthropology, philanthropy
Bio	Biography
Chronos	Time
Di	Dilemma
Bio	Biology
Biblio	Bibliography
Chron	Chronology
Cracy	Contradiction
Geo	Geology
Hyper	Hyperactive
Mania	Kleptomania
Mega	Megaserial
Eu	Eulogy, euphoria
Geo	Geology
Graph	autograph, photograph
Hetero	Heterogeneous
Hyper	Hyperactive
Hypo	hypodermic, hypoglycemia
Macro	Macrocosm
Mega	megalomania
Micro	microcosm

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Mono	Monarch
Pan	Panorama
Pathos	Pathetic
Phobia	Hydrophobia
Pod (Gk), ped (Latin)	Pseudopodia
Poly	polyglot
Tele	Telephone
Theo	Theology, theist
Latin Root	Examples
Aud	Audible
Bene	Beneficial
Brev	abbreviate, brief
circum	Circulate
Contra	Contradict
Cred	Credible
Dict	Diction
Femina	Feminine
Inter	Internet, interval
Magna	Magnificent
Mal	Malnutrition
Multi	multinational
Nova	Novel
Multi	Multiple, multiplex
Non	Nonstop

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 (Applicable from the academic session 2018-2019)

Pre	Previous, predicate
Re	Redo, rewind
Scrib	Scripture
Spect	Spectator
Trans	Transport
Uni	Unity
Omni	Omnipotent
Semi	Semicircle
Sub	Subway
somnus	Insomnia,
Super	Superman
Sym	Sympathy
scribe	Describe, scribble(write illegibly), inscribe
Trans	Transform
Un	Unnecessary
Uni	Universal

Learning Resources:

- (i) Kulbushan Kumar, R S Salaria, Effective Communication Skills, Khanna Publishing House, Delhi.
- (ii) Practical English Usage. Michael Swan. OUP. 1995.
- (iii) Remedial English Grammar. F.T. Wood. Macmillan. 2007
- (iv) On Writing Well. William Zinsser. Harper Resource Book. 2001
- (v) Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- (vi) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
- (vii) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
- (viii) Universal English Prof. Prasad Kataria Publications, 2019.
- (ix) "Communication Skills for Professionals"-Nira Konar, Prentice Hall of India 2nd edition, New Delhi, 2011
- (x) Gajendra Singh Chauhan, Smita Kashiramka and L. Thimmesha. Functional English. Cengage, 2019.

Course Outcomes

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Course Code : HM-HU291	Category : Humanities and Social Sciences including Management courses
Course Title : Language Laboratory	Semester : Second
L-T-P : 0-0-2	Credit:1
Pre-Requisites:	

- | | |
|---|----|
| 1) Honing ‘Listening Skill’ and its sub skills through Language Lab Audio device; | 3P |
| 2) Honing ‘Speaking Skill’ and its sub skills | 2P |
| 3) Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/
Voice modulation/ Stress/ Intonation/ Pitch & Accent) of connected speech | 2P |
| 4) Honing ‘Conversation Skill’ using Language Lab Audio –Visual input;
Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone &
Role Play Mode) | 2P |
| 5) Introducing ‘Group Discussion’ through audio –Visual input and acquainting them
with key strategies for success | 2P |
| 6) G D Practice Sessions for helping them internalize basic Principles
(turn- taking, creative intervention, by using correct body language, courtesies &
other soft skills) of GD | 4P |
| 7) Honing ‘Reading Skills’ and its sub skills using Visual / Graphics/
Diagrams /Chart Display/Technical/Non Technical Passages
Learning Global / Contextual / Inferential Comprehension; | 2P |
| 8) Honing ‘Writing Skill’ and its sub skills by using
Language Lab Audio –Visual input; Practice Sessions | 2P |

Course Outcomes

- The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

MOOCs for B. Tech Honours



Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal

Notice

1st May, 2018

MOOCs for B.Tech Honours (Applicable from the session 2018-2019)

Preamble

All India Council for Technical Education (AICTE) has introduced Model Curriculum for Bachelor of Technology programme with 160 credits in the entire programme of 4 years, and additional 20 credits will be required to be done for the degree of Bachelor of Technology with Honours. These additional 20 credits will have to be acquired with online courses (MOOCs) as per AICTE. So students will have to complete additional 20 credits through MOOCs within 4 years of time. This creates an excellent opportunity for students to acquire the necessary skill set for employability through massive online courses where the rare expertise of world famous experts from academics and industry are available. Maulana Abul Kalam Azad University of Technology, West Bengal (MAKAUT,WB) has thus decided to introduce AICTE model curriculum for its B.Tech Programmes and suggest baskets for MOOCs available year wise for the four-year long B.Tech programme from the sessions 2018-2019. The basket for MOOCs will be a dynamic one, as courses keep on updating with time. Few essential skill sets required for employability are also identified year wise by MAKAUT,WB. For MOOCs platforms where examination or assessment is absent (like SWAYAM) or where certification is costly (like Coursera or edX), faculty members of the Institutes are to audit the courses and prepare the examination question papers, for the courses undertaken by the students of respective Institutes, so that MAKAUT,WB can conduct examination for the course. The total of 20 credits that is required to be attained for B.Tech Honours degree are distributed over four years in the following way:

For first year	:	8 credits
For second year	:	4 credits
For third year	:	4 credits
For fourth year	:	4 credits

A student of first year has to cover courses from at least three skills :

1. Computer Programing with Python / R
2. Soft skill
3. Ethics

Courses are * marked in the above areas

If a student is unable to cover the credits assigned for the first year, he/she can do these courses in either of the subsequent years, but he/she has to choose the courses from the basket of MOOCs announced by MAKAUT,WB from time to time. The same rule will be applicable for the other years of the programme.

The basket for MOOCs for the 1st year B. Tech for the session 2018-2019 are made available herewith.

By order.

MOOCs for First Year, Engineering and Technology

Sl. No	Course	Provider	Duration	Credits	Name of University / Institution
1.	Presentation Skills: Designing Presentation Slides	Coursera *	4 weeks	1	Tomsk State University
2.	Effective Problem-Solving and Decision-Making	Coursera	4 weeks	1	University of California
3.	Communication in the 21st Century Workplace	Coursera *	4 weeks	1	University of California
4.	Psychology at Work	Coursera *	6 weeks	2	University of Western Australia
5.	Critical Thinking & Problem Solving	EdX *	3 weeks	3	Rochester Institute of Technology
6.	Successful Career Development	Coursera	7 weeks	2	University System of Georgia
7.	Working in Teams: A Practical Guide	edX	4 weeks	1	University of Queensland
8.	Communication theory: bridging academia and practice	Coursera	9 weeks	3	Higher School of Economics
9.	Speaking Effectively	NPTEL *	8 weeks	3	Indian Institute of Technology, Kharagpur
10.	Introduction to Philosophy	Coursera	5 weeks	1	University of Edinburgh
11.	Moralities of Everyday Life	Coursera	6 weeks	2	Yale University
12.	Introduction to Logic	Coursera *	10 weeks	3	Stanford University
13	Write Professional Emails in English	Coursera *	5 weeks	2	Georgia Institute of Technology
14	Technical Writing	Coursera	5 weeks	1	Moscow Institute of Physics and Technology
15	Learn to Program: The Fundamentals	Coursera	7 weeks	2	University of Toronto
16	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
17	Introduction to Problem Solving and Programming	NPTEL	12 weeks	4	NPTEL
18	The Science of Well Being	Coursera	6 weeks	2	Yale University
19	Developing Soft Skills and Personality	NPTEL	8 weeks	3	
20	Programming Basics	edX	9 weeks	3	IIT Bombay
21	Introduction to Python: Absolute Beginner	EdX *	5 weeks	2	Microsoft
22	Inferential Statistics	Coursera *	7 weeks	2	University of Amsterdam
23	Linear Regression and Modelling	Coursera	4 weeks	1	Duke University
24	Foundation of Data Structures	edX	6 weeks	2	IIT Bombay
25	Introduction to Logic	NPTEL	12 weeks	4	NPTEL
26	Introduction to Probability and Data	Coursera *	5 weeks	1	Duke University
27	Ethics	NPTEL *	12 weeks	4	
28	Science, Technology and Society	NPTEL	12 weeks	4	
29	Creating Innovation	Coursera	6 weeks	2	Macquarie University
30	Ethical Leadership Through Giving Voice to Values	Coursera *	4 weeks	2	University of Virginia
31	Creativity, Innovation, and Change	Coursera *	6 weeks	2	Pennsylvania State University
32	Interpersonal Communication for Engineering Leaders	Coursera	4 weeks	1	Rice University

33	Learn to Program: The Fundamentals	Coursera *	7 weeks	3	University of Toronto
34	Introduction to Mathematical Thinking	Coursera *	9 weeks	3	Stanford University
35	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
36	A Life of Happiness and Fulfillment	Coursera	6 weeks	2	Indian School of Business
37	Model Thinking	Coursera	12 weeks	4	University of Michigan
38	Introduction to Philosophy: God, Knowledge, and Consciousness	edX	12 weeks	4	MIT
39	Soft skills	NPTEL *	12 Weeks	4	IIT Roorkee
40	Developing Soft Skills and Personality	NPTEL *	8 weeks	3	IIT Kanpur
41	Indian Fiction in English	NPTEL	12 Weeks	4	IIT Madras
42	Development of Sociology in India	NPTEL	4 Weeks	1	IIT Kanpur
43	Intellectual Property	NPTEL	12 Weeks	4	IIT Madras
44	Essential Statistics for Data Analysis using Excel	EdX *	Self Paced	3	Microsoft
45	Ethics and Law in Data and Analytics	edX	Self Paced	4	Microsoft
46	Climate Change Mitigation in Developing Countries	Coursera *	6 weeks	3	University of Cape town
47	Web Design for Everybody (Basics of Web Development and Coding) Specialization	Coursera	15weeks	4	University of Michigan
48	Ecology: Ecosystem Dynamics and Conservation	Coursera	5 weeks	1	American Museum of Natural History, Howard Hughes Medical Institute
49	Environmental Studies: A Global Perspective	EdX *	Self Paced	4	Curtin University
50	Introduction to Computer Science and Programming Using Python	edX *	Self Paced	4	MIT, USA
51	Statistics and R	edX *	Self Paced	4	Harvard University
52	Introduction to Programming in C	Coursera *	4 weeks	4	Duke University
53	Java Programming: Solving Problems with Software	Coursera	4 weeks	4	Duke University
54	Grammar and Punctuation	Coursera	4 weeks	1	University of California
55	How to Write an Essay	Coursera *	5 weeks	1	University of California, Berkeley
56	Conversational English Skills	EdX *	10 weeks	3	Tsinghua University
57	Advanced Writing	Coursera *	4 weeks	1	University of California, Irvine
58	Speak English Professionally: In Person, Online & On the Phone	Coursera *	5 weeks	1	Georgia Institute of Technology
59	English for Science, Technology, Engineering, and Mathematics	Coursera	5 weeks	1	University of Pennsylvania
60	English Composition	edX	8 weeks	3	Arizona State University
61	Take Your English Communication Skills to the Next Level	Coursera *	4 weeks	1	Georgia Institute of Technology

**Guidelines regarding
Mandatory Induction Program for
the new students**



Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Date: 06.12.2017

Maulana Abul Kalam Azad University of Technology, West Bengal

Guidelines regarding Induction Programme for the new students

(As per Model Curriculum for 1st Year UG degrees courses in Engineering & Technology, November 2017)

To be followed from the 2018-19 academic session

Preamble: Engineering education has evolved globally in a continuous manner to address the twin needs of industry and society. It is now an accepted fact that the institutions imparting technical education should aspire to create manpower who will possess strong technical knowledge and skill, have leadership qualities and be a team player, capable of coming up with innovative solutions and be alive to societal and community concerns.

The aim of the Induction Programme is to acclimatize the students to the environment of their engineering institution, give them a flavour of the exciting new world of education that they are entering, provide them with mentoring schemes, and make them aware of their neighbourhood, society and people. This will allow them to evolve as well rounded individuals.

The following schedule is laid down by the University to implement the three week long Induction Programme:

Week 1	1 st Half	Day 1	Overall introduction of the new students to the Institution, its different Departments & Faculty Members
	2 nd Half	Day 1	(a) Assignment of faculty mentors to the new students (b) Assessment and allotment for mentoring by senior students preferably from the second year
	2 hrs	Day 2, 3, 4, 5	Lectures by eminent personalities on different areas such as (a) Introduction to Engineering (b) Various topics of science and technology (c) Innovation and entrepreneurship (d) Creative and performing arts (e) Social issues
	2 hrs.	Day 2, 3, 4, 5	Participation in Games, Yoga, Meditation etc.
	2 hrs	Day 2, 3, 4, 5	Visit to the different Departments of the Institute
Week 2 (All Days)	2hrs		Scheduled class lectures as per time table.
	2hrs		Students to be conducted through proficiency modules to be prepared by respective Colleges for ascertaining English skills & Computer knowledge of the students

			and to prepare a report on the same
	2hrs		Participation in Games, Sports, Yoga, Creative arts etc.
Week 3	2hrs		Scheduled class lectures as per time table
		Day 1	Visits to neighbourhood locations
		Day 2	Visits to natural spots in adjoining areas to understand the effect of nature on society
		Day 3	Visits to Science Museum / laboratories
		Day 4	Visits to NGOs
		Day 5	

Any other activity, as deemed fit by the Director/Principal of the affiliated Colleges, may be proposed and discussed with the Academic Coordinator of the University, by sending email to the following address: academics.makaut@gmail.com.

Note: 1) If necessary, networking may be established with NGOs to facilitate the different components and aspects of the Induction Programme.

Mandatory Additional Requirement for earning B. Tech Degree



Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal
BF-142, Sector-I, Saltlake

Notice

Mandatory Additional Requirement for earning B.Tech Degree

Addressing the needs of the industry and the society: Globally, engineering education systems have continuously evolved, in order to address the needs of the industry and the society. It is becoming imperative that every University should create opportunities for the students to inculcate attributes, which are not restricted only to engineering knowledge and acumen. Industry needs professionals who can work successfully in teams, who have leadership qualities, who are alive to social and community needs and who can bring innovation and creativity to their work and who are also digitally proficient. Hence, in order to prepare its students to match these multiple requirements, MAKAUT, WB has created a unique mechanism of awarding 100 Activity Points over and above the academic grades. It is planned that the students at MAKAUT, WB will be able to reap benefits from these activities at their own pace and comfort. It is expected that by the time MAKAUT, WB's students reach their Final Year, they would have developed themselves so well both through their studies in the respective technological field and through their active participation in the co-curricular and extra-curricular activities as also through SAWYAM based learning activities that they would be well-prepared for contributing to building the India and the world of their dreams.

The additional requirement applies to: Every student, who is admitted to the 4 years B.Tech program from the academic year 2018-19 onwards, is required to earn minimum 100 Activity Points in addition to the required academic grades, for getting MAKAUT, WB's B.Tech degree. Similarly, it is mandatory to earn 75 Activity Points, in addition to the academic grades, for getting B.Tech degree by a student (Lateral Entry) who is admitted to the B.Tech program from the academic year 2018-19 onwards. *(Please see Table 1 for details.)* [Lateral Entry students will have a multiplying factor of 1.33 to bring uniformity in score].

Level of Entry in B.Tech Course	Total duration for earning Points	Minimum Points
1 st Year from the academic year 2018-19 onwards	1 st to 4 th Year	100
2 nd Year from the academic year 2018-19 onwards (Lateral Entry)	2 nd to 4 th Year	75

Table – I

For existing Students (except students in the 4th year): Every student, who is admitted to the 4 years B.Tech program prior to the academic year 2018-19, is required to earn minimum number of Activity Points as per Table II in addition to the required academic grades, for getting MAKAUT, WB's B.Tech degree.

Current Semester	Total Points to be earned During the full course
2 nd	100
4 th	75
6 th	50

Table –II

These points must be earned on the basis of active participation in co-curricular and extracurricular activities spanning through all the semesters of study. Every student may choose, as per his/her liking, activities in order to achieve the mandatory points (as per Table-III, depending on his/her entry level), before becoming eligible for award of the Degree. These activities can be spread over the years, as per convenience of the student.

Notes:

- **Current 4th year students who are going to sit for Final Semester examination in May-June, 2018 are outside the preview of this Mandatory Additional Requirement**
- Every student shall participate in the co-curricular and extra-curricular activities and produce documentary proof to the designated Faculty Members appointed by the Head of Department / Principal / Director in the respective college. Thereby the student should earn the required Points before *her* she appears for his/ her Final Examinations.
- A student's result of his/her Final Examinations will be withheld until he/she completes the minimum Activity Points by the end of his/her B.Tech Program.
- In every semester, every student is required to prepare a file containing documentary proofs of activities, done by him / her. This file will be duly verified and Activity Points will be assigned by the teachers as appointed above, at the end of every semester.
- The college will form a 3 members committee and finalize the Activity Points for each student before entering them into the Online Point Entry System (at the URL, as specified by the COE of the University).
- Every student has to earn at least 100 activity points. The points students has earned will be reflected in the student's marksheet.
- Activity points earned by Lateral Entry students will be multiplied by 1.33.

Table III provides a List of Activity Heads and Sub-Activity Heads along with their capping of the Activity Points that can be earned by the students during the entire B.Tech duration.

Sl. No.	Name of the Activity	Points	Maximum Points Allowed
1.	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) (per course)	20	40
2.	Tech Fest/Teachers Day/Freshers Welcome		
	Organizer	5	10
	Participants	3	6
5.	Rural Reporting	5	10
6.	Tree Plantation (per tree)	1	10
7.	Participation in Relief Camps	20	40
8.	Participation in Debate/Group Discussion/ Tech quiz	10	20
9.	Publication of Wall magazine in institutional level (magazine/article/internet)	10	20
10.	Publication in News Paper, Magazine & Blogs	10	20
11.	Research Publication (per publication)	15	30
12.	Innovative Projects (other than course curriculum)	30	60
13.	Blood donation	8	16
	Blood donation camp Organization	10	20
15.	Participation in Sports/Games		
	College level	5	10
	University Level	10	20
	District Level	12	24
	State Level	15	30
	National/International Level	20	20
21.	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20
22.	Member of Professional Society	10	20
23.	Student Chapter	10	20
24.	Relevant Industry Visit & Report	10	20
25.	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	5	10
26.	Participation in Yoga Camp (Certificate to be submitted)	5	10
27.	Self-Entrepreneurship Programme	20	20
28.	Adventure Sports with Certification	10	20
29.	Training to under privileged/Physically challenged	15	30
30.	Community Service & Allied Activities	10	20

Suggestions from the College Principals will be considered to append in the above Table-III.

Sd/-

Registrar(Acting)
MAKAUT,WB

Maulana Abul Kalam Azad University of Technology, West Bengal
Record of Activities for Mandatory Additional Requirement

Annexure-I
Rev:00

College Name (College Code):						Department:						
Student Name:				University Roll No:			Registration No:					
Sl No	Activity	Points	Max. Points Allowed	Points Earned								
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	Total
1	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) per course											
	For 12 weeks duration	20	40									
	For 8 weeks duration	16										
2	Tech Fest/Teachers Day/Freshers Welcome											
	Organizer	5	10									
	Participants	3	6									
3	Rural Reporting	5	10									
4	Tree Plantation and up keeping (per tree)	1	10									
5	Participation in Relief Camps	20	40									
6	Participation in Debate/Group Discussion/ Tech quiz	10	20									
7	Publication of Wall magazine in institutional level (magazine/article/internet)											
	Editor	10	20									
	Writer	6	12									
8	Publication in News Paper, Magazine & Blogs	10	20									
9	Research Publication (per publication)	15	30									
10	Innovative Projects (other than course curriculum)	30	60									
11	Blood donation	8	16									
	Blood donation camp Organization	10	20									

Maulana Abul Kalam Azad University of Technology, West Bengal
Record of Activities for Mandatory Additional Requirement

Annexure-I
Rev:00

Sl No	Activity	Points	Max. Points Allowed	Points Earned								Total
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	
12	<i>Participation in Sports/Games</i>											
	College level	5	10									
	University Level	10	20									
	District Level	12	24									
	State Level	15	30									
	National/International Level	20	20									
13	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20									
14	Member of Professional Society	10	20									
15	Student Chapter	10	20									
16	Relevant Industry Visit & Report	10	20									
17	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	5	10									
18	Participation in Yoga Camp (Certificate to be submitted)	5	10									
19	Self-Entrepreneurship Programme	20	20									
20	Adventure Sports with Certification	10	20									
21	Training to under privileged / Differently abled	15	30									
22	Community Service & Allied Activities	10	20									
Total Points												
Signature of Mentor												
Signature of HOD												
*Please abide strictly to the Notes at the end of the Notice by Registrar, MAKAUT, WB regarding Mandatory Additional Requirement for earning B.Tech Degree												
* <i>Annexure-I</i> is to be retained in the Institute records with all documentary proofs of activities (to be verified by the University as and when required).												

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Syllabus for B. Tech in Electrical Engineering
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Name of the course		ELECTRIC CIRCUIT THEORY	
Course Code: PC-EE 301		Semester: 3 rd	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 1 hr/week		Assignment & Quiz: 10 Marks	
Practical: 2 hrs/week		Attendance: 05 Marks	
Credit Points: 4+1		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the structure and properties of different type of electrical circuits, networks and sources.		
2.	To apply different mathematical tools & techniques for analyzing electrical networks.		
3.	To apply circuit analysis techniques to simplify electrical networks..		
4.	To solve problems of electrical circuits.		
Pre-Requisite			
1.	Basic Electrical Engineering (ES-EE-101)		
2.	Mathematics (BS-M-102, Bs-M202)		
Unit	Content	Hrs	Marks
1	Introduction: Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks and systems. Independent & Dependent sources, Step, Ramp, Impulse, Sinusoidal, Square, Saw tooth signals	3	
2	Graph theory and Networks equations: Concept of Tree, Branch, Tree link, Incidence matrix, Tie-set matrix and loop currents, Cut set matrix and node pair potentials. Duality, Solution of Problems	4	
3	Coupled circuits: Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Modeling of coupled circuits, Solution of problems.	3	
4	Laplace transforms: Impulse, Step & Sinusoidal response of RL, RC, and RLC circuits. Transient analysis of different electrical circuits with and without initial conditions. Concept of Convolution theorem and its application. Solution of Problems with DC & AC sources.	8	
5	Fourier method of waveform analysis: Fourier series and Fourier Transform (in continuous domain only). Application in circuit analysis, Solution of Problems	6	
6	Network Theorems: Formulation of network equations, Source transformation, Loop variable analysis, Node variable analysis. Network theorem: Superposition, Thevenin's, Norton's & Maximum power transfer theorem. Millman's theorem and its application in three phase unbalanced circuit analysis. Solution of Problems with DC & AC sources.	8	

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7	Two port networks analysis: Open circuit Impedance & Short circuit Admittance parameter, Transmission parameters, Hybrid parameters and their inter relations. Driving point impedance & Admittance. Solution of Problems	4	
8	Filter Circuits: Analysis and synthesis of Low pass, High pass, Band pass, Band reject, All pass filters (first and second order only) using operational amplifier. Solution of Problems	4	

Text books:

1. Networks & Systems, Ashfaq Husain, Khanna Book Publishing, New Delhi
2. Networks and Systems, D. Roy Chowdhury, New Age International Publishers
3. Network Analysis and Synthesis, C.L. Wadhwa, New Age International Publishers
4. Circuit and Networks: Analysis and synthesis, A. Sudhakar & S.S. Palli 4th edition. Tata Mc Graw Hill Education Pvt. Ltd.
5. Circuit theory, Dr. Abhijit Chakrabarty, Dhanpat Rai & Co Pvt. Ltd.

Reference books

1. Network Analysis, M.E. Valkenburg, Pearson Education .
2. Fundamental of Electric circuit theory, D. Chattopadhyay & P.C. Rakshit, S. Chand
3. Engineering Circuit Analysis, W.H. Hyat, J.E. Kemmerly & S.M. Durbin, The Mc Graw Hill Company.
4. Problems and Solutions of Electric Circuit Analysis, R.K. Mehta & A.K. Mal, CBS, New Delhi

Course Outcome: After completion of this course, the learners will be able to

1. describe different type of networks, sources and signals with examples.
2. explain different network theorems, coupled circuit and tools for solution of networks.
3. apply network theorems and different tools to solve network problems.
4. select suitable techniques of network analysis for efficient solution.
5. estimate parameters of two-port networks.
6. design filter circuits.

Special Remarks:

The above mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course	Electric circuit theory
Course Code:PC-EE391	Semester: 3rd
Duration: 6 months	Maximum marks:100
Teaching Scheme	Examination scheme:
Theory: Nil	Continuous Internal Assessment:40
Tutorial: Nil	External Assessment: 60
Practical: 2 hrs/week	
Credit Points:1	
Laboratory Experiments:	
1.	Transient response of R-L and R-C network: simulation with software & hardware
2.	Transient response of R-L-C series and parallel circuit: simulation with software & hardware
3.	Determination of Impedance (Z) and Admittance (Y) parameter of two-port network: simulation & hardware.
4.	Frequency response of LP and HP filters: simulation & hardware.
5.	Frequency response of BP and BR filters: simulation & hardware.
6.	Generation of Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, Ramp signal using MATLAB in both discrete and analog form.
7.	Determination of Laplace transform and Inverse Laplace transform using MATLAB.
8.	Amplitude and Phase spectrum analysis of different signals using MATLAB.
9.	Verification of Network theorems using software & hardware

Course Outcome: After completion of this course, the learners will be able to

1. determine
 - transient response of different electrical circuit
 - parameters of two port network
 - frequency response of filters.
 - Laplace transform and inverse Laplace transform
2. generate different signals in both discrete and analog form
3. analyze amplitude and phase spectrum of different signals.
4. verify network theorems.
5. construct circuits with appropriate instruments and safety precautions.
6. Simulate electrical circuit experiments using suitable software.

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Special Remarks: The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

Name of the course		ANALOG ELECTRONICS	
Course Code: PC-EE 302		Semester: 3rd	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Practical: 2 hrs/week		Attendance: 05 Marks	
Credit Points: 3+1		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the structure and properties of different components of analog electronics.		
2.	To explain principle of operation of analog electronics components and circuits.		
3.	To understand the application of operational amplifier		
4.	To solve problems of analog electronic components and circuits		
5.	To analyze amplifiers, oscillators and other analog electronic circuits.		
Pre-Requisite			
1.	Physics (10+2)		
Unit	Content	Hrs	Marks
1	Filters & Regulators: Review of half wave and full wave rectifier, Capacitor filters, π -section filter, ripple factor, series and shunt voltage regulator, percentage regulation.	4	
2	BJT circuits: Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common-collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits	8	
3	MOSFET circuits: MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, trans-conductance, high frequency equivalent circuit.	8	
4	Feed back amplifier & Oscillators: Concept of Feed back, Negative & Positive feedback, Voltage/Current, Series/Shunt feedback, Berkhausen criterion, Colpit , Hartley's, Phase shift, Wien bridge, & Crystal oscillators.	5	
5	Operational amplifier: Ideal OPAMP, Differential amplifier, Constant current source (Current mirror etc), Level shifter, CMRR, Open & closed loop circuits, importance of feedback loop (positive & negative), inverting & non-inverting amplifiers, Voltage follower/Buffer circuits.	5	

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6	Application of Operational amplifiers: Adder, Integrator & Differentiator, Comparator, Schmitt Trigger, Instrumentation Amplifier, Log & Antilog amplifier, Trans-conductance multiplier, Precision rectifier, Voltage to current & Current to voltage converter.	5	
7	Power amplifier: Class A, B, AB, C, Conversion efficiency	2	
8	Multivibrator: Monostable, Bistable multivibrator, Monostable & Astable operation using 555 timer.	2	
9	Special function circuits: VCO & PLL	2	

Text books:

1. Malvino—Electronic Principles , 6/e ,TMH
2. Nagrath, Electronics: Analog and Digital, PHI, 2004
3. Mottershed, Electronics Devices & Circuits, Wiley Eastern
4. Millman & Halkias – Integrated Electronics, Tata McGraw Hill.
5. Gayakwad R.A -- OpAmps and Linear IC's, 4/e, Pearson-PHI
6. Franco—Design with Operational Amplifiers & Analog Integrated Circuits , 3/e,TMH
7. Coughlin and Drisscol – Operational Amplifier and Linear Integrated Circuits – Pearson Education Asia.
8. A.K. Maini, Analog Electronics, Khanna Publishing House, 2019
9. L.K. Maheswari, Analog Electronics, Laxmi Publications

Reference books

1. Nagchoudhuri , Microelectronic Devices, 1/e, Pearson Education, 2001
2. Natarajan, Microelectronics: Analysis & Design, 1/e 2005, TMH
3. Maheshwari and Anand , Analog Electronics, PHI
4. Boyle'stead , Nashelsky: & Kishore, Electronic Devices & Circuit theory, 1/e, PHI/Pearson.
5. Millman & Halkias: Basic Electronic Principles; TMH.
6. Tobey & Grame – Operational Amplifier: Design and Applications, Mc Graw Hill.

Course Outcome: After completion of this course, the learners will be able to

1. describe analog electronic components and analog electronics circuits
2. explain principle of operation of analog electronic components, filters, regulators and analog electronic circuits.
3. compute parameters and operating points of analog electronic circuits.
4. determine response of analog electronic circuits.
5. distinguish different types amplifier and different types oscillators based on application.
6. construct operational amplifier based circuits for different applications.

Special Remarks:

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Syllabus for B. Tech in Electrical Engineering

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The above mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

Name of the course	Analog electronic laboratory
Course Code:PC-EE392	Semester: 3rd
Duration: 6 months	Maximum marks:100
Teaching Scheme	Examination scheme:
Theory: Nil	Continuous Internal Assessment: 40
Tutorial: Nil	External Assessment: 60
Practical: 2 hrs/week	Credit Points:1
	Laboratory Experiments:
1.	Study of ripple and regulation characteristics of full wave rectifier with and without capacitor filter.
2.	Study of Zener diode as voltage regulator.
3.	Study of characteristics curves of B.J.T & F.E.T .
4.	Construction of a two-stage R-C coupled amplifier & study of it's gain & Bandwidth.
5.	Study of class A, C & Push-Pull amplifiers.
6.	Study of timer circuit using NE555 & configuration for monostable & astable and bistable multivibrator
7.	Study of Switched Mode Power Supply & construction of a linear voltage regulator using regulator IC chip
8.	Construction of a simple function generator using IC.
9.	Realization of a V-to-I & I-to-V converter using Op-Amps.
10.	Realization of a Phase Locked Loop using Voltage Controlled Oscillator (VCO).
11.	Study of D.A.C & A.D.C.

Course Outcome: After completion of this course, the learners will be able to

1. determine
 - characteristics of full wave rectifier with filter and without filter
 - characteristics of BJT and FET
 - characteristics of Zener diode as voltage regulator
 - characteristics of class A, C and push pull amplifiers
2. verify function of DAC and ADC
3. construct
 - function generator using IC
 - R-C coupled amplifier
 - linear voltage regulator using regulator IC chip.
 - timer circuit using 555 for monostable, astable and multistable multivibrator.
 - V to I and I to V converter with Op amps.

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- phase locked loop using Voltage Controlled Oscillator (VCO)
- 4. work in a team
- 5. validate theoretical learning with practical

Special Remarks: The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

Name of the course		ELECTRO MAGNETIC FIELD THEORY	
Course Code: PC-EE 303		Semester: 3rd	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Practical: 0 hrs/week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the basic mathematical tools to deal with Electromagnetic field Problem.		
2.	To understand properties and application of Electric and magnetic field.		
3.	To analyze electromagnetic wave propagation		
4.	To solve problem related to Electromagnetic field.		
Pre-Requisite			
1.	Basic Electrical Engineering (ES-EE-101)		
2.	Mathematics (BS-M-102, Bs-M202)		
3.	Physics (BS-PH 101)		
Unit	Content	Hrs	Marks
1	Introduction: Co-ordinate systems and transformation, Cartesian coordinates, Circular cylindrical coordinates, Spherical coordinates & their transformation. Differential length, area and volume in different coordinate systems. Solution of problems	4	
2	Introduction to Vector calculus: DEL operator, Gradient of a scalar, Divergence of a vector & Divergence theorem, Curl of a vector & Strokes theorem, Laplacian of a scalar, Classification of vector fields, Helmholtz’s theorem. Solution of problems	4	
3	Electrostatic field: Coulomb’s law, field intensity, Gauss’s law, Electric potential and Potential gradient, Relation between E and V, an Electric dipole and flux lines. Energy density in electrostatic field. Boundary conditions: Dielectric-dielectric, Conductor –dielectric, Conductor-free space. Poisson’s and Laplace’s equation, General procedure for solving Poisson’s and Laplace’s equation. Solution of problems	8	
4	Magneto static fields: Biot- savart law, Ampere’s circuit law, Magnetic flux density, Magnetic static and Vector potential, Forces due to magnetic field, Magnetic torque and moments,	8	

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	Magnetisation in material, Magnetic boundary condition, Inductor and Inductances, Magnetic energy, Force on magnetic material. Solution of problems		
5	Electromagnetic fields: Faraday's law, Transformer and motional emf, Displacement current, Maxwell's equations, Time varying Potential, Time harmonic fields. Solution of problems	6	
6	Electromagnetic wave propagation: Wave equation, Wave propagation in lossy dielectric, Plane waves in loss less dielectric, Plane wave in free space, Plane wave in good conductor, Skin effect, Skin depth, Power & Poynting vector, Reflection of a plane wave at normal incidence, reflection of a plane wave at oblique incidence, Polarisation. Solution of problems	6	
7	Transmission line: Concept of lump & distributed parameters, Line parameters, Transmission line equation & solutions, Physical significance of solutions, Propagation constants, Characteristic impedance, Wavelength, Velocity of propagation. Solution of problems	4	

Text books:

1. Elements of Electromagnetic, Mathew N.O. Sadiku, 4th edition, Oxford university press.
2. Engineering Electromagnetic, W.H. Hyat & J.A. Buck, 7th Edition, TMH
3. Theory and problems of Electromagnetic, Edminister, 2nd Edition, TMH
4. Electromagnetic field theory fundamentals, Guru & Hizroglu, 2nd edition, Cambridge University

Reference books

Course Outcome: After completion of this course, the learners will be able to

1. relate different coordinate systems for efficient solution of electromagnetic problems.
2. describe mathematical tools to solve electromagnetic problems.
3. explain laws applied to electromagnetic field.
4. apply mathematical tools and laws to solve electromagnetic problems.
5. analyze electromagnetic wave propagation
6. estimate transmission line parameters

Special Remarks:

The above mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		ENGINEERING MECHANICS	
Course Code: ES-ME 301		Semester: 3rd	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Practical: 0 hrs/week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the basic mathematical tools to deal with the physical bodies.		
2.	To learn different mathematical techniques to analyze physical bodies.		
2.	To learn analysis techniques of rigid bodies.		
2.	To solve problem of general motion.		
Pre-Requisite			
1.	Physics (BS-PH-101)		
2.	Mathematics (BS-M102, BS-M202)		
Unit	Content	Hrs	Marks
1	Introduction to vectors and tensors and co-ordinate systems Introduction to vectors and tensors and coordinate systems; Vector and tensor algebra; Indical notation; Symmetric and anti-symmetric tensors; Eigenvalues and Principal axes.	5	
2	Three-dimensional Rotation Three-dimensional rotation: Euler’s theorem, Axis-angle formulation and Euler angles; Coordinate transformation of vectors and tensors.	4	
3	Kinematics of Rigid Body Kinematics of rigid bodies: Dentition and motion of a rigid body; Rigid bodies as coordinate systems; Angular velocity of a rigid body, and its rate of change; Distinction between two- and three dimensional rotational motion; Integration of angular velocity to find orientation; Motion relative to a rotating rigid body: Five term acceleration formula.	6	
4	Kinetics of Rigid Bodies Kinetics of rigid bodies: Angular momentum about a point; Inertia tensor: Dentition and computation, Principal moments and axes of inertia, Parallel and perpendicular axes theorems;	5	

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	Mass moment of inertia of symmetrical bodies, cylinder, sphere, cone etc., Area moment of inertia and Polar moment of inertia, Forces and moments; Newton-Euler's laws of rigid body motion.		
5	Free Body Diagram (1 hour) Free body diagrams; Examples on modelling of typical supports and joints and discussion on the kinematic and kinetic constraints that they impose.	1	
6	General Motion Examples and problems. General planar motions. General 3-D motions. Free precession, Gyroscopes, Rolling coin.	9	
7	Bending Moment Transverse loading on beams, shear force and bending moment in beams, analysis of cantilevers, simply supported beams and overhanging beams, relationships between loading, shear force and bending moment, shear force and bending moment diagrams.	5	
8	Torsional Motion Torsion of circular shafts, derivation of torsion equation, stress and deformation in circular and hollow shafts.	2	
9	Friction Concept of Friction; Laws of Coulomb friction; Angle of Repose; Coefficient of friction.	3	

Text books:

1. J. L. Meriam and L. G. Kraige, "Engineering Mechanics: Dynamics", Wiley, 2011.
2. M. F. Beatty, "Principles of Engineering Mechanics", Springer Science & Business Media, 1986.
3. Manoj K. Harbola, "Engineering Mechanics", Cengage Learning India Pvt. Ltd, 2018
4. D.S. Bedi & M.P. Poonia, "Engineering Mechanics", Khanna Publishing House, 2019
5. R.S. Khurmi, "Engineering Mechanics", S.Chand Publications
6. R.K. Bansal, "Engineering Mechanics", Laxmi Publications

Course Outcome: After completion of this course, the learners will be able to

1. explain the co-ordinate system, principle of three dimensional rotation, kinematics and kinetics of rigid bodies.
2. elaborate the theory of general motion, bending moment, torsional motion and friction.
3. develop free body diagram of different arrangements.

Name of the course	MATHEMATICS-III		
Course Code: BS- M 301	Semester: 3rd		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme	Examination Scheme		
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks		
Tutorial: 0 hr/week	Assignment & Quiz: 10 Marks		
Practical: 0 hrs/week	Attendance: 05 Marks		
Credit Points: 3	End Semester Exam: 70 Marks		
Objective:			
1.	To understand Probability theory required an Electrical Engineer to apply in profession.		
2.	To understand numerical methods to solve engineering problem		
3.	To understand basics of Z transform to solve engineering problems.		
Pre-Requisite			
1.	Mathematics (10+2)		
Unit	Content	Hrs	Marks
1	Probability: Basic Probability Theory: Classical definition and its limitations. Axiomatic definition. Some elementary deduction: i) $P(O)=0$, ii) $0 \leq P(A) \leq 1$, iii) $P(A')=1-P(A)$ etc. where the symbols have their usual meanings. Frequency interpretation of probability.	1	
	Addition rule for 2 events (proof) & its extension to more than 2 events (statement only). Related problems. Conditional probability & Independent events. Extension to more than 2 events (pair wise & mutual independence). Multiplication Rule. Examples. Baye's theorem (statement only) and related problems.	3	
	Random Variable & Probability Distributions. Expectation: Definition of random variable. Continuous and discrete random variables. Probability density function & probability	2	

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	<p>mass function for single variable only. Distribution function and its properties (without proof). Examples. Definitions of Expectation & Variance, properties & examples.</p> <p>Some important discrete distributions: Binomial & Poisson distributions and related problems. Some important continuous distributions: Uniform, Exponential, Normal distributions and related problems. Determination of Mean & Variance for Binomial, Poisson & Uniform distributions only.</p>	2	
2	<p>Numerical Methods: Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors.</p> <p>Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation.</p> <p>Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.</p> <p>Numerical solution of a system of linear equations: Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method.</p> <p>Numerical solution of Algebraic equation: Bisection method, Regula-Falsi method, Newton-Raphson method.</p> <p>Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method.</p>	4 5 3 6 4 6	
3	<p>Z transform: Sequence, Representation of sequence, Basic operations on sequences, Z-transforms, Properties of Z-transforms, Change of scale, Shifting property, Inverse Z-transform, Solution of difference equation, Region of convergence.</p>	4	

Text books:

1. Lipschutz S., and Lipson M.L.: Probability (Schaum's Outline Series), TMH.
2. C.Xavier: C Language and Numerical Methods.
3. Dutta & Jana: Introductory Numerical Analysis.
4. J.B.Scarborough: Numerical Mathematical Analysis.
5. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).

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6. Hwei P Hsu, “Signal and system”, (Schaum's Outline Series), Mc Graw Hill education.

Reference books

1. Balagurusamy: Numerical Methods, Scitech.
2. R.S. Salaria: Numerical Methods, Khanna Publishing House.
3. S.S. Sashtry: Numerical Methods, PHI
4. Baburam: Numerical Methods, Pearson Education.
5. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
6. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
7. Srimanta Pal: Numerical Methods, OUP.

Course Outcome: After completion of this course, the learners will be able to

1. explain basics of probability theories, rules, distribution and properties of Z transform
2. describe different methods of numerical analysis.
3. solve numerical problems based on probability theories, numerical analysis and Z transform
4. apply numerical methods to solve engineering problems.
5. solve engineering problems using z transform and probability theory.

Special Remarks:

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course	Numerical Methods laboratory
Course Code: PC-CS 391	Semester: 3rd
Duration: 6 months	Maximum marks:100
Teaching Scheme	Examination scheme:
Theory: Nil	Continuous Internal Assessment:40
Tutorial: Nil	External Assessment: 60
Practical: 2 hrs/week	
Credit Points:1	
	Laboratory Experiments:
1.	Assignments on Newton forward /backward, Lagrange's interpolation.
2.	Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.
3.	Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations
4.	Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.
5.	Assignments on ordinary differential equation: Euler's and Runge-Kutta methods.
6.	Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica.

Course Outcome: After completion of this course, the learners will be able to

1. solve
 - problems with Newton forward /backward, Lagrange's interpolation
 - problems of numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule
 - problems to find numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations.
 - problems to find numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.
 - ordinary differential equation by Euler's and Runge-Kutta methods.
2. find appropriate numerical methods to solve engineering problems.
3. use software package to solve numerical problems.

Special Remarks:

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Name of the course		BIOLOGY FOR ENGINEERS	
Course Code:BS- 301		Semester: 3rd	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Practical: 0 hrs/week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To introduce modern biology with an emphasis on evolution of biology as a multi-disciplinary field.		
2.	To make students aware of application of engineering principles in biology and engineering robust solution inspired by biological examples.		
Pre-Requisite			
1.	NIL		
Unit	Content	Hrs	Marks
1	Introduction Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry. Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry	2	
2	Classification: Purpose: To convey that classification <i>per se</i> is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructureprokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e) Habitata- aquatic or terrestrial (e) Molecular	3	

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	taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus.		
3	Biomolecules Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine. Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.	4	
4	Macromolecular analysis: Purpose: To analyze biological processes at the reductionistic level. Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.	5	
5	Metabolism Purpose: The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergonic reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO ₂ + H ₂ O (Glycolysis and Krebs cycle) and synthesis of glucose from CO ₂ and H ₂ O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge.	4	
6	Microbiology Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.	3	
7	Immunology Purpose: How does the immune system work? What are the molecular and cellular components and pathways that protect an organism from infectious agents or cancer? This comprehensive course answers these questions as it explores the cells and molecules of the immune system. Immunology- Self vs Non-self, pathogens, human immune system, antigen-antibody reactions.	5	
8	Information Transfer Purpose: The molecular basis of coding and decoding genetic information is universal. Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic	4	

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	code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination. s • on cell proliferation • metastasis • cell proliferation • cell death • cell • D		
9	Cancer biology Purpose: A basic understanding of cancer biology and treatment. The course is not designed for patients seeking treatment guidance – but it can help to understand how cancer develops and provides a framework for understanding cancer diagnosis and treatment. cell Identification of the major types of cancer worldwide. Description of how genes contribute to the risk and growth of cancer. List and description of the ten cellular hallmarks of cancer. Definition of metastasis, and identification of the major steps in the metastatic process. Description of the role of imaging in the screening, diagnosis, staging, and treatments of cancer. Explanation of how cancer is treated.	5	
10	Techniques in bio physics Purpose: Biophysics is an interdisciplinary science that applies approaches and methods traditionally used in physics to study biological phenomena. The techniques including microscopy, spectroscopy, electrophysiology, single-molecule methods and molecular modeling	3	
11	Stem cell Purpose: Stem cells and derived products offer great promise for new medical treatments. Learn about stem cell types, current and possible uses, ethical issues.	2	

Text / References:

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, “Biology: A global approach”, Pearson Education Ltd, 2014.
2. E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, “Outlines of Biochemistry”, John Wiley and Sons, 2009.
3. D. L. Nelson and M. M. Cox, “Principles of Biochemistry”, W.H. Freeman and Company, 2012.
4. G. S. Stent and R. Calendar, “Molecular Genetics”, Freeman and company, 1978.
5. L. M. Prescott, J. P. Harley and C. A. Klein, “Microbiology”, McGraw Hill Higher Education, 2005.
6. Lewis J. Kleinsmith. “Principles of cancer biology”, Pearson, 2016

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Course Outcome: After completion of this course, the learners will be able to

1. describe with examples the biological observations lead to major discoveries.
2. explain
 - the classification of kingdom of life
 - the building blocks of life
 - different techniques of bio physics used to study biological phenomena.
 - the role of imaging in the screening, diagnosis, staging, and treatments of cancer.
3. identify DNA as a genetic material in the molecular basis of information transfer
4. analyze biological processes at the reductionistic level.
5. apply thermodynamic principles to biological systems.
6. identify microorganisms.

Special Remarks:

The above mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		INDIAN CONSTOTUTION	
Course Code: MC-EE 301		Semester: 3rd	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Practical: 0 hrs/week		Attendance: 05 Marks	
Credit Points: 0		End Semester Exam: 70 Marks	
Objective:			
1.	To have basic knowledge about Indian Constitution.		
2.	To understand the structure and functioning of union, state and local self-government.		
3.	To understand the structure, jurisdiction and function of Indian judiciary.		
Pre-Requisite			
1.	NIL		
Unit	Content	Hrs	Marks
1	Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy	5	
2	Union government and its administration: Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha. State government and its administration: Governor: Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions	10	
3	Supreme court: Organization of supreme court, procedure of the court, independence of the court, jurisdiction and power of supreme court. High court: Organization of high court, procedure of the court, independence of the court, jurisdiction and power of supreme court. Subordinate courts: constitutional provision, structure and jurisdiction. National legal services authority, Lok adalats, family courts, gram nyayalays. Public interest litigation (PIL): meaning of PIL, features of PIL, scope of PIL, principle of PIL, guidelines for admitting PIL	10	
4	Local Administration:	10	

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	District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.		
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Text books:

1. Indian polity, M, Laxmikanth, MC Graw Hill education, 5th Edition.

Reference books

1. DD Basu, " Introduction to the constitution of India", 21st Edition, Lexis Nexis Books Publication Ltd, India

Course Outcome: After completion of this course, the learners will be able to

1. describe
 - different features of Indian constitution..
 - power and functioning of Union, state and local self-government.
 - structure, jurisdiction and function of Indian Judiciary.
 - basics of PIL and guideline for admission of PIL.
 - Functioning of local administration starting from block to Municipal Corporation.
2. identify authority to redress a problem in the profession and in the society.

Special Remarks:

The above mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Semester-IV

Name of the course		ELECTRIC MACHINE-I	
Course Code: PC-EE-401		Semester: 4th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Practical: hrs/week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To review the concept of magnetic fields and magnetic circuits		
2.	To learn the principle of production of electromagnetic force and torque.		
3.	To learn the basic principle of operation of DC machine		
4.	To learn the principle of operation and characteristics of DC motor and generator		
5.	To learn the principle of operation, connections and different tests on Transformers		
6.	To acquire problem solving skills to solve problems of DC machines and Transformers		
Pre-Requisite			
1.	Basic Electrical Engineering (ES-EE-101)		
2.	Electric Circuit Theory (PC-EE-301)		
3.	Electromagnetic Field Theory (PC-EE-303)		
Unit	Content	Hrs	Marks
1	Magnetic fields and magnetic circuits: Review of magnetic circuits - MMF, flux, reluctance, inductance; review of Ampere Law and Biot Savart Law; Visualization of magnetic fields produced by a bar magnet and a current carrying coil - through air and through a combination of iron and air; influence of highly permeable materials on the magnetic flux lines.	3	
2	Electromagnetic force and torque: B-H curve of magnetic materials; flux-linkage vs current characteristic of magnetic circuits; linear and nonlinear magnetic circuits; energy stored in the magnetic circuit; force as a partial derivative of stored energy with respect to position of a moving element; torque as a partial derivative of stored energy with respect to angular position of a rotating element. Examples - galvanometer coil, relay contact, lifting magnet, rotating element with eccentricity or saliency	5	
3	DC machines: Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an	8	

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	armature coil. Armature winding and commutation – Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.		
4	DC machine - motoring and generation: Armature circuit equation for motoring and generation, Types of field excitations – separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torque-speed characteristics of separately excited, shunt and series motors. Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines	7	
5	Transformers: Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses Three-phase transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers - No-load and on-load tap-changing of transformers, Three-winding transformers. Cooling of transformers.	12	

Text books:

1. Electrical Machines-I, P.S. Bimbhra, Khanna Publishing House (AICTE)
2. Electrical Machinery, P.S. Bimbhra, 7th Edition, Khanna Publishers
3. Electric machines, D.P. Kothari & I.J Nagrath, 3rd Edition, Tata Mc Graw-Hill Publishing Company Limited
4. Electrical Machines, P.K. Mukherjee & S. Chakrabarty, 2nd edition, Dhanpat Rai Publication.

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Reference books:

1. Electric Machinery & Transformers, Bhag S. Guru and H.R. Hiziroglu, 3rd Edition, Oxford University press.
2. Electrical Machines, R.K. Srivastava, Cengage Learning
3. Theory of Alternating Current Machinery, Alexander S Langsdorf, Tata Mc Graw Hill Edition.
4. The performance and Design of Alternating Current Machines, M.G.Say, CBS Publishers & Distributors.
5. Electric Machinery & transformer, Irving L Koskow, 2nd Edition, Prentice Hall India

Course Outcome:

After completion of this course, the learners will be able to

1. describe the function of different components of magnetic circuit, DC machines and transformers
2. explain the principle of operation of different types of DC machines and transformers
3. solve numerical problems of DC machines and transformers.
4. estimate the parameters and efficiency of transformer.
5. determine the characteristics of DC machines
6. recommend methods to control output of DC machines.

Special Remarks (if any)

The above mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		DIGITAL ELECTRONICS	
Course Code: PC-EE-402		Semester: 4 th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Practical: hrs/week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To learn the fundamentals of Digital systems and principle of operation of Logic families.		
2.	To learn the principle of operation of Combinational digital circuits.		
3.	To learn the principle of operation of sequential circuit and systems.		
4.	To learn the principle of operation of A/D and D/A converter		
5.	To learn the principle of operation of semiconductor memories and Programmable logic devices.		
6.	To acquire problem solving skills to solve problems of Digital circuits		
Pre-Requisite			
1.	Analog Electronics (PC-EE-302)		
Unit	Content	Hrs	Marks
1	Fundamentals of Digital Systems and logic families: Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital ICs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.	7	
2	Combinational Digital Circuits: Standard representation for logic functions, K-map representation, simplification of Logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.	7	
3	Sequential circuits and systems: A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T and D types flipflops, applications of flipflops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of	7	

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	counters.		
4	A/D and D/A Converters: Digital to analog converters: weighted resistor/converter, R-2R Ladder, D/A converter, specifications for D/A converters, examples of D/A converter, ICs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs.	7	
5	Semiconductor memories and Programmable logic devices: Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory (RAM), content addressable memory (CAM), charge coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDs), Field Programmable Gate Array (FPGA).	7	

Text books:

1. Digital Principles & Application, 5th Edition, Leach & Malvino, Mc Graw Hill Company.
2. Modern Digital Electronics, 4th Edition, R.P. Jain. Tata Mc Graw Hill Company Limited
3. Fundamental of Digital Circuits, A. Anand Kumar, 4th Edition, PHI.
4. Digital Electronics, R. Anand, Khanna Publishing House (2018).

Reference books:

1. Digital Logic Design, Morries Mano, PHI.
2. Digital Integrated Electronics, H. Taub & D. Shilling, Mc Graw Hill Company.
3. Digital Electronics, James W. Bignell & Robert Donovan, Thomson Delman Learning.
4. Fundamental of logic Design, Charles H. Roth, Thomson Delman Learning.

Course Outcome:

After completion of this course, the learners will be able to

1. describe the function of different building blocks of digital electronics, semiconductor memories and programmable logic devices.
2. explain the principle of operation of combinational and sequential digital circuits, A/D and D/A converter
3. solve numerical problems of Boolean algebra, number system, combinational & sequential digital circuits and A/D and D/A converter.
4. specify applications of combinational and sequential digital circuits.
5. determine specifications of different digital circuits.
6. design combinational and sequential digital circuits

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Special Remarks (if any)

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Name of the course		ELECTRICAL & ELECTRONICS MEASUREMENTS	
Course Code: PC-EE-403		Semester: 4th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks	
Practical: hrs/week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To learn methods of measurement, errors in measurement and its classification.		
2.	To learn the principle of operation of analog and digital meters.		
3.	To learn the basic principle of operation of instrument transformers.		
4.	To learn the principle of operation of cathode ray oscilloscope and different sensors and transducers.		
5.	To learn the principle of measurement of power, energy and different electrical parameters		
6.	To acquire problem solving skills to solve problems on the topics studied.		
Pre-Requisite			
1.	Basic Electrical Engineering (ES-EE-101)		
2.	Electric Circuit Theory (PC-EE-301)		
Unit	Content	Hrs	Marks
1	Measurements: <ul style="list-style-type: none">• Method of measurement, Measurement system, Classification of instruments, Definition of accuracy, Precision, Resolution, Speed of response, Error in measurement, Classification of errors, loading effect due to shunt and series connected instruments. Analog meters: <ul style="list-style-type: none">• General features, Construction, Principle of operation and torque equation of Moving coil, Moving iron, Electrodynamometer, Induction instruments, Principle of operation of the Electrostatic, Thermoelectric, Rectifier type instruments, Extension of instrument ranges and multipliers.	7	
2	Instrument transformer: <ul style="list-style-type: none">• Disadvantage of shunt and multipliers, Advantage of Instrument transformers, Principle of operation of Current & Potential transformer, errors. Measurement of Power: <ul style="list-style-type: none">• Principle of operation of Electrodynamometer & Induction type wattmeter, Wattmeter errors Measurement of Energy: <ul style="list-style-type: none">• Construction, theory and application of AC energy meter, testing of energy meters.	9	
3	Measurement of resistance: <ul style="list-style-type: none">• Measurement of medium, low and high resistances, Megger Potentiometer: <ul style="list-style-type: none">• Principle of operation and application of Crompton's DC potentiometer, Polar and Co-ordinate type AC potentiometer, applications	8	

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	AC Bridges: <ul style="list-style-type: none">• Measurement of Inductance, Capacitance and frequency by AC bridges		
4	Cathode ray oscilloscope (CRO): <ul style="list-style-type: none">• Measurement of voltage, current, frequency & phase by oscilloscope. Frequency limitation of CRO. Sampling and storage oscilloscope, Double beam CRO. Electronic Instruments: <ul style="list-style-type: none">• Advantages of digital meter over analog meters, Digital voltmeter, Resolution and sensitivity of digital meters, Digital multimeter, Digital frequency meter, Signal generator, Digital Storage oscilloscope.	7	
5	Sensors & Transducers: <ul style="list-style-type: none">• Introduction to sensors & Transducers, Strain gauge, LVDT, Temperature transducers, Flow measurement using magnetic flow measurement.	4	

Text books:

1. A course in Electrical & Electronic Measurements & Instrumentation, A.K. Sawhney, Dhanpat Rai & sons.
2. Electrical Measurement & Measuring Instruments, E.W. Golding & F.C. Wides, Wheeler Publishing
3. Sensors & Transducers, D. Patranabis, PHI, 2nd edition.

Reference books:

1. Electronic Instruments, H.S. Kalsi, Tata Mc-Graw hill, 2nd Edition.
2. Digital Instrumentation, A.J. Bouwens, Tata Mc-Graw hill.
3. Modern Electronic instrumentation & Measuring instruments, A.D. Heltric & W.C. Copper, Wheeler Publication
4. Instrument transducers, H.K.P. Neubert, Oxford University press.
5. All-in One Electronics Simplified, A.K. Maini, Khanna Book Publishing Co. (2018)

Course Outcome:

After completion of this course, the learners will be able to

1. explain the terms accuracy, precision, resolution, speed of response, errors in measurement, loading effect
2. describe methods of measurement of power, energy by instruments and resistance, capacitance and inductance by bridges and potentiometer
3. explain the principle of operation of analog meters, instrument transformer, digital multimeter, digital voltmeter, digital frequency meter, signal generator, strain gauge, LVDT and temperature transducers

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4. explain the different building block, principle of operation of oscilloscope and measurement techniques of voltage, current, frequency and phase by oscilloscope
5. solve numerical problems related to analog meters, instrument transformer, measurement of power, energy, resistance, inductance and capacitance
6. specify applications of analog and digital measuring instruments, sensors and transducers

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		THERMAL POWER ENGINEERING	
Course Code:ES-EE-401		Semester: 4th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Practical: hrs/week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To learn the principle of operation of different types of boilers and Turbines		
2.	To learn the principle of operation of IC engines and Gas turbines		
6.	To acquire problem solving skills to solve problems of boilers, turbines, IC engines and Gas turbines		
Pre-Requisite			
1.	Mathematics (BS M102 & BS M201)		
Unit	Content	Hrs	Marks
1	Boilers: Water Tube & Fire Tube boilers, Circulating Principles, Forced Circulation, Critical pressure, Superheaters, Reheaters, attemperators, induced draught, forced draught and secondary air Fans, Boiler performance analysis and heat balance. Combustion Systems, Environmental Protection – ESP, Cyclone Separator, Dust Collector etc.	12	
2	Turbines: Rotary Thermodynamic devices – Steam turbines & their classifications – Impulse & Reaction typeTurbines, Thermodynamics of compressible fluid-flow, equation and continuity – Isentropic flow throughnozzles, velocity diagram, Blade efficiency, optimum velocity ratio, multi-staging, velocity & pressurecompounding, losses in turbines, erosion of turbine blades, turbine governing, performance analysis ofturbine, Condensing system.	12	
3	IC Engines: IC Engines – classification, Analysis of a standard cycle, fuel characteristic of SI & CI Engine,Combustion, Engine performance Automotive Engine exhaust emission and their control	6	
4	Gas Turbines: Gas turbine Analysis – Regeneration - Reheating, Isentropic efficiency Combustion efficiency	5	

Text books:

1. Engineering Thermodynamics, P.K. Nag, 6th Edition, Mc Graw Hill Education Pvt. Ltd
2. Power Plant Engineering, P K Nag, 4th Edition, Mc Graw Hill Education Pvt. Ltd
3. Thermal Engineering, P.S. Ballaney, 25th Edition, Khanna publishers

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4. Power Plant Engineering, Domkundwar, Arora, Dhanpat Rai & Co.

Reference books:

1. Thermodynamics , Cengel , 6th Edition, Tata Mc Graw- Hill Education.
2. Power Plant Technology ,M M Ei-Wakil 1st Edition, Tata McGraw Hill
3. Heat and Thermodynamics, M W Zemansky & R.H.Dittman , 8th Edition, McGraw Hill

Course Outcome:

After completion of this course, the learners will be able to

1. describe the function of different components of boilers. Engines and turbines
2. explain the principle of operation of different types of boilers, turbines, IC engines and Gas turbines.
3. solve numerical problems of boilers, turbines, IC engines and Gas turbines.
4. analyze the performance of boilers, engines and turbines.
5. determine efficiency of boilers, engines and turbines.
6. explain methods to control boiler, engines and turbines parameters.

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		VALUES AND ETHICS IN PROFESSION	
Course Code: HM-EE-401		Semester: 4th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Practical: 0 hrs/week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To inculcate Human values to grow as a responsible human beings with a proper personality.		
2.	To instill Professional Ethics to maintain ethical conduct and discharge professional duties.		
Pre-Requisite			
1.	Not applicable		
Unit	Content	Hrs	Marks
1	Human values: Morals, Values, and Ethics – Integrity –Trustworthiness – Work Ethics – Service-Learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value Time – Co-operation – Commitment – Empathy – Self-confidence – Spirituality- Character.	5	
2	Principles for harmony: Truthfulness – Customs and Traditions -Value Education – Human Dignity – Human Rights – Fundamental Duties – Aspirations and Harmony (I, We & Nature) – Gender Bias – Emotional Intelligence – Salovey – Mayer Model – Emotional Competencies – Conscientiousness	5	
3	Engineering ethics and social experimentation: History of Ethics – Need of Engineering Ethics – Senses of Engineering Ethics- Profession and Professionalism —Self Interest – Moral Autonomy – Utilitarianism – Virtue Theory – Uses of Ethical Theories – Deontology- Types of Inquiry –Kohlberg’s Theory – Gilligan’s Argument – Heinz’s Dilemma – Comparison with Standard Experiments — Learning from the Past – Engineers as Managers – Consultants and Leaders – Balanced Outlook on Law – Role of Codes – Codes and Experimental Nature of Engineering.	8	
4	Engineers’ responsibility towards safety and risk for sustainable development: The concept of Safety – Safety and Risk – Types of Risks – Voluntary v/s Involuntary Risk – Consequences – Risk Assessment –Accountability – Liability – Reversible Effects – Threshold Levels of Risk – Delayed v/s Immediate Risk – Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.	5	
5	Engineers’ duties and rights: Concept of Duty – Professional Duties – Collegiality – Techniques for Achieving Collegiality – Senses of Loyalty – Consensus and Controversy – Professional and Individual Rights – Confidential and		

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	Proprietary Information – Conflict of Interest-Ethical egoism – Collective Bargaining – Confidentiality – Gifts and Bribes – Problem solving-Occupational Crimes- Industrial Espionage- Price Fixing-Whistle Blowing.	7	
6	Global issues: Globalization and MNCs –Cross Culture Issues – Business Ethics – Media Ethics – Environmental Ethics – Endangering Lives – Bio Ethics – Computer Ethics – War Ethics – Research Ethics - Intellectual Property Rights.	5	

Text books:

1. Professional Ethics & Human Values, Premvir Kapoor, Khanna Publishing House, Delhi (AICTE Recommended Textbook).
2. A text book on professional Ethics & Human values, R.S. Naagarazan, New Age international Publishing.
3. Engineering Ethics, M. Govindarajan, S. Natarajan , V.S. Senthilkumar, Prentice Hall India.
4. Human value and professional Ethics, Jayshree Suresh, B.S. Raghvan, S. Chand Publishing

Reference books:

1. Ethics in Science and Engineering, James G. Speight & Russel Foote, Wiley.

Course Outcome:

After completion of this course, the learners will be able to

1. illustrate different aspects of human values, ethics, engineers' responsibility and duties
2. explain different principles, different theories and laws of engineering ethics and social experimentation
3. identify different factors in the light of Engineers' responsibility towards safety and risk
4. correlate ethics of different work environment.
5. explain the need for intellectual property rights.

Special Remarks (if any)

The above mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		ENVIRONMENTAL SCIENCE	
Course Code: MC-EE-401		Semester: 4th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Practical: 0 hrs/week		Attendance: 05 Marks	
Credit Points: 0		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the environment and its relationships with human activities		
2.	To be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk		
3.	To understand environmental laws and regulations to develop guidelines and procedures for health and safety issues		
4.	To acquire the skill to solve problem related to environment and pollution		
Pre-Requisite			
1.	Basic knowledge of science		
Unit	Content	Hrs	Marks
1	Basic ideas of environment, basic concepts, man, society & environment, their interrelationship (1L) Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development (2L). Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function (1L). Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering (2L)	6	
2	Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function (1L). Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundarban); Food chain [definition and one example of each food chain], Food web (2L) Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur] (1L) Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.(2L)	6	
	Atmospheric Composition: Troposphere, Stratosphere,		

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3	<p>Mesosphere, Thermosphere, Tropopause and Mesopause (1L) Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.(1L) Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth's heat budget.(1L) Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).(2L) Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.(2L) Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN (2L) Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green-house gases, effect of ozone modification. (1L) Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference). (1L)</p>	11	
4	<p>Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. (2L) River/Lake/ground water pollution: River: DO, 5-day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenation, reaeration], COD, Oil, Greases, pH. (2L) Lake: Eutrophication [Definition, source and effect]. (1L) Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only)(1L) Standard and control: Waste water standard [BOD, COD, Oil, Grease], Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. (2L) Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic (1L)</p>	9	
5	<p>Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. (3L)</p>	3	

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Text books:

1. Environmental Studies, M.P. Poonia & S.C. Sharma, Khanna Publishing House
2. Introduction to Environmental Engineering and Science, G.M. Masters, Prentice-Hall of India Pvt. Ltd., 1991.

Reference books:

1. Environmental Chemistry, A. De, New Age International
2. Text Book for Environmental Studies, Erach Bharucha, UGC
3. Elements of Environmental Pollution Control, O.P. Gupta, Khanna Publishing House (AICTE Recommended Book).

Course Outcome:

After completion of this course, the learners will be able to

- 1 understand the natural environment and its relationships with human activities
- 2 apply the fundamental knowledge of science and engineering to assess environmental and health risk
- 3 develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations
- 4 acquire skills for scientific problem-solving related to air, water, noise & land pollution.

Special Remarks (if any)

The above mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course	ELECTRIC MACHINE-I LABORATORY
Course Code:PC-EE491	Semester: 4th
Duration: 6 months	Maximum marks:100
Teaching Scheme	Examination scheme:
Theory: 0 hr/week	Continuous Internal Assessment:40
Tutorial: 0 hr/week	External Assessment: 60
Practical: 2 hrs/week	
Credit Points:1	
	Laboratory Experiments:
1.	Determination of the characteristics of a separately excited DC generator.
2.	Determination of the characteristics of a DC motor
3.	Study of methods of speed control of DC motor
4.	Determination of the characteristics of a compound DC generator (short shunt)
5.	Determination of speed of DC series motor as a function of load torque.
6.	Polarity test on a single phase transformer
7.	Determination of equivalent circuit of a single phase transformer and efficiency.
8.	Study of different connections of three phase transformer.
9.	Study of Parallel operation of a single phase transformers.
10.	Determination of temperature rise and efficiency of the transformer.(Back to back test)

Course Outcome:

After completion of this course, the learners will be able to

1. identify appropriate equipment and instruments for the experiment.
2. test the instrument for application to the experiment.

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3. construct circuits with appropriate instruments and safety precautions
4. validate different characteristics of DC machine , methods of speed control of DC motor and parallel operation of the transformer
5. work effectively in a team

Special Remarks: The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		DIGITAL ELECTRONICS LABORATORY
Course Code:PC-EE492		Semester: 4th
Duration: 6 months		Maximum marks:100
Teaching Scheme		Examination scheme:
Theory: 0 hr/week		Continuous Internal Assessment:40
Tutorial: 0 hr/week		External Assessment: 60
Practical: 2 hrs/week		
Credit Points:1		
	Laboratory Experiments:	
1.	Realization of basic gates using Universal logic gates.	
2.	Code conversion circuits- BCD to Excess-3 & vice-versa.	
3.	.4-bit parity generator & comparator circuits.	
4.	Construction of simple Decoder & Multiplexer circuits using logic gates.	
5.	Design of combinational circuit for BCD to decimal conversion to drive 7-segment display usingmultiplexer.	
6.	Construction of simple arithmetic circuits-Adder, Subtractor.	
7.	Realization of RS-JK & D flip-flops using Universal logic gates.	
8.	Realization of Universal Register using JK flip-flops & logic gates.	
9.	Realization of Universal Register using multiplexer & flip-flops.	
10.	Construction of Adder circuit using Shift Register & full Adder.	
11.	Realization of Asynchronous Up/Down counter	
12.	Realization of Synchronous Up/Down counter	
13.	Design of Sequential Counter with irregular sequences.	

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14.	Realization of Ring counter & Johnson's counter.
15.	Familiarization with A/D and D/A circuits

Course Outcome:

After completion of this course, the learners will be able to

1. identify appropriate equipment and instruments for the experiment
2. test the instruments for application to the experiment
3. construct decoder, multiplexer, adder and subtractor circuits with appropriate instruments and precaution
4. realize RS-JK and D flip flop, universal register with gates, multiplexer and flip-flops and asynchronous and synchronous up down counters
5. validate the operation of code conversion circuit –BCD to Excess 3 & vice versa, 4 bit parity generator & comparator circuits,
6. work effectively in a team

Special Remarks: The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course	ELECTRICAL & ELECTRONICS MEASUREMENT LABORATORY
Course Code:PC-EE493	Semester: 4th
Duration: 6 months	Maximum marks:100
Teaching Scheme	Examination scheme:
Theory: 0 hr/week	Continuous Internal Assessment:40
Tutorial: 0 hr/week	External Assessment: 60
Practical: 2 hrs/week	
Credit Points:1	
	Laboratory Experiments:
1.	Instrument workshop- Observe the construction of PMMC, Dynamometer, Electrothermal and Rectifier type of instruments, Oscilloscope and Digital multimeter.
2.	Calibrate moving iron and electrodynamic type ammeter/voltmeter by potentiometer.
3.	Calibrate dynamometer type wattmeter by potentiometer.
4.	Calibrate AC energy meter.
5.	Measurement of resistance using Kelvin double bridge.
6.	Measurement of power using Instrument transformer.
7.	Measurement of power in Polyphase circuits.
8.	Measurement of frequency by Wien Bridge.
9.	Measurement of Inductance by Anderson bridge
10.	Measurement of capacitance by De Sauty Bridge.
11.	Measurement of capacitance by Schering Bridge.

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Course Outcome:

After completion of this course, the learners will be able to

7. identify appropriate equipment and instruments for the experiment
8. test the instrument for application to the experiment
9. construct circuits with appropriate instruments and safety precautions
10. evaluate and adjust the precision and accuracy of AC energy meter, moving iron and dynamometer type ammeter, voltmeter and wattmeter by potentiometer
11. measure voltage, current, power, energy, phase, frequency, resistance, inductance, capacitance
12. work effectively in a team

Special Remarks: The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		THERMAL POWER ENGINEERING LABORATORY
Course Code: ES-ME-491		Semester: 4th
Duration: 6 months		Maximum marks:100
Teaching Scheme		Examination scheme:
Theory: 0 hr/week		Continuous Internal Assessment:40
Tutorial: 0 hr/week		External Assessment: 60
Practical: 2 hrs/week		
Credit Points:1		
	Laboratory Experiments:	
1.	Study of Cut Models – Boilers IC Engines: Lanchashire Boiler, Bahcock & Willcox Boiler, Cochran Boiler, Vertical Tubular Boiler, Locomotive Boiler, 4S Diesel Engine, 4S Petrol Engine, 2S Petrol Engine	
2.	Load Test on 4 Stroke Petrol Engine & Diesel Engine by Electrical Load Box.	
3.	Load Test on 4 Stroke Diesel Engine by Rope Brake Dynamometer.	
4.	Heat Balance on 4 Stroke Diesel Engine by Rope Brake Dynamometer & by Electrical Load Box.	
5.	Valve Timing Diagram on 4S Diesel Engine Model & 4S Petrol Engine Model	
6.	To find the Calorific Value of Diesel Fuel & Coal by Bomb Calorimeter	
7.	To find the Flash Point & Fire Point of Petrol & Diesel Fuel	
8.	To find the Cloud Point & Pour Point of Petrol & Diesel Fuel	
9.	To find Carbon Particle Percentage in Diesel Engine Exhaust Smoke by Smokemeter and trace the BHP Vs. % Carbon Curve	
10.	Measurement of the Quality of Steam – Enthalpy & Dryness fraction	

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Course Outcome:

After completion of this course, the learners will be able to

1. identify appropriate equipment and instruments for the experiment
2. construct experimental setup with appropriate instruments and safety precautions
3. identify different parts of Lanchashire Boiler, Bahcock & Willcox Boiler, Cochran Boiler, Vertical Tubular Boiler, Locomotive Boiler, 4S Diesel Engine, 4S Petrol Engine, 2S Petrol engine
4. test 4 stroke petrol engine by electrical load box and diesel engine by electrical load box and rope brake dynamometer
5. find calorific value, flash point, fire point, cloud point, pour point of fuel.
6. work effectively in a team

Special Remarks: The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Semester-V

Name of the course		ELECTRIC MACHINE-II	
Course Code: PC-EE-501		Semester: 5th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks	
Practical: hrs/week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the arrangement of windings of AC machines.		
2.	To understand the principle of production of pulsating and revolving magnetic fields.		
3.	To understand the principle of operation and characteristics of three phase Induction machines		
4.	To understand the principle of operation and characteristics of single phase Induction machines		
5.	To understand the principle of operation and characteristics of synchronous machine		
6.	To understand the principle of operation and characteristics of special electromechanical devices.		
7.	To solve problems of Induction machines, synchronous machines and special eletromechanical devices.		
Pre-Requisite			
1.	Basic Electrical Engineering (ES-EE-101)		
2.	Electric Circuit Theory (PC-EE-301)		
3.	Electromagnetic field theory (PC-EE-303)		
4.	Electric Machine-I (PC-EE-401)		
Unit	Content	Hrs	Marks
1	Fundamentals of AC machine windings: Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single-turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis,3D visualization of the above winding types, Air-gap MMF distribution with fixed current through winding-concentrated and distributed, Sinusoidally distributed winding, winding distribution factor	5	
2	Pulsating and revolving magnetic fields: Constant magnetic field, pulsating magnetic field - alternating current in windings with spatial displacement, Magnetic field produced by a single winding - fixed current and alternating current Pulsating fields produced by spatially displaced windings, Windings spatially shifted by 90 degrees, Addition of pulsating magnetic fields, Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), revolving magnetic field.	5	
3	Induction Machines: Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and Maximum Torque. Equivalent circuit. Phasor Diagram, Losses and Efficiency. Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors. Generator operation. Self-excitation. Doubly-Fed Induction Machines.	10	
	Single-phase induction motors:		

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4	Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and applications	5	
5	Synchronous machines: Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation. Operating characteristics of synchronous machines, V-curves. Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division.	10	
6	Special Electromechanical devices: Principle and construction of switched Reluctance motor, Permanent magnet machines, Brushless DC machines, Hysteresis motor, Stepper motor, Tacho generators.	5	

Text books:

1. Electrical Machinery, P.S. Bhimra, Khanna Publishers.
2. Electrical Machines, Nagrath & Kothary, TMH
3. Electrical Machines, P.K. Mukherjee and S. Chakravorti, Dhanpat Rai Publications.
4. Electrical Machines, Theory & Applications, M.N. Bandyopadhyay, PHI

Reference books

1. Electric Machinery & Transformer, Bhag S. Guru and H.R. Hiziroglu, 3rd Edition, Oxford University press.
2. Electric Machinery & Transformes, Irving L. Kosow, PHI
3. Electric Machinery, A.E.Fitzgerald, Charles Kingsley,Jr. & Stephen D. Umans, 6th Edition, Tata McGraw Hill Edition.
4. Electrical Machines, R.K. Srivastava, Cengage Learning
5. Theory of Alternating Current Machinery, Alexander S Langsdorf, Tata Mc Graw Hill Edition
6. The performance and Design of Alternating Current Machines, M.G.Say, CBS publishers & distributors
7. Electric Machines, Charles A. Gross, CRC press.
8. Problems in Electrical Engineering, Parker smith, 9th Edition, CBS publishers & distributors.

Course Outcome:

After completion of this course, the learners will be able to

1. describe the arrangement of winding of AC machines.
2. explain the principle of operation of Induction machines, Synchronous machines and special machines.
3. solve numerical problems of Induction machines, Synchronous machines and Special machines.
4. estimate the parameters and efficiency of Induction machines and Synchronous machines.
5. determine the characteristics of Induction machines and Synchronous machines.
6. select appropriate methods for starting , braking and speed control of Induction machines.

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		POWER SYSTEM-I	
Course Code: PC-EE-502		Semester: 5th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks	
Practical: hrs/week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the basic principle of generation of Electricity from different sources		
2.	To find parameters and characteristics of overhead transmission lines and cables.		
3.	To find different parameters for the construction of overhead transmission line		
4.	To determine the performance of transmission lines.		
5.	To understand the principle tariff calculation.		
6.	To solve numerical problems on the topics studied.		
Pre-Requisite			
1.	Basic Electrical Engineering (ES-EE-101)		
2.	Electric Circuit Theory (PC-EE-301)		
3.	Electromagnetic field theory (PC-EE-303)		
Unit	Content	Hrs	Marks
1	Basic Concepts: Evolution of Power System and present day Scenario. Structure of power system: Bulk power grid and Micro Grid. Generation of Electric Power: General layout of a typical coal fired power station, Hydro electric power station, Nuclear power station, their components and working principles, comparison of different methods of power generation. Introduction to Solar & Wind energy system. Indian Electricity Rule-1956: General Introduction.	10	
2	Overhead transmission line: Choice of frequency, Choice of voltage, Types of conductors, Inductance and Capacitance of a single phase and three phase symmetrical and unsymmetrical configurations. Bundle conductors. Transposition. Concept of GMD and GMR. Influence of earth on conductor capacitance. Overhead line construction: Line supports, Towers, Poles, Sag, Tension and Clearance, Effect of Wind and Ice on Sag. Dampers. Corona: Principle of Corona formation, Critical disruptive voltage, Visual critical corona discharge potential, Corona loss, advantages & disadvantages of Corona. Methods of reduction of Corona.	12	
3	Insulators: Types, Voltage distribution across a suspension insulator string, String efficiency, Arching shield & rings, Methods of improving voltage distribution across Insulator strings, Electrical tests on line Insulators.	05	

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4	Cables: Types of cables, cable components, capacitance of single core & 3 core cables, dielectric stress, optimum cable thickness, grading, dielectric loss and loss angle.	04	
5	Performance of lines: Short, medium (nominal, T) and long lines and their representation. A.B.C.D constants, Voltage regulation, Ferranti effect, Power equations and line compensation, Power Circle diagrams.	06	
6	Tariff: Guiding principle of Tariff, different types of tariff.	03	

Text book:

1. Electrical Power System, Subir Roy, Prentice Hall
2. Power System Engineering, Nagrath & Kothery, TMH
3. Elements of power system analysis, C.L. Wodhwa, New Age International.
4. Electrical Power System, Ashfaq Hussain, CBS Publishers & Distributors

Reference books

1. Electric Power transmission & Distribution, S.Sivanagaraju, S.Satyanarayana,, Pearson Education.
2. A Text book on Power system Engineering, Soni, Gupta, Bhatnagar & Chakrabarti, Dhanpat Rai & Co.
3. Electric Power distribution system Engineering, 2nd Edition, T. Gonen, CRC Press.
4. www.powermin.nic.in/acts_notification/pdf/ier1956.pdf

Course Outcome:

After completion of this course, the learners will be able to

1. explain the principle of generation of Electric power from different sources
2. determine parameters of transmission lines and its performance
3. explain the principle of formation of corona and methods of its reduction
4. conduct electrical tests on insulators
5. solve numerical problems related to overhead transmission line, cable, insulators and tariff
6. analyze overhead transmission line based on short medium and long lines.

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		CONTROL SYSTEM	
Course Code: PC-EE-503		Semester: 5th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester Exam: 15 Marks	
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks	
Practical: hrs./week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To find mathematical representation of LTI systems.		
2.	To find time response of LTI systems of different orders		
3.	To find the frequency response of LTI systems of different orders		
4.	To understand stability of different LTI systems.		
5.	To analyze LTI systems with state variables.		
6.	To solve problems of mathematical modelling and stability of LTI systems		
Pre-Requisite			
1.	Basic Electrical Engineering (ES-EE-101)		
2.	Electric Circuit Theory (PC-EE-301)		
3.	Electromagnetic field theory (PC-EE-303)		
4.	Electric Machine-I (PC-EE-401)		
Unit	Content	Hrs	Marks
1	Introduction to control system: Concept of feedback and Automatic control, Effects of feedback, Objectives of control system, Definition of linear and nonlinear systems, Elementary concepts of sensitivity and robustness. Types of control systems, Servomechanisms and regulators, examples of feedback control systems. Transfer function concept. Pole and Zeroes of a transfer function. Properties of Transfer function.	04	
2	Mathematical modeling of dynamic systems: Translational systems, Rotational systems, Mechanical coupling, Liquid level systems, Electrical analogy of Spring–Mass–Dashpot system. Block diagram representation of control systems. Block diagram algebra. Signal flow graph. Mason’s gain formula. Control system components: Potentiometer, Synchros, Resolvers, Position encoders. DC and AC tachogenerators. Actuators. Block diagram level description of feedback control systems for position control, speed control of DC motors, temperature control, liquid level control, voltage control of an Alternator.	08	
3	Time domain analysis: Time domain analysis of a standard second order closed loop system. Concept of undamped natural frequency, damping, overshoot, rise time and settling time. Dependence of time domain performance parameters on natural frequency and damping ratio. Step and Impulse response of first and second order systems. Effects of Pole and Zeros on transient response. Stability by pole location. Routh-Hurwitz criteria and applications. Error Analysis: Steady state errors in control systems due to step,	08	

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	ramp and parabolic inputs. Concepts of system types and error constants.		
4	Stability Analysis: Root locus techniques, construction of Root Loci for simple systems. Effects of gain on the movement of Pole and Zeros. Frequency domain analysis of linear system: Bode plots, Polar plots, Nichols chart, Concept of resonance frequency of peak magnification. Nyquist criteria, measure of relative stability, phase and gain margin. Determination of margins in Bode plot. Nichols chart. M-circle and M-Contours in Nichols chart.	10	
5	Control System performance measure: Improvement of system performance through compensation. Lead, Lag and Lead-lag compensation, PI, PD and PID control.	05	
6	State variable Analysis: Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.	10	

Text books:

1. Modern Control Engineering, K. Ogata, 4th Edition, Pearson Education
2. Control System Engineering, I. J. Nagrath & M. Gopal. New Age International Publication.
3. Control System Engineering, D. Roy Choudhury, PHI
4. Automatic Control Systems, B.C. Kuo & F. Golnaraghi, 8th Edition, PHI

Reference books

1. Control Engineering Theory & Practice, Bandyopadhyaya, PHI
2. Control systems, K.R. Varmah, Mc Graw hill
3. Control System Engineering, Norman Nise, 5th Edition, John Wiley & Sons
4. Modern Control System, R.C. Dorf & R.H. Bishop, 11th Edition, Pearson Education.
5. Control System Design, C. Goodwin Graham, F. Graebe F. Stefan, Salgado. E. Mario, PHI
6. Modeling & Control of dynamic system, Macia & Thaler, Thompson
7. Modern Control Technology Components & Systems, 3rd edition, C.T Kilian, Cengage Learning
8. Modern Control Engineering, Y. Singh & S. Janardhanan, Cengage Learning
9. Control System Engineering, R. Anandanatarajan & R. Ramesh Babu, SCITECH
10. Automatic Control system, A. William, Wolovich, Oxford

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Course Outcome:

After completion of this course, the learners will be able to

1. develop mathematical model of mechanical, electrical, thermal, fluid system and different control system components like servomotors, synchros, potentiometer, tacho-generators etc.
2. analyse stability of LTI system using routh-hurwitz (RH) criteria, root locus techniques in time domain and bode plot and nyquist technique in frequency domain.
3. design different control law or algorithms like proportional control, proportional plus derivative (PD) control, proportional plus integration (PI) control, and proportional plus integration plus derivative (PID) control and compensators like lag, lead, lag-lead for LTI systems.
4. apply state variable techniques for analysis of linear systems.
5. analyze the stability of linear discrete system.
6. solve numerical problems on LTI system modelling, responses, error dynamics and stability.

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		POWER ELECTRONICS	
Course Code: PC-EE-504		Semester: 5 th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester Exam: 15 Marks	
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks	
Practical: hrs./week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the functioning and characteristics of power switching devices.		
2.	To understand the principle of operation of converters.		
3.	To understand different triggering circuits and techniques of commutation of SCR		
4.	To find external performance parameter of converters.		
5.	To analyze methods of voltage control, improvement of power factor and reduction of harmonics of the converter		
6.	To solve numerical problems of converters		
Pre-Requisite			
1.	Electric Circuit Theory (PC-EE-301)		
2.	Analog Electronics (PC-EE-302)		
3.	Electromagnetic field theory (PC-EE-303)		
4.	Digital Electronics (PC-EE-402)		
Unit	Content	Hrs	Marks
1	Introduction: Concept of power electronics, application of power electronics, uncontrolled converters, advantages and disadvantages of power electronics converters, power electronics systems, power diodes, power transistors, power MOSFETS, IGBT and GTO.	04	
2	PNPN devices: Thyristors, brief description of members of Thyristor family with symbol, V-I characteristics and applications. Two transistor model of SCR, SCR turn on methods, switching characteristics, gate characteristics, ratings, SCR protection, series and parallel operation, gate triggering circuits, different commutation techniques of SCR.	05	
3	Phase controlled converters: Principle of operation of single phase and three phase half wave, half controlled, full controlled converters with R, R-L and RLE loads, effects of freewheeling diodes and source inductance on the performance of converters. External performance parameters of converters, techniques of power factor improvement, single phase and three phase dual converters	06	
	DC-DC converters:		

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4	Principle of operation, control strategies, step up choppers, types of choppers circuits based on quadrant of operation, performance parameters, multiphase choppers.	05	
5	Inverters: Definition, classification of inverters based on nature of input source, wave shape of output voltage, method of commutation & connections. Principle of operation of single phase and three phase bridge inverter with R and R-L loads, performance parameters of inverters, methods of voltage control and harmonic reduction of inverters.	10	
6	Resonant Pulse Converters: Introduction, Series Resonant inverter, Parallel Resonant inverter, Zero-Current Switching Resonant converters, Zero-Voltage Switching Resonant converter, Two quadrant Zero-Voltage Switching Resonant converter, Resonant DC link inverter.	05	
7	Applications: Speed control of AC and DC motors. HVDC transmission. Static circuit breaker, UPS, static VAR controller.	05	

Text books:

1. Power Electronics, M.H. Rashid, 4th Edition, Pearson
2. Power Electronics, P.S. Bhimra, 3rd Edition, Khanna Publishers
3. Power Electronics, V.R. Moorthi, Oxford.
4. Power Electronics, M.D. Singh and K.B. Khanchandani, Tata Mc Graw Hill.

Reference books

1. Modern Power Electronics & AC drives, B.K. Bose, Prentice Hall
2. Power Electronics, Mohan, Undeland & Robbins, Wiley India
3. Element of power Electronics, Phillip T Krein, Oxford.
4. Power Electronics systems, J.P. Agarwal, Pearson Education.
5. Analysis of Thyristor power conditioned motor, S.K. Pillai, University Press.
6. Power Electronics, M.S. Jamal Asgha, PHI.
7. Power Electronics : Principles and applications, J.M. Jacob, Thomson

Course Outcome:

After completion of this course, the learners will be able to

1. differentiate between signal level and power level devices.
2. construct triggering and commutation circuits of SCR.
3. explain the principle of operation of AC-DC, DC-DC and DC-AC converters.
4. analyse the performance of AC-DC, DC-DC and DC-AC converters.
5. apply methods of voltage control and harmonic reduction to inverters.
6. solve numerical problems of switching devices, AC-DC, DC-DC and DC-AC converters.

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course	ELECTRIC MACHINE-IILABORATORY
Course Code: PC-EE 591	Semester: 5th
Duration: 6 months	Maximum marks:100
Teaching Scheme	Examination scheme:
Theory: 0 hr/week	Continuous Internal Assessment:40
Tutorial: 0 hr/week	External Assessment: 60
Practical: 2 hrs/week	
Credit Points:1	
Laboratory Experiments:	
1.	Different methods of starting of a 3 phase Cage Induction Motor & their comparison [DOL, Auto transformer & Star-Delta]
2.	Study of equivalent circuit of three phase Induction motor by no load and blocked rotor test.
3.	Study of performance of wound rotor Induction motor under load.
4.	Study of performance of three phase squirrel- cage Induction motor –determination of iron-loss, friction & windage loss.
5.	Speed control of 3 phase squirrel cage induction motor by different methods & their comparison [voltage control & frequency control].
6.	Speed control of 3 phase slip ring Induction motor by rotor resistance control
7.	Determination of regulation of Synchronous machine by a. Potier reactance method. b. Synchronous Impedance method.
8.	Determination of equivalent circuit parameters of a single phase Induction motor.
9.	Load test on single phase Induction motor to obtain the performance characteristics.
10.	To determine the direct axis resistance [X_d] & quadrature reactance [X_q] of a 3 phase synchronous machine by slip test.
11.	Load test on wound rotor Induction motor to obtain the performance characteristics.
12.	To make connection diagram to full pitch & fractional slot winding of 18 slot squirrel cage Induction motor for 6 poles & 4 pole operation
13.	To study the performance of Induction generator
14.	Parallel operation of 3 phase Synchronous generators
15.	V-curve of Synchronous motor

Institute may develop experiments based on the theory taught in addition to experiments mentioned.

Reference book:

1. Laboratory experiments on Electrical Machines, C.K. Chanda, A. Chakrabarti, Dhanpat Rai & Co.
2. Laboratory manual for Electrical Machines, D.P. Kothari, B.S. Umre, I K International Publishing House Pvt. Ltd.

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Course outcome: After completion of this course, the learners will be able to

1. identify appropriate equipment and instruments for the experiment.
2. test the instrument for application to the experiment.
3. construct circuits with appropriate instruments and safety precautions.
4. validate different characteristics of single phase Induction motor, three phase Induction motor, Induction generator and synchronous motor , methods of speed control of Induction motors and parallel operation of the 3 phase Synchronous generator.
5. work effectively in a team

Special Remarks: The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		POWER SYSTEM-I LABORATORY
Course Code: PC-EE 592		Semester: 5 th
Duration: 6 months		Maximum marks:100
Teaching Scheme		Examination scheme:
Theory: 0 hr/week		Continuous Internal Assessment:40
Tutorial: 0 hr/week		External Assessment: 60
Practical: 2 hrs/week		
Credit Points:1		
	Laboratory Experiments:	
1.	Determination of the generalized constants A,B, C, D of long transmission line and regulation of a 3- Φ transmission line model	
2.	Study of distribution system by network analyzer.	
3.	Measurement of earth resistance by earth tester.	
4.	Determination of dielectric strength of insulating oil.	
5.	Determination of breakdown strength of solid insulating material	
6.	Determination of parameter of 3- Φ transmission line model by power circle diagram	
7.	Study of different types of insulator.	
8.	Study of active and reactive power control of alternator.	
9.	Study and analysis of an electrical transmission line circuit with the help of software	
10.	Determination of dielectric constant, tan delta, resistivity of transformer oil.	

Institute may develop experiments based on the theory taught in addition to experiments mentioned.

Course outcome: After completion of this course, the learners will be able to

1. identify appropriate equipment and instruments for the experiment.
2. test the instrument for application to the experiment.
3. construct circuits with appropriate instruments and safety precautions.
4. validate different characteristics of transmission line.
5. determine earth resistance, dielectric strength of insulating oil, breakdown strength of solid insulating material and dielectric constant of transformer oil.
6. analyze an electrical transmission line circuit with the help of software
7. work effectively in a team

Special Remarks: The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course	CONTROL SYSTEM LABORATORY
Course Code: PC-EE 593	Semester: 5th
Duration: 6 months	Maximum marks:100
Teaching Scheme	Examination scheme:
Theory: 0 hr/week	Continuous Internal Assessment:40
Tutorial: 0 hr/week	External Assessment: 60
Practical: 2 hrs/week	
Credit Points:1	
	Laboratory Experiments:
1.	Familiarization with MAT-Lab control system tool box, MAT-Lab- simulink tool box & PSPICE
2.	Determination of Step response for first order & Second order system with unity feedback with the help of CRO & calculation of control system specification , Time constant, % peak overshoot, settling time etc. from the response.
3.	Simulation of Step response & Impulse response for type-0, type-1 & Type-2 system with unity feedback using MATLAB & PSPICE.
4.	Determination of Root locus, Bode plot, Nyquist plot using MATLAB control system tool box for a given system & stability by determining control system specification from the plot.
5.	Determination of PI, PD and PID controller action of first order simulated process.
6.	Determination of approximate transfer functions experimentally from Bode plot.
7.	Evaluation of steady state error, setting time , percentage peak overshoot, gain margin, phase margin with addition of Lead, Lag, Lead-lag compensator.
8.	Study of a practical position control system obtaining closed step responses for gain setting corresponding to over-damped and under-damped responses. Determination of rise time and peak time using individualized components by simulation. Determination of un-damped natural frequency and damping ratio from experimental data.
9.	Analysis of performance of Lead, Lag and Lead-Lag compensation circuits for a given system using simulation.
10.	Determination of Transfer Function of a given system from State Variable model and vice versa.
11.	Analysis of performance of a physical system using State variable technique by simulation. Study of step response and initial condition response for a single input, two-output system in SV form by simulation.

Institute may develop experiments based on the theory taught in addition to experiments mentioned.

Course outcome: After completion of this course, the learners will be able to

1. identify appropriate equipment and instruments for the experiment.
2. test the instrument for application to the experiment.
3. construct circuits with appropriate instruments and safety precautions.
4. use MAT-Lab control system tool box, MAT-Lab- simulink tool box & PSPICE for simulation of systems.
5. determine control system specifications of first and second order systems.

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6. validate step response & impulse response for type-0, type-1 & Type-2 system with unity feedback using MATLAB & PSPICE.
7. work effectively in a team

Special Remarks: The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course	POWER ELECTRONICSLABORATORY
Course Code: PC-EE 594	Semester: 5th
Duration: 6 months	Maximum marks:100
Teaching Scheme	Examination scheme:
Theory: 0 hr/week	Continuous Internal Assessment:40
Tutorial: 0 hr/week	External Assessment: 60
Practical: 2 hrs/week	
Credit Points:1	
	Laboratory Experiments:
1.	Study of the characteristics of an SCR.
2.	Study of the characteristics of a Triac
3.	Study of different triggering circuits of an SCR
4.	Study of firing circuits suitable for triggering SCR in a single phase full controlled bridge.
5.	Study of the operation of a single phase full controlled bridge converter with R and R-L load.
6.	Study of performance of single phase half controlled symmetrical and asymmetrical bridge converters.
7.	Study of performance of step down chopper with R and R-L load.
8.	Study of performance of single phase controlled converter with and without source inductance (simulation)
9.	Study of performance of step up and step down chopper with MOSFET, IGBT and GTO as switch (simulation)
10.	Study of performance of single phase half controlled symmetrical and asymmetrical bridge converter.(simulation)
11.	Study of performance of three phase controlled converter with R & R-L load. (simulation)
12.	Study of performance of PWM bridge inverter using MOSFET as switch with R and R-L load.
13.	Study of Zero Voltage Switching Resonant converter and Zero Current Switching Resonant Converter and to plot its output waveforms.
14.	Study the speed control of universal motor to plot speed $v/s \alpha$

Institute may develop experiments based on the theory taught in addition to experiments mentioned.

Reference book:

1. Power Electronics Laboratory: Theory, Practice and Organization, O.P.Arora, Om Prakash Arora, Alpha science International.

Course outcome: After completion of this course, the learners will be able to

1. identify appropriate equipment and instruments for the experiment.
2. test the instrument for application to the experiment.
3. construct circuits with appropriate instruments and safety precautions.

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4. validate characteristics of SCR, Triac, and performance of phase controlled converter, DC-DC converter, inverters and resonant pulse converters.
5. demonstrate the relation between the speed and firing angle of Universal motor.
6. work effectively in a team

Special Remarks:

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Elective-II (Open elective)

Name of the course		DATA STRUCTURE & ALGORITHM	
Course Code: OE-EE-501A		Semester: 5th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester Exam: 15 Marks	
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks	
Practical: hrs./week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the basics of abstract data types.		
2.	To understand the principles of linear and nonlinear data structures.		
3.	To build an application using sorting and searching		
Pre-Requisite			
1.	Programing for problem solving (ES-CS 201)		
2.	Mathematics (BS-M-102)		
3.	Mathematics (BS-M-202)		
Unit	Content	Hrs	Marks
1	Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Technique sand their complexity analysis.	10	
2	Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.	10	
3	Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms andthe complexity analysis. Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis	10	
4	Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing. Graph: BasicTerminologies and Representations, Graph search and traversal algorithms and complexity analysis.	10	

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Text books:

1. Data Structures and Program Design In C, 2/E by Robert L. Kruse, Bruce P. Leung. PHI
2. Data Structure & Algorithms Using C, R.S. Salaria, 5th Ed., Khanna Publishing House
3. Data Structures in C, Aaron M. Tenenbaum. Pearson.
4. Data Structure, S. Lipschutz.. Mc Graw Hill.

Reference books

1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, MIT press
2. Expert Data Structures with C++, R.B Patel, Khanna Publishing House
3. Fundamentals of Data Structures of C, Ellis Horowitz, Sartaj Sahni, Susan Andersonfreed, MIT press
4. Data Structures Using C, Reema Thareja. Oxford University press
5. Data Structure Using C, 2/e by A.K. Rath, A. K. Jagadev. SCITECH
6. Data Structures through C, Yashwant Kanetkar, BPB Publications.

Course Outcome:

After completion of this course, the learners will be able to

1. differentiate how the choices of data structure & algorithm methods enhance the performance of the program.
2. solve problems based upon different data structure & also write programs.
3. write programs based on different data structure
4. identify appropriate data structure & algorithmic methods in solving problem.
5. discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing
6. compare the benefits of dynamic and static data structures implementations.

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Elective-II (Open elective)

Name of the course		OBJECT ORIENTED PROGRAMMING	
Course Code: OE-EE-501B		Semester: 5 th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester Exam: 15 Marks	
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks	
Practical: hrs./week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To understand simple abstract data types		
2.	To understand features of object-oriented design such as encapsulation, polymorphism, inheritance		
3.	To understand common object-oriented design patterns		
4.	To design applications with an event-driven graphical user interface.		
Pre-Requisite			
1.	Programing for problem solving (ES-CS 201)		
Unit	Content	Hrs	Marks
1	Abstract data types and their specification. How to implement an ADT. Concrete state space, concrete invariant, abstraction function. Implementing operations, illustrated by the Text example.	08	
2	Features of object-oriented programming. Encapsulation, object identity, polymorphism – but not inheritance.	08	
3	Inheritance in OO design. Design patterns. Introduction and classification. The iterator pattern.	08	
4	Model-view-controller pattern. Commands as methods and as objects. Implementing OO language features. Memory management.	08	
5	Generic types and collections GUIs. Graphical programming with Scale and Swing . The software development process	08	

Text books:

1. Object Oriented Modelling and Design, Rumbaugh, James Michael, Blaha Prentice Hall India.
2. The complete reference-Java2, Patrick Naughton, Herbert Schildt, TMH
3. Core Java For Beginners, R.K. Das, VIKAS PUBLISHING
4. Java How to Program, Deitel and Deitel, 6th ED, Pearson

Reference books

1. Object Oriented System Development, Ali Bahrami, McGraw Hill.
2. Ivor Horton's Beginning Java 2 SDK – Wrox
3. Programming With Java: A Primer, E. Balagurusamy 3rd Ed., TMH

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Course Outcome:

After completion of this course, the learners will be able to

1. specify simple abstract data types.
2. recognise features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.
3. apply common object-oriented design patterns
4. specify uses of common object oriented design patterns with examples.
5. design applications with an event-driven graphical user interface.

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Elective-II (Open elective)

Name of the course		COMPUTER ORGANISATION	
Course Code: OE-EE-501C		Semester: 5th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester Exam: 15 Marks	
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks	
Practical: hrs./week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the analysis and design of various digital electronic circuits.		
2.	To understand how Computer Systems work & its basic principles		
3.	To understand how I/O devices are being accessed and its principles etc.		
Pre-Requisite			
1.	Programing for problem solving (ES-CS 201)		
2.	Digital Electronics (PC-EE 402)		
Unit	Content	Hrs	Marks
1	Basic organization of the stored program computer and operation sequence for execution of a program. Role of operating systems and compiler/assembler. Fetch, decode and execute cycle, Concept of operator, operand, registers and storage, Instruction format. Instruction sets and addressing modes. Commonly used number systems. Fixed and floating point representation of numbers.	08	
2	Overflow and underflow. Design of adders - ripple carry and carry look ahead principles. Design of ALU. Fixed point multiplication - Booth's algorithm. Fixed point division - Restoring and non-restoring algorithms. Floating point - IEEE 754 standard.	08	
3	Memory unit design with special emphasis on implementation of CPU-memory interfacing. Memory organization, static and dynamic memory, memory hierarchy, associative memory. Cache memory, Virtual memory. Data path design for read/write access.	10	
4	Design of control unit - hardwired and microprogrammed control. Introduction to instruction pipelining. Introduction to RISC architectures. RISC vs CISC architectures. I/O operations - Concept of handshaking, Polled I/O, interrupt and DMA.	10	

Text books:

1. Computer System Architecture, Mano, M.M. PHI.
2. Computer Architecture & Organisation, Hayes J. P, McGraw Hill,
3. Computer Organisation & Design, Chaudhuri P. Pal, PHI,
4. Computer Organization & Architecture, Rajaraman , PHI

Reference books

1. Computer Architecture, BehroozParhami , Oxford University Press
2. Microprocessors and Microcontrollers, N. senthil Kumar, M. Saravanan, S. Jeevananthan ,OUP

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3. Computer Organization & Architecture , P N BasuVikas Pub
4. Computer Organization & Architecture, B.Ram, Newage Publications
5. Computer Organisation, Hamacher, McGraw Hill,

Course Outcome:

After completion of this course, the learners will be able to

1. explain basic structure of digital computer, stored program concept, different arithmetic and control unit operations, operating systems and compiler/assembler, memory and I/O operations.
2. differentiate between RISC vs CISC architectures, cache memory, virtual memory.
3. performfixed point multiplication and division.
4. applyrestoring and non-restoring algorithms, floating point - IEEE 754 standard.
5. design adder, memory unit and control unit, data path for read/write access.

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Elective-I

Name of the course		HIGH VOLTAGE ENGINEERING	
Course Code: PE-EE-501A		Semester: 5 th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester Exam: 15 Marks	
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks	
Practical: hrs./week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the breakdown phenomenon of solid, liquid and gases.		
2.	To understand the method of generation of high voltage AC and DC.		
3.	To understand measurement techniques of high voltage and current		
4.	To understand the over voltage phenomenon and insulation coordination in Electric power systems		
5.	To understand different methods of high voltage testing.		
6.	To solve numerical problems of breakdown phenomena, generation and measurement of high voltage and currents, over voltage phenomena and high voltage testing.		
Pre-Requisite			
1.	Electric Circuit Theory (PC-EE-301)		
2.	Electromagnetic field theory (PC-EE-303)		
3.	Electric Machine-I (PC-EE-401)		
4.	Electrical and Electronics measurement (PC-EE-403)		
Unit	Content	Hrs	Marks
1	Breakdown phenomena: Breakdown of Gases: Mechanism of Breakdown of gases, Charge multiplication, Secondary emission, Townsend Theory, Streamer Theory, Paschen's Law, Determination of Minimum breakdown voltage, Breakdown in non-uniform field, Effect of polarity on corona inception and break down voltage. Partial Discharge: definition and development in solid dielectric. Break Down of Solids: Intrinsic breakdown, Electromechanical break down, Thermal breakdown, Streamer Breakdown. Breakdown of Liquid: Intrinsic Break down, Cavitation Theory, Suspended particle Theory. Breakdown in Vacuum: Non-metallic electron emission mechanism, Clump mechanism, Effect of pressure on breakdown voltage.	10	
2	Generation of High Voltage and Currents Generation of high DC and AC voltages: half wave rectifier circuit, Cockroft-Walton voltage multiplier circuit, Electrostatic generator, Cascaded transformers, Series resonant circuit. Generation of Impulse voltages and currents: standard impulse wave shapes, Multistage impulse generators, generation of switching surges, generation of impulse currents, tripping and control of impulse generators.	08	
3	Measurement of High Voltage and Currents Sphere gap, Uniform field spark gap, Rod gap, Electrostatic voltmeter, Generating voltmeter, Impulse voltage measurements		

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	using voltage dividers, Measurement of High DC and Impulse currents. Cathode ray oscillographs for impulse voltage and current measurements.	08	
4	Over voltage phenomenon and insulation coordination in Electric power systems: Lightning Phenomena, Electrification of cloud, Development of Lightning Stroke, lightning induced over voltage, direct stroke, indirect stroke. Protection of Electrical Apparatus against over voltage, Lightning Arrestors, Valve Type, Metal Oxide arresters, Expulsion type. Effect of location of lightning arresters on protection of transformer. Protection of substation, Ground wires. Insulation Co-ordination, Basic Insulation level. Basic Impulse level, Switching Impulse level. Volt time characteristics of protective devices, Determination of Basic Impulse level of substation equipment.	08	
5	High Voltage Testing: Various standards for HV Testing of electrical apparatus, IS, IEC standards, Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, power transformers. High voltage laboratory layout, indoor and outdoor laboratories, testing facility requirements, safety precautions in H. V. Labs.	06	

Text books:

1. High Voltage Engineering, C.L. Wadhawa, New Age International Publishers.
2. High Voltage Engineering, M.S. Naidu & V. Kamraju, Tata MC Graw Hill publication.

Reference books

1. High-Voltage Engineering : theory and practice, Mazen Abdel-Salam; Hussein Anis; Ahdab El-Morshedy; Roshdy Radwan, New York, N.Y. : Marcel Dekker, ©2000.
2. High Voltage Engineering, E. Kuffel, W.S. Zaengl, J. Kuffel, 2nd edition, Butterworth-Heinemann.

Course Outcome:

After completion of this course, the learners will be able to

1. explain breakdown phenomenon of gas, liquid and solid and vacuum
2. suggest methods for generation and measurement of high voltage and currents.
3. determine the basic insulation level of substation equipment.
4. apply methods for protection of electrical apparatus against over voltage
5. test insulators, bushings, isolators, circuit breakers, cables and power transformers.
6. solve numerical problems of breakdown phenomena, generation and measurement of high voltage and currents, over voltage phenomena and high voltage testing.

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Elective-I

Name of the course		POWER PLANT ENGINEERING	
Course Code: PE-EE-501B		Semester: 5 th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester Exam: 15 Marks	
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks	
Practical: hrs./week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To understand methods of selection of power plant and its economic.		
2.	To understand the principle of operation different types of power plants.		
3.	To understand methods of site selection of different power plants.		
4.	To understand the cause of pollution and its remedy for power plants.		
5.	To understand methods of cooling of generators and transformers.		
6.	To solve numerical problems of load estimation, economics of power plants.		
Pre-Requisite			
1.	Electric Circuit Theory (PC-EE-301)		
2.	Electromagnetic field theory (PC-EE-303)		
3.	Electric Machine-I (PC-EE-401)		
4.	Electrical and Electronics measurement (PC-EE-403)		
Unit	Content	Hrs	Marks
1	Introduction: Power and energy, sources of energy, review of thermodynamic cycles related to powerplants, fuels and combustion calculations. Load estimation, load curves, various terms and factors involved in power plant calculations. Effect of variable load on power plant operation, Selection of power plant. Power plant economics and selection: Effect of plant type on costs, rates, fixed elements, energy elements, customer elements and investor's profit; depreciation and replacement, theory of rates. Economics of plant selection, other considerations in plant selection.	08	
2	Steam power plant: General layout of steam power plant, Power plant boilers including critical and supercritical boilers. Fluidized bed boilers, boilers mountings and accessories, Different systems such as coal handling system, pulverizers and coal burners, combustion system, draft, ash handling system, Dust collection system, Feed water treatment and condenser and cooling towers and cooling ponds, Turbine auxiliary systems such as governing, feed heating, reheating, flange heating and gland leakage. Operation and maintenance of steam power plant, heat balance and efficiency, Site selection of a steam power plant.	08	
3	Diesel power plant: General layout, Components of Diesel power plant, Performance of diesel power plant, fuel system, lubrication system, air intake and admission system, supercharging system, exhaust system, diesel plant operation and efficiency, heat balance, Site selection of diesel		

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	powerplant, Comparative study of diesel power plant with steampower plant. Gas turbine power plant: Layout of gas turbine power plant, Elements of gas turbine power plants, Gas turbine fuels, cogeneration, auxiliary systems such as fuel, controls and lubrication, operation and maintenance, Combined cycle power plants, Site selection of gas turbine power plant .	08	
4	Nuclear power plant: Principles of nuclear energy, Lay out of nuclear power plant, Basic components of nuclear reactions, nuclear power station, Nuclear waste disposal, Site selection of nuclear power plants. Hydro electric station: Hydrology, Principles of working, applications, site selection, classification and arrangements, hydro-electric plants, run off size of plant and choice of units, operation and maintenance, hydro systems, interconnected systems. Non Conventional Power Plants: Introduction to non-conventional power plants (Solar, wind, geothermal, tidal) etc.	10	
5	Electrical system: Generators and their cooling, transformers and their cooling. Instrumentation Purpose, classification, selection and application, recorders and their use, listing of various control rooms. Pollution due to power generation and its remedy	06	

Text books:

1. Power Plant Engineering, P.K. Nag, McGraw Hill.
2. Power Plant Engineering, F.T. Morse, Affiliated East-West Press Pvt. Ltd.
3. Power Plant Technology El-Vakil, McGraw Hill.

Reference books

1. Steam & Gas Turbines & Power Plant Engineering by R.Yadav, Central Pub.House.
2. An introduction to thermal power plant engineering and operation, P.K.Das and A.K.Das, Notion press.

Course Outcome:

After completion of this course, the learners will be able to

1. explain the principle of operational of Steam, Hydroelectric, Diesel, Gas turbine, Nuclear power and non-conventional power plant.
2. identify the cause of pollution for power generation and its remedy.
3. suggest location to set up Steam, Hydroelectric, Diesel, Gas turbine and Nuclear power plant.
4. compare Steam, Hydroelectric, Diesel, Gas turbine, Nuclear power and non-conventional power plant.
5. suggest methods of maintenance of Steam, Gas and Hydroelectric power plants
6. solve numerical problems of load estimation and economics of power plants.

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Elective-I

Name of the course		RENEWABLE & NON CONVENTIONAL ENERGY	
Course Code: PE-EE-501C		Semester: 5 th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester Exam: 15 Marks	
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks	
Practical: hrs./week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the difference between Renewable and non-renewable energy sources		
2.	To understand methods of conversion of solar energy and wind energy to other form of energy.		
3.	To understand methods harnessing energy from Biomass, Geothermal and ocean		
4.	To understand the principle of operation of Magneto Hydrodynamic power generation:		
5.	To understand the principle and operation of fuel cell.		
6.	To solve numerical problems of Renewable and non-renewable energy sources		
Pre-Requisite			
1.	Electric Circuit Theory (PC-EE-301)		
2.	Electromagnetic field theory (PC-EE-303)		
3.	Electric Machine-I (PC-EE-401)		
4.	Electrical and Electronics measurement (PC-EE-403)		
Unit	Content	Hrs	Marks
1	Introduction to Energy sources: Renewable and non-renewable energy sources, energy consumption as a measure of Nation's development; strategy for meeting the future energy requirements Global and National scenarios, Prospects of renewable energy sources. Impact of renewable energy generation on environment, Kyoto Protocol.	03	
2	Solar Energy: Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond, solar water heaters, solar distillation, solar still, solar cooker, solar heating & cooling of buildings, photo voltaic - solar cells, different types of PV Cells, Mono-poly Crystalline and amorphous Silicon solar cells. Design of PV array. Efficiency and cost of PV systems & its applications. PV hybrid systems	08	
3	Wind Energy: Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations	05	
	Energy from Biomass:		

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4	Biomass conversion technologies, Biogas generation plants, classification, advantages and disadvantages, constructional details, site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas	05	
5	Geothermal Energy: Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dryrock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.	05	
6	Energy from Ocean: Ocean Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India. Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy. Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy.	05	
7	Magneto Hydrodynamic power generation: Principle of MHD power generation, MHD system, Design problems and developments, gas conductivity, materials for MHD generators and future prospects.	05	
8	Hydrogen Energy: Introduction, Hydrogen Production methods, Hydrogen storage, hydrogen transportation, utilization of hydrogen gas, hydrogen as alternative fuel for vehicles.	03	
9	Fuel cell: Introduction, Design principle and operation of fuel cell, Types of fuel cells, conversion efficiency of fuel cell, application of fuel cells	03	

Text books:

1. Renewable energy sources and conversion technology, Bansal Keemann, Meliss, Tata Mc Graw Hill.
2. Renewable energy resources and emerging technologies, D.P. Kothari, PHI.
3. Non-conventional Energy sources, G.D. Rai, Khanna Publishers.

Reference books

1. Non-conventional Energy, Ashok V. Desai, New Age International Publishers Ltd.

Course Outcome:

After completion of this course, the learners will be able to

1. explain the principle of conversion of solar energy, wind energy, biomass, Geothermal energy, Ocean energy and Hydrogen energy to other form of energy.
2. explain the principle of operation of magneto hydrodynamic power generation:
3. use Solar energy, Wind energy, Biomass, Geothermal energy, Ocean energy, Hydrogen energy and fuel cell for different applications.
4. suggest location to set up wind mill and biogas generation plant
5. estimate conversion efficiency of fuel cell.

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6. solve numerical problems relating to conversion of Solar energy, Wind energy , Biomass, Ocean energy and Hydrogen energy to heat and electric energy.

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Semester-VI

Name of the course		POWER SYSTEM-II	
Course Code: PC-EE-601		Semester: 6 th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks	
Credit Points: 3		Attendance: 05 Marks	
		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the method of representation of power system components		
2.	To know about location and components of a distribution substation.		
3.	To understand different methods of load flow studies.		
4.	To determine faults in Electrical systems.		
5.	To understand the principle of power system stability.		
6.	To understand the principle of relays and methods of protection of power system		
7.	To solve numerical problems on the topics studied.		
Pre-Requisite			
1.	Electric Circuit Theory (PC-EE-301)		
2.	Electromagnetic field theory (PC-EE-303)		
3.	Power system-I (PC-EE-502)		
Unit	Content	Hrs	Marks
1	Representation of Power system components: Single-phase representation of balanced three phase networks, the one-line diagram and the impedance or reactance diagram, per unit (PU) system.	02	
2	Distribution substation: Types of substations, location of substations, substation equipments and accessories, earthing (system & equipment), feeder and distributors, radial and loop systems.	05	
3	Load flow studies: Network model formulation, formation of Ybus, load flow problem, Gauss-Siedel method, Newton-Raphson method, Decoupled load flow studies, comparison of load flow methods.	05	
4	Faults in Electrical systems: Transient on a transmission line, short circuit of a synchronous machine under no load & loaded condition. Symmetrical component transformation, sequence impedance and sequence network of power system, synchronous machine, transmission lines and transformers. Symmetrical component analysis of unsymmetrical faults, single line-to –ground fault, line-to-line fault, double line-to- ground fault	08	
	Power system stability: Steady state stability, transient stability,		

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5	equal area criteria, swing equation, multi machine stability concept	04	
6	<p>Power system protection: Protective zones, Relaying elements and quantities. Protective relays, basic requirements and type of protection, phase and amplitude comparator, grading (time & current), classification of Electromagnetic relays, Directional relay, Distant relay, Differential relay, basic aspects of static and digital relays, relay protection scheme for transformer, feeder, generators and motors.</p> <p>Circuit breakers, circuit breaking transients, transient recovery voltage, current chopping and resistance switching, circuit breaker rating, arc and arc extinction, circuit breaker types, oil circuit breaker, vacuum circuit breaker, air blast circuit breaker, SF6 circuit breaker and operating mechanism, advantages and disadvantages of different types</p>	12	

Text book:

1. Modern Power System Analysis, D.P. Kothari & I.J. Nagrath, 4th Edition, Tata McGraw Hill.
2. Electrical Power Systems, Subir Ray, PHI
3. Switchgear protection and power systems, Sunil S Rao, Khanna Publications.
4. A text book on Power System Engineering, M.L.Soni, P.V.Gupta, U.S. Bhatnagar & A. Chakrabarti, Dhanpat Rai & CO.

Reference Books:

1. Protection & Switchgear, B. Bhalja, R.P. Maheshwari, N.G.Chothani, Oxford.
2. Power system protection & switchgear, B.Ram & D.N. Vishwakarma, Tata McGraw Hill.
3. Handbook of Electrical Power Distribution, G. Ramamurthy, University Press
4. Electric Power Transmission and Distribution, S. Sivanagaraju, S.Satyanarayana, Pearson Education.
5. Power Systems Stability, Vol. I,II & II, E.W. Kimbark, Wiley.
6. Power Engineering, D.P Kothari & I.J. Nagrath, Tata McGraw Hill.
7. Power Systems Analysis, A. R. Bergen & V. Vittal, Pearson Education.
8. Computer Aided Power systems analysis, Dr. G. Kusic, CEC press.

Course Outcome:

After completion of this course, the learners will be able to

1. Represent power system components in line diagrams.
2. Determine the location of distribution substation.
3. Determine the performance of power system with the help of load flow studies.
4. Analyse faults in Electrical systems.
5. Determine the stability of Power system.
6. Explain principle of operation of different power system protection equipments.
7. Solve numerical problems related to representation, load flow, faults, stability and protection of power system.

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		MICROPROCESSOR & MICRO CONTROLLER	
Course Code: PC-EE-602		Semester: 6th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks	
Credit Points: 3		Attendance: 05 Marks	
		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the architecture of 8086 microprocessor.		
2.	To understand the design aspects of I/O and Memory Interfacing circuits.		
3.	To interface microprocessors with supporting chips.		
4.	To understand the architecture of 8051 microcontroller.		
5.	To design a microcontroller based system		
Pre-Requisite			
1.	Analog Electronics (PC-EE-302)		
2.	Digital Electronics (PC-EE-402)		
Unit	Content	Hrs	Marks
1	The 8086 Microprocessor: Introduction to 8086- Microprocessor architecture – Addressing modes – Instruction set and assembler directives – Assembly language programming – Modular Programming – Linking and Relocation – Stacks – Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.	08	
2	8086 System bus structure: 8086 signals – Basic configurations – System bus timing –System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.	08	
3	I/O INTERFACING: Memory Interfacing and I/O interfacing – Parallel communication interface – Serial communication interface – D/A and A/D Interface – Timer – Keyboard /display controller – Interrupt controller –DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.	08	
4	Microcontroller: Architecture of 8051 – Special Function Registers(SFRs) – I/O Pins Ports and Circuits – Instruction set – Addressing modes – Assembly language programming.	08	
5	Interfacing Microcontroller: Programming 8051 Timers – Serial Port Programming – Interrupts Programming – LCD & Keyboard Interfacing – ADC, DAC & Sensor Interfacing – External Memory Interface- Stepper Motor and Waveform generation – Comparison	06	

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	of Microprocessor, Microcontroller, PIC and ARM processors		
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Text books:

1. Advanced Microprocessors and Peripheral, Koshor M Bhurchandi, Ajay Kumar Ray, 3rd Edition, MC Graw hill education.
2. Microprocessor & Interfacing, D.V. Hall, Mc Graw Hill.
3. The 8051 microcontroller, Ayala, Thomson.

Ref erence books:

1. Advanced Microprocessors, Y. Rajasree, New Age international Publishers.
2. An introduction to the Intel family of Microprocessors, James L. Antonakos, Pearson Education,
3. The 8051 Microcontroller and Embedded systems, Muhammad Ali Mazidi & J. G. Mazidi, Pearson Education.
4. The 8086 Microprocessors: Programming & Interfacing the PC, K.J.Ayala, Thomson.
5. Microprocessor & Peripherals, S.P. Chowdhury & S. Chowdhury, Scitech.
6. Microchip technology data sheet, www.microchip.comerence books

Course Outcome:

After completion of this course, the learners will be able to

1. explain the architecture of 8086 and 8051.
2. do assembly language programming of 8086, 8051
3. interface different peripheral with 8086 and 8051
4. develop micro processor/ microcontroller based systems.
5. compare microprocessor, microcontroller, PIC and ARM processors

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		DIGITAL CONTROL SYSTEM	
Course Code: PE-EE-601A		Semester: 6th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks	
Credit Points: 3		Attendance: 05 Marks	
		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the principle of sampling and reconstruction of signals.		
2.	To find Z-traform and inverse Z-transform of systems.		
3.	To carry out the analysis and design of digital control systems		
4.	To design compensators for digital control system to achieve desired specifications.		
5.	To represent digital control systems using state space models.		
6.	To analyze the effect sampling on stability, controllability and observability.		
7.	To design digital controllers for industrial applications.		
8.	To solve numerical problems on the topics studied.		
Pre-Requisite			
1.	Control system (PC-EE-503)		
Unit	Content	Hrs	Marks
1	Sampling and reconstruction: Introduction, Examples of Data control systems – Digital to Analog conversion and Analog to Digital conversion, sample and hold operations.	03	
2	Z-transform: Introduction, Linear difference equations, pulse response, Z – transforms, Theorems of Z – Transforms, the inverse Z – transforms, Modified Z- Transforms	05	
3	Z- Plane analysis of discrete-time control system: Z-Transform method for solving difference equations; Pulse transforms function, block diagram analysis of sampled – data systems, mapping between s-plane and z-plane.	05	
4	State space analysis: State Space Representation of discrete time systems, Pulse Transfer Function Matrix solving discrete time state space equations, State transition matrix and it's Properties, Methods for Computation of State Transition Matrix, Discretization of continuous time state – space equations.	06	
5	Controllability and observability: Concepts of Controllability and Observability, Tests for controllability and Observability. Duality between Controllability and Observability, Controllability and Observability conditions for Pulse Transfer Function	04	
6	Stabilty analysis: Mapping between the S-Plane and the Z-Plane – Primary strips and Complementary Strips – Constant frequency loci, Constant damping ratio loci, Stability Analysis of	05	

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	closed loop systems in the Z-Plane. Jury stability test – Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion.		
7.	Design of discrete time control system by conventional methods: Transient and steady – State response Analysis – Design based on the frequency response method – Bilinear Transformation and Design procedure in the w-plane, Lead, Lag and Lead-Lag compensators and digital PID controllers.	06	
8.	State feedback controllers and observers: Design of state feedback controller through pole placement – Necessary and sufficient conditions, Ackerman's formula. State Observers – Full order and Reduced order observers.	05	

Text book:

1. Digital Control and State Variable Methods , M. Gopal, TMH Publishers
2. Discrete-time Control Systems, K. Ogata, Pearson Education,
3. Digital Control Systems, B.C. Kuo, Wiley Publications.
4. Control System Engineering, I.J. Nagrath, M. Gopal, New age International.

Reference books

1. Digital control of dynamic systems, Gene F. Franklin, J. David Powell, and Michael Workman 3rd ed, 1998, Addison-Wesley.
2. Digital Control Systems, design, identification and implementation, Landau, Ioan Doré, Zito, Gianluca, Springer-Verlag London.

Course Outcome:

After completion of this course, the learners will be able to

1. explain the principle of sampling and reconstruction of analog signal.
2. perform Z-transformation and inverse Z-transformation of systems.
3. analyse and design digital control systems.
4. design compensators for digital control system to achieve desired specifications.
5. represent digital control systems using state space models.
6. analyze the effect sampling on stability, controllability and observability.

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		HVDC TRANSMISSION	
Course Code: PE-EE-601B		Semester: 6th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks	
Practical: hrs/week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the basics of DC power transmssion system		
2.	To analyse HVDC converters.		
3.	To understand methods of control of HVDC system		
4.	To understand causes of fault and protection against fault of converters.		
5.	To understand function of smooting reactor and transient over voltage of DC line		
6.	To understand methods of reactive power control.		
7.	To solve numerical problems on the topics studied.		
Pre-Requisite			
1.	Electric Circuit Theory (PC-EE-301)		
2.	Power system-1 (PC-EE-502)		
3.	Control system (PC-EE-503)		
4.	Power Electronics (PC-EE-504)		
Unit	Content	Hrs	Marks
1	DC power transmission technology: Introduction, Comparison of HVAC and HVDC transmission system, Applications of DC transmission, Description of DC transmission system, Configurations, Modern trends in DC transmission.	04	
2	Analysis of HVDC converters: Pulse number, Choice of converter configuration, Simplified analysis of Graetz circuit, Converter bridge characteristics, Characteristics of a twelve-pulse converter, Detailed analysis of converters with and without overlap	06	
3	Converter and HVDC system control: General, Principles of DC link control, Converter control characteristics, System control hierarchy, Firing angle control, Current and extinction angle control, Starting and stopping of DC link, Power control, Higher level controllers.	06	
4	Converter faults and protection: Converter faults, Protection against over-currents, Overvoltages in a converter station, Surge arresters, Protection against over-voltages.	05	
5	Smoothing reactor and DC line: Introduction, Smoothing reactors, DC line, Transient over voltages in DC line, Protection of DC line, DC breakers, Monopolar operation, Effects of proximity of AC and DC transmission lines.	06	
6	Reactive power control: Reactive power requirements in steady state, Sources of reactive power, Static VAR systems, Reactive	06	

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	power control during transients, Harmonics and filters, Generation of harmonics, Design of AC filters and DC filters.		
7.	Component models for the analysis of ac/dc systems: General, Converter model, Converter control, Modelling of DC network, Modelling of AC networks. Power flow analysis in AC/DC systems: General, Modelling of DC links, Solution of DC load flow, Discussion, Per unit system for DC quantities.	06	

Text book:

1. HVDC Power transmission systems , K.R. Padiyar , Third Edition, New Age International Publishers

Reference books

1. Power Transmission by Direct Current, Erich Uhlmann, Fourth Indian Reprint, Springer International Edition, 2012.
2. HVDC Transmission, S Kamakshaiah, V Kamaraju , 2nd Edition, Mcgraw Hill Education, 2020.
3. Direct Current Transmission, E.W.Kimbark, Wiley–Blackwell; Volume 1 edition (1 January 1971)
4. H.V.D.C Transmission , J Arrillaga , 1st Edition, The Institution of Engineering and Technology, 1998

Course Outcome:

After completion of this course, the learners will be able to

1. choose intelligently AC and DC transmission systems for the dedicated application(s).
2. identify the suitable two-level/multilevel configuration for high power converters.
3. select the suitable protection method for various converter faults.
4. identify suitable reactive power compensation method.
5. decide the configuration for harmonic mitigation on both AC and DC sides..
6. solve numerical problems related to converters, power flow analysis, reactive power control.

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		ELECTRICAL MACHINE DESIGN	
Course Code: PE-EE-601C		Semester: 6th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Credit Points: 3		Attendance: 05 Marks	
		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the basic principle of design of Electric machines.		
2.	To understand basics of design of Transformer, Induction machine and Synchronous machines.		
3.	To understand different factors that influence design of Electric machines.		
4.	To understand the need and use software tools for design of Electric machines		
5.	To solve numerical problems on the topics studied		
Pre-Requisite			
1.	Electric Machine-I (PC-EE-401)		
2.	Electric Machine-II (PC-EE-501)		
Unit	Content	Hrs	Marks
1	Introduction: Major considerations in Electrical Machine Design - Electrical Engineering Materials – Space factor – Choice of Specific Electrical and Magnetic loadings - Thermal considerations - Heat flow – Temperature rise and Insulating Materials - Rating of machines – Standard specifications.	04	
2	Transformer: Output Equations – Main Dimensions - kVA output for single and three phase transformers – Window space factor – Design of core and winding – Overall dimensions – Operating characteristics – No load current – Temperature rise in Transformers – Design of Tank - Methods of cooling of Transformers.	10	
3	Induction motors: Output equation of Induction motor – Main dimensions – Choice of Average flux density – Length of air gap- Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars & slots – Design of end rings – Design of wound rotor – Magnetic leakage calculations – Leakage reactance of polyphase machines- Magnetizing current - Short circuit current – Operating characteristics- Losses and Efficiency.	10	
4	Synchronous machines: Output equations – choice of Electrical and Magnetic Loading – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field mmf – Design of field winding – Design of turbo alternators – Rotor design.	10	
	Computer aided Design (CAD): Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid	05	

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	methods, design optimization methods, variables, constraints and objective function, problem formulation.		
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Text book:

1. A Course in Electrical Machine Design, A.K. Sawhney, Dhanpat rai and sons.
2. Electrical machine design, V. rajini, V.S. Nagarajan, Pearson India education services Pvt. Ltd.
3. Computer Aided Design of Electrical Machine, K. M. V. Murthy, B.S. Publications.

Reference books

1. Design and Testing of Electrical Machines, M.V.Deshpande, PHI
2. Principles of Electrical Machine Design, 3rd Edition, S.K. sen, Oxf-Ibh
3. Computer Aided Design of Electrical Equipment, M. Ramamoorthy, East-West Press.

Course Outcome:

After completion of this course, the learners will be able to

1. specify the rating of electrical machines with standard specifications.
2. explain the principles of electrical machine design and carry out basic design of an ac machine
3. determine the various factors which influence the design of electrical, magnetic and thermal loading of electrical machines
4. explain the construction and performance characteristics of electrical machines.
5. use software tools to do design calculations.

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		ELECTRICAL AND HYBRID VEHICLE	
Course Code: PE-EE-602A		Semester: 6th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Credit Points: 3		Attendance: 05 Marks	
		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the basic difference between conventional and Hybrid vehicles.		
2.	To understand different configuration and control of Electric drives.		
3.	To understand energy storage system in Hybrid vehicles.		
4.	To understand different energy management strategies of Hybrid vehicles.		
5.	To solve numerical problems on the topics studied		
Pre-Requisite			
1.	Electric Machine-I (PC-EE-401)		
2.	Electric Machine-II (PC-EE-501)		
Unit	Content	Hrs	Marks
1	Introduction: Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance. Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.	09	
2	Electric Trains: Electric Drive-trains: Basic concept of electric traction, introduction to various electric drivetrain topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.	10	
3	Energy Storage: Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching	09	

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	the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems		
4	Energy Management Strategies: Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.	06	
5	Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).	05	

Text book:

1. Electric and Hybrid Vehicles: Design Fundamentals, Iqbal Hussein, CRC Press.
2. Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, C. Mi, M. A. Masrur and D. W. Gao, John Wiley & Sons, .
3. Hybrid Electric Vehicles: Energy Management Strategies, Onori Simona, Serrao Lorenzo and Rizzoni Giorgio, Springer.
4. Electric and Hybrid Vehicles, T. Denton, Routledge.

Reference books

1. Electric Vehicle Technology Explained, James Larminie, John Lowry, Wiley.
2. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi CRC Press, 2004.

Course Outcome:

After completion of this course, the learners will be able to

1. explain the principle of Electric traction.
2. choose a suitable drive scheme for developing an electric hybrid vehicle depending on resources.
3. design and develop basic schemes of electric vehicles and hybrid electric vehicles.
4. choose proper energy storage systems for vehicle applications
5. implement different energy management strategies for hybrid vehicle.

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		POWER QUALITY AND FACTS	
Course Code: PE-EE-602B		Semester: 6th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Credit Points: 3		Attendance: 05 Marks	
		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the characteristics of ac transmission and the effect of shunt and series reactive compensation.		
2.	To understand the working principles of FACTS devices and their operating characteristics.		
3.	To understand the basic concepts of power quality.		
4.	To understand the working principles of devices to improve power quality.		
5.	To solve numerical problems on the topics studied		
Pre-Requisite			
1.	Power system-I (PC-EE-502)		
2.	Control system (PC-EE-503)		
3.	Power Electronics (PC-EE-504)		
Unit	Content	Hrs	Marks
1	Transmission Lines and Series/Shunt Reactive Power Compensation: Basics of AC Transmission. Analysis of uncompensated AC transmission lines. Passive Reactive Power Compensation. Shunt and series compensation at the mid-point of an AC line. Comparison of Series and Shunt Compensation.	04	
2	Thyristor-based Flexible AC Transmission Controllers (FACTS): Description and Characteristics of Thyristor-based FACTS devices: Static VAR Compensator (SVC), Thyristor Controlled Series Capacitor (TCSC), Thyristor Controlled Braking Resistor and Single Pole Single Throw (SPST) Switch. Configurations/Modes of Operation, Harmonics and control of SVC and TCSC. Fault Current Limiter.	06	
3	Voltage Source Converter based (FACTS) controllers: Voltage Source Converters (VSC): Six Pulse VSC, Multi-pulse and Multi-level Converters, Pulse-Width Modulation for VSCs. Selective Harmonic Elimination, Sinusoidal PWM and Space Vector Modulation. STATCOM: Principle of Operation, Reactive Power Control: Type I and Type II controllers, Static Synchronous Series Compensator (SSSC) and Unified Power Flow Controller (UPFC): Principle of Operation and Control. Working principle of Interphase Power Flow Controller. Other Devices: GTO Controlled Series Compensator. Fault Current Limiter.	08	
	Application of FACTS : Application of FACTS devices for power-flow control and stability improvement. Simulation example of power		

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4	swing damping in a single-machine infinite bus system using a TCSC. Simulation example of voltage regulation of transmission mid-point voltage using a STATCOM.	04	
5	Power Quality Problems in Distribution Systems : Power Quality problems in distribution systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, Wave-form Distortions: harmonics, noise, notching, dc-offsets, fluctuations. Flicker and its measurement. Tolerance of Equipment: CBEMA curve.	04	
6.	DSTATCOM : Reactive Power Compensation, Harmonics and Unbalance mitigation in Distribution Systems using DSTATCOM and Shunt Active Filters. Synchronous Reference Frame Extraction of Reference Currents. Current Control Techniques for DSTATCOM.	06	
7.	Dynamic Voltage Restorer and Unified Power Quality Conditioner : Voltage Sag/Swell mitigation: Dynamic Voltage Restorer – Working Principle and Control Strategies. Series Active Filtering. Unified Power Quality Conditioner (UPQC): Working Principle. Capabilities and Control Strategies.	06	

Text book:

1. FACTS Controllers in Power Transmission and Distribution, N K. R. Padiyar, New Age International (P) Ltd. 2007.

Reference books

1. Understanding FACTS: Concepts and Technology of FACTS Systems, N. G. Hingorani and L. Gyugyi Wiley-IEEE Press, 1999.
2. Reactive Power Control in Electric Systems, T. J. E. Miller, John Wiley and Sons, New York, 1983.
3. Electrical Power Systems Quality”, R. C. Dugan, McGraw Hill Education, 2012.
4. Electric Power Quality, G. T. Heydt, Stars in a Circle Publications, 1991

Course Outcome:

After completion of this course, the learners will be able to

1. analyse uncompensated AC transmission line.
2. explain the working principles of FACTS devices and their operating characteristics.
3. apply FACTS devices for power flow control and stability.
4. identify different issues of power quality in distribution system.
5. apply different compensation and control techniques for DSTATCOM
6. explain working principle of dynamic voltage restorer and UPQC

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		INDUSTRIAL ELECTRICAL SYSTEMS	
Course Code: PE-EE-602C		Semester: 6th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Credit Points: 3		Attendance: 05 Marks	
		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the electrical wiring systems with standard symbols , drawings and SLD for residential, commercial and industrial consumers		
2.	To understand various components of industrial electrical systems		
3.	To analyze and selec tthe proper size of various electrical system components		
4.	To understand methods of automation of Industrial Electrical Systems		
5.	To solve numerical problems on the topics studied		
Pre-Requisite			
1.	Power system-I (PC-EE-502)		
2.	Control system (PC-EE-503)		
3.	Power Electronics (PC-EE-504)		
Unit	Content	Hrs	Marks
1	Electrical System Components: LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices	06	
2	Residential and Commercial Electrical Systems : Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.	08	
3	Illumination Systems : Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.	06	
4	Industrial Electrical Systems I: HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR	06	

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	calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.		
5	Industrial Electrical Systems II: DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.	06	
6.	Industrial Electrical System Automation: Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.	06	

Text book:

1. Electrical Wiring, Estimating & Costing, S. L. Uppal and G. C. Garg, Khanna publishers, 2008.
2. Electrical Design, Estimating & Costing, K. B. Raina, New age International, 2007.

Reference books

1. Electrical estimating and costing, S. Singh and R. D. Singh, Dhanpat Rai and Co., 1997.
2. Web site for IS Standards.
3. Residential Commercial and Industrial Systems, H. Joshi, McGraw Hill Education, 2008.

Course Outcome:

After completion of this course, the learners will be able to

1. Represent electrical wiring system for residential, commercial and industrial consumers.
2. Determine the rating of components of residential and commercial electrical systems.
3. Design lighting scheme for a residential and commercial premises.
4. Select transformer, switchgear, protection equipments for industrial electrical systems.
5. explain methods of automation of Industrial Electrical Systems
6. Solve numerical problems related to earthing system, lighting scheme, power factor correction.

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		DIGITAL SIGNAL PROCESSING	
Course Code: OE-EE-601A		Semester: 6th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Credit Points: 3		Attendance: 05 Marks	
		End Semester Exam: 70 Marks	
Objective:			
1.	To understand sampling and reconstruction of signal		
2.	To understand the method of Z-transform and inverse Z- transform of signal and its properties		
3.	To understand Discrete Fourier Transform		
4.	To understand methods of design of Digital filters		
5.	To understand applications of Digital signal processing		
6.	To solve numerical problems on the topics studied		
Pre-Requisite			
1.	Electric circuit theory (PC-EE-301)		
2.	Control system (PC-EE-503)		
Unit	Content	Hrs	Marks
1	Discrete-time signals and systems: Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.	06	
2	Z-transform: z-Transform, Region of convergence, Analysis of Linear Shift Invariant systems using z-transform, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z- transforms.	06	
3	Discrete Fourier Transform : Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform Algorithm, Parseval’s Identity, Implementation of Discrete Time Systems.	08	
4	Design of Digital filters: Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Bandstop and High-pass filters. Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multi-rate signal processing	12	
5	Applications of Digital Signal Processing: Correlation Functions and Power Spectra, Stationary Processes, Optimal	06	

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	filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter.		
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Text book:

1. Digital Signal Processing-A computer based approach, S. Mitra, TMH
2. Digital Signal Processing: Principles, Algorithms & Application, J.C. Proakis & M.G. Manslakis, PHI
3. Fundamental of Digital Signal Processing using MATLAB , Robert J. Schilling, S.L. Harris, Cengage Learning.

Reference books

1. Digital Signal Processing-implementation using DSP microprocessors with examples from TMS320C54XX, Avtar Singh & S. Srinivasan, Cengage Learning
2. Digital Signal Processing, Chen, OUP
3. Digital Signal Processing, Johnson, PHI
4. Digital Signal Processing using MATLAB, Ingle, Vikas.
5. Digital Signal Processing, Ifeachor, Pearson Education.
6. Digital Signal Processing, A.V. Oppenheim & R.W. Shaffer, PHI
7. Theory and application of Digital Signal Processing, L.R. Rabiner & B. Gold, PHI
8. Digital Signal Processing, Ashok Ambarder, Cengage Learning.
9. Digital Signal Processing, S. Salivahanan, A. Vallavaris & C. Gnanpruja, TMH.
10. Xilinx FPGA user manual and application notes.

Course Outcome:

After completion of this course, the learners will be able to

1. represent signals mathematically in continuous and discrete-time and in the frequency domain.
2. analyse discrete-time systems using z-transform.
3. explain the Discrete-Fourier Transform (DFT) and the FFT algorithms.
4. design digital filters for various applications.
5. apply digital signal processing for the analysis of real-life signals.

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		COMMUNICATION ENGINEERING	
Course Code: OE-EE-601B		Semester: 6th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Credit Points: 3		Attendance: 05 Marks	
		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the AM, FM and PM schemes with reference to SNR		
2.	To understand the performance of ASK, FSK, PSK, BPSK, QPSK in a digital communication system		
3.	To understand the source coding and channel coding schemes for a given communication link		
4.	To understand the band width requirement and probability of error in various digital modulation systems		
5.	To understand various digital modulation methods		
6.	To solve numerical problems on the topics studied		
Pre-Requisite			
1.	Analog Electronics (PC-EE 302)		
2.	Digital Electronics (PC-EE 402)		
Unit	Content	Hrs	Marks
1	Elements of communication system: The elements of a communication system, origin of noise and its effect, importance of SNR in system design. Basic principle of linear (AM) modulation, Generation of AM waves, Demodulation of AM wave. Basic principle of nonlinear (FM, PM) modulation. Generation of FM waves. Demodulation of FM waves. Sampling theorem, sampling rate, impulse sampling, reconstruction from samples, Aliasing. Analog pulse modulation-PAM (natural & flat topped sampling), PWM, PPM. Basic concept of Pulse code modulation, Block diagram of PCM, Multiplexing-TDM, FDM.	12	
2	Digital transmission: Concept of Quantization & Quantization error, Uniform quantizer, Non-uniform quantizer, A-law and μ -law. Encoding, coding efficiency. Line coding & properties, NRZ & RZ, AMI, Manchester coding, PCM, DPCM. Base band pulse transmission, Matched filter, error rate due to noise, ISI, Raised cosine function, Nyquist criterion for distortion-less base band binary transmission, Eye pattern, Signal power in binary digital signal.	08	
3	Digital carrier modulation & demodulation technique: Bit rate, Baud rate, Information capacity, Shanon's limit, M-ary encoding, Introduction to the different digital modulation techniques-ASK.FSK, PSK, BPSK, QPSK, mention of 8 BPSK, 16 BPSK.	10	

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	Introduction to QAM, basic of 8 QAM, 16 QAM. Basic concept of Delta modulating, Adaptive delta modulation. Introduction to the concept DPCM. Basic concept of spread spectrum modulation.		
4	Introduction to coding theory: Introduction, News value & Information content, Entropy, Mutual information, Information rate, Shanon-Fano algorithm for encoding, Shanon's theorem-source coding theorem, Channel coding theorem, Information capacity theorem. Basic principle of Error control & coding.	08	

Text book:

1. An Introduction to Analog and Digital communication, Simon Haykin, Wiely India.
2. Analog communication system, P. Chakrabarti, Dhanpat Rai & Co.
3. Principle of digital communication, P. Chakrabarti, Dhanpat Rai & Co.
4. Modern Digital and Analog Communication systems, B.P. Lathi, Oxford university press

Reference books

1. Digital and Analog communication Systems, Leon W Couch II, Pearson Education Asia.
2. Communication Systems, A.B. Calson, Mc Graw Hill.

Course Outcome:

After completion of this course, the learners will be able to

1. compare the performance of AM, FM and PM schemes with reference to SNR
2. explain noise as a random process and its effect on communication receivers
3. evaluate the performance of ASK, FSK, PSK, BPSK, QPSK in a digital communication system
4. identify source coding and channel coding schemes for a given communication link
5. analyze various digital modulation methods
6. compute band width requirement and probability of error in various digital modulation systems

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		VLSI AND MICRO ELECTRONICS	
Course Code: OE-EE-601C		Semester: 6th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Credit Points: 3		Attendance: 05 Marks	
		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the concept of VLSI design		
2.	To understand the basics of MOS structure		
3.	To understand the process of VLSI fabrication		
4.	To understand the principle of logic circuit design with hardware description language		
Pre-Requisite			
1.	Analog Electronics (PC-EE 302)		
2.	Digital Electronics (PC-EE 402)		
Unit	Content	Hrs	Marks
1	Introduction to VLSI Design: VLSI Design Concepts, Moor's Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI – basic idea only), Types of VLSI Chips (Analog & Digital VLSI chips, General purpose, ASIC, PLA, FPGA), Design principles (Digital VLSI – Concept of Regularity, Granularity etc), Design Domains (Behavioral, Structural, Physical), Y-Chart, Digital VLSI Design Steps.	08	
2	MOS structure: E-MOS & D-MOS, Charge inversion in E-MOS, Threshold voltage, Flat band voltage, Potential balance & Charge balance, Inversion, MOS capacitances. Three Terminal MOS Structure: Body effect Four Terminal MOS Transistor: Drain current, I-V characteristics. Current-voltage equations (simple derivation) Scaling in MOSFET: Short Channel Effects, General scaling, Constant Voltage & Field scaling CMOS: CMOS inverter, Simple Combinational Gates - NAND gate and NOR Gate using CMOS.	12	
3	Micro-electronic Processes for VLSI Fabrication: Silicon Semiconductor Technology- An Overview, Wafer processing, Oxidation, Epitaxial deposition, Ion-implantation & Diffusion, Cleaning, Etching, Photo-lithography – Positive & Negative photo-resist. Basic CMOS Technology – (Steps in fabricating CMOS), Basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator Layout Design Rule: Stick diagram with examples, Layout rules.	10	

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4	Hardware Description Language – VHDL or Verilog Combinational & Sequential Logic circuit Design.	08	
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Text book:

1. Digital Integrated Circuit, J.M.Rabaey, Chandrasan, Nicolic, Pearson Education.
2. CMOS Digital Integrated Circuit, S.M.Kang & Y.Leblebici, TMH.
3. Modern VLSI Design, Wayne Wolf, Pearson Education.
4. VHDL, Bhaskar, PHI.
5. Advance Digital Design Using Verilog , Michel D. Celliti, PHI

Reference books

1. Digital Integrated Circuits, Demassa & Ciccone, John Willey & Sons .
2. Modern VLSI Design: system on silicon, Wayne Wolf; Addison Wesley Longman Publisher
3. Basic VLSI Design, Douglas A. Pucknell & Kamran Eshranghian, PHI
4. CMOS Circuit Design, Layout & Simulation, R.J.Baker, H.W.Lee, D.E. Boyee, PHI

Course Outcome:

After completion of this course, the learners will be able to

1. explain the principle of design of VLSI circuits
2. explain different MOS structure with characteristics
3. apply different processes for VLSI fabrication
4. use programming language for the design of logic circuits
5. draw the stick diagram and layout for simple MOS circuits

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		ECONOMICS FOR ENGINEERS	
Course Code: HM-EE-601		Semester: 6th	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Credit Points: 3		Attendance: 05 Marks	
		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the process of economic decision making		
2.	To understand th basic financial management aspects		
3.	To develop the skills to analyze financial statements		
4.	To understand the basic of accounting		
Pre-Requisite			
1.	Basic understanding of Engineering processes		
Unit	Content	Hrs	Marks
1	Economic Decisions Making – Overview, Problems, Role, Decision making process. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - PerUnit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits.	06	
2	Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value Of Money, Debt repayment, Nominal & Effective Interest. Present Worth Analysis : End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives. Cash Flow & Rate Of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate Of Return, Calculating Rate Of Return, Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity And Breakeven Analysis. Economic Analysis In The Public Sector - Quantifying And Valuing Benefits & drawbacks.	10	
3	Uncertainty In Future Events - Estimates And Their Use In Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation	10	

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	Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances.		
4	Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life Of A New Asset, Marginal Cost, Minimum Cost Life Problems. Inflation And Price Change – Definition, Effects, Causes, Price Change With Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates.	08	
5	Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.	06	

Text book:

1. Engineering Economics, James L.Riggs, David D. Bedworth, Sabah U. Randhawa 4e , McGraw-Hill Education.
2. Engineering Economics Analysis, Donald Newnan, Ted Eschembach, Jerome Lavelle , OUP
3. Principle of Engineering Economic Analysis, John A. White, Kenneth E.Case,David B.Pratt , Wiley

Reference books

1. Engineering Economy, Sullivan and Wicks, Koelling, Pearson
2. Engineering Economics, R.Paneer Seelvan, PHI
3. Engineering Economics Analysis, Michael R Lindeburg, ,Professional Pub

Course Outcome:

After completion of this course, the learners will be able to

1. evaluate the economic theories, cost concepts and pricing policies
2. explain the market structures and integration concepts
3. apply the concepts of financial management for project appraisal
4. explain accounting systems , the impact of inflation, taxation, depreciation
5. analyze financial statements using ratio analysis
6. explain financial planning, economic basis for replacement, project scheduling, legal and regulatory issues applied to economic investment and project-management problems

Special Remarks (if any)

The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course		POWER SYSTEM-II LABORATORY
Course Code: PC-EE 691		Semester: 6th
Duration: 6 months		Maximum marks:100
Teaching Scheme		Examination scheme:
Theory: 0 hr/week		Continuous Internal Assessment:40
Tutorial: 0 hr/week		External Assessment: 60
Practical: 2 hrs/week		
Credit Points:1		
	Laboratory Experiments:	
1.	Study on the characteristics of on load time delay relay and off load time delay relay.	
2.	Test to find out polarity, ratio and magnetization characteristics of CT and PT.	
3.	Test to find out characteristics of (a) under voltage relay (b) earth fault relay.	
4.	Study on DC load flow	
5.	Study on AC load flow using Gauss-seidel method	
6.	Study on AC load flow using Newton Raphson method.	
7.	Study on Economic load dispatch.	
8.	Study of different transformer protection schemes by simulation	
9.	Study of different generator protection schemes by simulation	
10.	Study of different motor protection schemes by simulation	

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11.	Study of different characteristics of over current relay.
12.	Study of different protection scheme for feeder.

Institute may develop experiments based on the theory taught in addition to experiments mentioned.

Course outcome: After completion of this course, the learners will be able to

1. Identify appropriate equipment and instruments for the experiment.
2. Test the instrument for application to the experiment.
3. Construct circuits with appropriate instruments and safety precautions.
4. Validate the characteristics of under voltage relay, over current relay, earth fault relay, on load time delay relay, off load time delay relay, CT and PT.
5. Validate protection schemes of transformer, generator, motor and feeder.
6. Apply software tools to find bus voltage, currents and power flows throughout the electrical system.
7. work effectively in a team

Special Remarks: The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course	MICRO PROCESSOR AND MICRO CONTROLLER LABORATORY
Course Code: PC-EE 692	Semester: 6th
Duration: 6 months	Maximum marks:100
Teaching Scheme	Examination scheme:
Theory: 0 hr/week	Continuous Internal Assessment:40
Tutorial: 0 hr/week	External Assessment: 60
Practical: 2 hrs/week	
Credit Points:1	
	Laboratory Experiments:
1.	Programs for 16 bit arithmetic operations for 8086 (using various addressing modes)
2.	Program for sorting an array for 8086
3.	Program for searching for a number or character in a string for 8086
4.	Program for String manipulations for 8086
5.	Program for digital clock design using 8086.
6.	Interfacing ADC and DAC to 8086.
7.	Parallel communication between two microprocessors using 8255.
8.	Serial communication between two microprocessor kits using 8251.
9.	Interfacing to 8086 and programming to control stepper motor.
10.	Programming using arithmetic, logical and bit manipulation instructions of 8051
11.	Program and verify Timer/Counter in 8051.

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12.	Program and verify interrupt handling in 8051.
13.	UART operation in 8051.
14.	Interfacing LCD to 8051.
15.	Interfacing matrix or keyboard to 8051.
16.	Data transfer from peripheral to memory through DMA controller 8237/8257

Institute may develop experiments based on the theory taught in addition to experiments mentioned.

Course outcome: After completion of this course, the learners will be able to

1. identify appropriate equipment and instruments for the experiment
2. test the instrument for application to the experiment
3. construct circuits with appropriate instruments and safety precautions
4. program 8086 for arithmetic operation, sorting of array, searching for a number in a string and string manipulation
5. interface ADC/DAC, 8255, 8251 to 8086 and LCD, keyboard to 8051
6. program 8051 using arithmetic, logical and bit manipulation instructions of 8051
7. work effectively in a team

Special Remarks: The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Name of the course	ELECTRICAL AND ELECTRONICS DESIGN LABORATORY
Course Code: PC-EE 681	Semester: 6th
Duration: 6 months	Maximum marks:100
Teaching Scheme	Examination scheme:
Theory: 1hr/week	Continuous Internal Assessment:40
Tutorial: 0 hr/week	External Assessment: 60
Practical: 4 hrs/week	
Credit Points:3	
	GROUP A
1.	Designing a heating element with specified wattage, voltage and ambient temperature.
2.	Designing an aircore grounding reactor with specified operating voltage, nominal current and fault current
3.	Designing the power distribution system for a small township
4.	Designing a double circuit transmission line for a given voltage level and power (MVA) transfer.
5.	Wiring and installation design of a multistoried residential building (G+4,not less than 16 dwelling flats with a lift and common pump)
	GROUP B
6.	Designing an ONAN distribution transformer.
7.	Designing a three phase squirrel cage induction motor.
8.	Designing a three phase wound rotor induction motor.
9.	Designing a split phase squirrel cage induction motor for a ceiling fan or a domestic pump.
10.	Designing a permanent magnet fractional hp servo motor .
	GROUP C

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11.	Design the control circuit of a Lift mechanism
12.	Design a controller for speed control of DC machine.
13.	Design a controller for speed control of AC machine.
14.	Electronic system design employing electronic hardware (Analog, Digital, Mixed signal), microcontrollers, CPLDs, and FPGAs, PCB design and layout leading to implementation of an application

Topics to be covered in the Lecture class:

1.	Basic concepts on measurements; Noise in electronic systems; Sensors and signal conditioning circuits; Introduction to electronic instrumentation and PC based data acquisition; Electronic system design, Analog system design, Interfacing of analog and digital systems, Embedded systems,; System assembly considerations..	01
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Evaluation Method:

<ol style="list-style-type: none"> 1. The students would INDIVIDUALLY design the equipment and systems as per specifications provided by the class teacher following established procedures. 2. For each student, one item from each of the three groups would be chosen. 3. For unspecified items of specification and or specifications of wires, cables etc., data should be taken by students from handbooks and Indian standard. 4. Students should spend the allotted periods for carrying out design computations. 5. Their attendance shall be recorded. 6. Students should maintain a dedicated bound notebook for recording design activities like calculations, formulae used, sketches, flowcharts etc. The notebook should be regularly submitted to the class teacher for review and signature. 7. Evaluation would be based on (i) Class attendance (20%), (ii) Design Note Book (30%) (iii) Design Report (30%) (iv) End of semester viva (20%,)
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Institute may develop experiments based on the theory taught in addition to experiments mentioned.

Course outcome: After completion of this course, the learners will be able to

1. explain basic concept of measurement, noise in electronic system, sensor and signal conditioning circuits
2. implement PC based data acquisition systems
3. construct circuits with appropriate instruments and safety precautions
4. design heating elements, air core grounding reactor, power distribution system for small township, double circuit transmission line and Electric machines
5. do wiring and installation design of a multistoried residential building with lift and pump
6. design electronic hardware for controller of lift, speed of AC/DC motor, and for an application with analog, digital, mixed signal, microcontroller and PCB

Special Remarks: The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

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Curriculum Structure

Semester III (Second year)							
Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				L	T	P	
Theory							
1	Engineering Science Course	ESC 301	Analog and Digital Electronics	3	0	0	3
2	Professional Core Courses	PCC-CS301	Data Structure & Algorithms	3	0	0	3
3	Professional Core Courses	PCC-CS302	Computer Organisation	3	0	0	3
4	Basic Science course	BSC 301	Mathematics-III (Differential Calculus)	2	0	0	2
5	Humanities & Social Sciences including Management courses	HSMC 301	Economics for Engineers (Humanities-II)	3	0	0	3
Practical							
6	Professional Core Courses	PCC-CS393	IT Workshop (Sci Lab/MATLAB/Python/R)	0	0	4	2
7	Engineering Science Course	ESC 391	Analog and Digital Electronics	0	0	4	2
8	Professional Core Courses	PCC-CS391	Data Structure & Algorithms	0	0	4	2
9	Professional Core Courses	PCC-CS392	Computer Organisation	0	0	4	2
			Total credits				22
Semester IV (Second year)							
Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				L	T	P	
Theory							
1	Professional Core Courses	PCC-CS401	Discrete Mathematics	3	1	0	4
2	Professional Core Courses	PCC-CS 402	Computer Architecture	3	0	0	3
3	Professional Core Courses	PCC-CS403	Formal Language & Automata Theory	3	0	0	3

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4	Professional Core Courses	PCC-CS404	Design & Analysis of Algorithms	3	0	0	3
5	Basic Science courses	BSC 401	Biology	2	1	0	3
6	Mandatory Courses	MC401	Environmental Sciences	1	-	-	0
Practical							
7	Engineering Science Course	PCC-CS 492	Computer Architecture	0	0	4	2
8	Professional Core Courses	PCC-CS494	Design & Analysis of Algorithms	0	0	4	2
				Total credits			20

Semester V (Third year)							
Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				L	T	P	
1	Engineering Science Course	ESC501	Software Engineering	3	0	0	3
2	Professional Core Courses	PCC-CS501	Compiler Design	3	0	0	3
3	Professional Core Courses	PCC-CS502	Operating Systems	3	0	0	3
4	Professional Core Courses	PCC-CS503	Object Oriented Programming	3	0	0	3
5	Humanities & Social Sciences including Management courses	HSMC-501	Introduction to Industrial Management (Humanities III)	3	0	0	3
6	Professional Elective	PEC-IT 501A/B/C/D	(Elective-I) Theory of	3	0	0	3

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	courses		Computation/Artificial Intelligence/ Advanced Computer Architecture/ Computer Graphics				
7	Mandatory Courses	MC- CS501	Constitution of India/ Essence of Indian Knowledge Tradition	-	-	-	0
Practical							
8	Professional Core Courses	ESC- 591	Software Engineering		0	4	2
9	Professional Core Courses	PCC- CS592	Operating Systems		0	4	2
10	Professional Core Courses	PCC- CS593	Object Oriented Programming		0	4	2
			Total credits				24

Semester VI (Third year)							
Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				L	T	P	
1	Professional Core Courses	PCC- CS601	Database Management Systems	3	0	0	3
2	Professional Core Courses	PCC- CS602	Computer Networks	3	0	0	3
3	Professional Elective courses	PEC- IT601A/B/C/D	(Elective-II) Advanced Algorithms/ Distributed Systems/ Signals & Systems / Image Processing	3	0	0	3
4	Professional Elective courses	PEC- IT602A/B/C/D	(Elective-III) Parallel and Distributed Algorithms/ Data Warehousing & Data Mining/ Human Computer Interaction/Pattern	3	0	0	3

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			Recognition				
5	Open Elective courses	OEC-IT601A/B	(Open Elective-) Numerical Methods/ Human Resource Development and Organizational Behavior	3	0	0	3
6	Project	PROJ-CS601	Research Methodology	3	0	0	3
Practical							
7	Professional Core Courses	PCC-CS691	Database Management Systems	0	0	4	2
8	Professional Core Courses	PCC-CS692	Computer Networks	0	0	4	2
			Total credits				22

Semester VII (Fourth year)

Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				L	T	P	
1	Professional Elective courses	PEC-IT701A/B/C/D	(Elective-IV) Internet Technology/Quantum Computing/ Cloud Computing/Machine learning	3	0	0	3
2	Professional Elective courses	PEC-IT702A/B/C/D/E/F	(Elective-V) Multimedia Technology/Neural Networks and Deep Learning/Soft Computing/ Ad-Hoc and Sensor Networks/Information Theory and Coding/Cyber Security	3	0	0	3
3	Open Elective courses	OEC-IT701A/B/C	(Open Elective-II) Operations Research/Introduction to Philosophical Thoughts/ Soft Skill & Interpersonal Communication	3	0	0	3
4	Humanities & Social Sciences including	HSMC 701	Project Management and Entrepreneurship	2	1	0	3

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	Management courses						
5	Project	PROJ-IT781	Project-II	0	0	12	6
			Total credits				18

Semester VIII (Fourth year)
[Summer Industry Internship]

Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				L	T	P	
1	Professional Elective courses	PEC-IT801A/B/C/D/E	(Elective-VI) Signals and Networks/Cryptography & Network Security/ Speech and Natural Language Processing/ /Internet of Things/ Remote Sensing and GIS	3	0	0	3
2	Open Elective courses	OEC-IT801A/B/C/D/E	Open Elective-III Big Data Analysis/Cyber Law and Ethics/ Mobile Computing/Bioinformatics/ Robotics	3	0	0	3
3	Open Elective courses	OEC-IT802A/B/C	(Open Elective-IV) E-Commerce and ERP/Micro-electronics and VLSI Design/Economic Policies in India	3	0	0	3
4	Project	PROJ-CS881	Project-III	0	0	12	6
			Total credits				15

1st Year Curriculum for B.Tech courses in Engineering & Technology

(Applicable from the academic session 2018-2019)



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BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits

B. Range of credits :

A range of credits from 150 to 160 for a student to be eligible to get B.Tech Degree in Engineering. A student will be eligible to get B.Tech Degree *with Honours*, if he/she completes an additional 20 credits. These could be acquired through Massive Open Online Courses (MOOCs).

C. MOOCs for B. Tech Honours

The additional 20 credits (for obtaining B. Tech with Honours) are to be gained through MOOCs. The complete description of the MOOCs relevant for the first year course are given in *Annexure-I*. The courses for subsequent years of study will be posted subsequently.

D. Guidelines regarding Mandatory Induction Program for the new students

All concerned are requested to follow the guidelines given in *Annexure-II* (Notice dt.06/12/2017) concerning Mandatory Induction Program. The colleges/ Institute may also refer to the AICTE Model Curriculum for Undergraduate Degree Courses in Engineering & Technology (January 2018) -Volume I (Page No.31-38), if necessary.

E. Mandatory Additional Requirement for earning B. Tech Degree

All concerned are requested to follow the guidelines in *Annexure-III* concerning Mandatory Additional Requirements.

F. Group division:

Group-A:

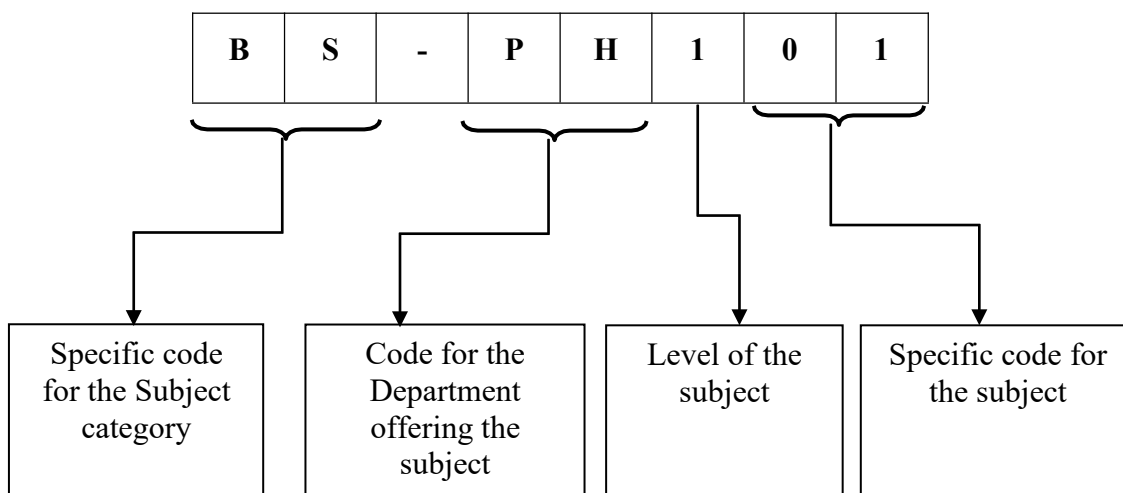
Chemistry based subjects: [Bio-Technology, Food Technology, Leather Technology, Textile Technology, Ceramic Technology, Chemical Engineering and any other Engineering that chooses to be Chemistry based] + Physics based subjects: [Mechanical Engineering, Production Engineering, Civil Engineering, Automobile Engineering, Marine Engineering, Apparel Production Engineering, Computer Science & Engineering, Information Technology.]

Group-B:

All Physics based subjects which are also Electrical & Electronics based [Electrical Engineering, Electronics & Communication Engineering, Applied Electronics & Instrumentation Engineering, Power Engineering, Electrical & Electronics Engineering, Bio-Medical Engineering, Instrumentation & Control Engineering]

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G. Subject Numbering Scheme:



List of Codes for Subject Category	
Code	Category Name
BS	Basic Science Courses
ES	Engineering Science Courses
HM	Humanities and Social Sciences including Management courses
PC	Professional core courses
PE	Professional Elective courses
OE	Open Elective courses
MC	Mandatory courses
PW	Project

List of Codes for Departments			
Code	Name of the Department	Code	Name of the Department
APM	Apparel Production Engineering	ECE	Electronics & Communication Engineering
AEIE	Applied Electronics & Instrumentation Engineering	FT	Food Technology
AUE	Automobile Engineering	IT	Information Technology
BME	Bio-Medical Engineering	ICE	Instrumentation & Control Engineering
BT	Bio-Technology	LT	Leather Technology
CT	Ceramic Technology	MRE	Marine Engineering
CHE	Chemical Engineering	ME	Mechanical Engineering
CE	Civil Engineering	PWE	Power Engineering
CSE	Computer Science & Engineering	PE	Production Engineering
EEE	Electrical & Electronics Engineering	TT	Textile Technology
EE	Electrical Engineering		

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First Year First Semester							
Mandatory Induction Program- 3 weeks duration							
Sl No.	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science course	BS-PH101/ BS-CH101	Physics-I (Gr-A)/ Chemistry-I(Gr-B)	3	1	0	4
2	Basic Science course	BS-M101/ BS-M102	Mathematics –IA*/ Mathematics –IB *	3	1	0	4
3	Engineering Science Courses	ES-EE101	Basic Electrical Engineering	3	1	0	4
	Total Theory			9	3	0	12
Practical							
1	Basic Science course	BS-PH191/ BS-CH191	Physics-I Laboratory (Gr-A)/ Chemistry-I Laboratory (Gr-B)	0	0	3	1.5
2	Engineering Science Courses	ES-EE191	Basic Electrical Engineering Laboratory	0	0	2	1
3	Engineering Science Courses	ES-ME191/ ES-ME192	Engineering Graphics & Design(Gr-B)/ Workshop/Manufacturing Practices(Gr-A)	1	0	4	3
	Total Practical			1		9	5.5
	Total of First Semester			10	3	9	17.5

* Mathematics –IA (BS-M101) - CSE & IT
 Mathematics –IB (BS-M102) - All stream except CSE & IT

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First Year Second Semester							
Sl No.	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science courses	BS-PH201/ BS-CH201	Physics-I (Gr-B)/ Chemistry-I (Gr-A)	3	1	0	4
2	Basic Science courses	BS-M201/ BS-M202	Mathematics –IIA [#] / Mathematics –IIB [#]	3	1	0	4
3	Engineering Science Courses	ES-CS201	Programming for Problem Solving	3	0	0	3
4	Humanities and Social Sciences including Management courses	HM-HU201	English	2	0	0	2
	Total Theory			11	2	0	13
Practical							
1	Basic Science courses	BS-PH291/ BS-CH291	Physics-I Laboratory (Gr-B)/ Chemistry-I Laboratory (Gr-A)	0	0	3	1.5
2	Engineering Science Courses	ES-CS291	Programming for Problem Solving	0	0	4	2
3	Engineering Science Courses	ES-ME291/ ES-ME292	Engineering Graphics & Design(Gr-A)/ Workshop/Manufacturing Practices(Gr-B)	1	0	4	3
4	Humanities and Social Sciences including Management courses	HM-HU291	Language Laboratory	0	0	2	1
	Total Practical			1	0	13	7.5
	Total of Second Semester			12	2	13	20.5

Mathematics –II (BS-M201) - CSE & IT
 Mathematics –II (BS-M202) - All stream except CSE & IT

	Group-A	Group-B
1 st Year 1 st Semester	Physics-I (BS-PH101); Workshop/Manufacturing Practices (ES-ME192)	Chemistry-I (BS-CH101); Engineering Graphics & Design (ES-ME191)
1 st Year 2 nd Semester	Chemistry-I (BS-CH201); Engineering Graphics & Design (ES-ME291)	Physics-I (BS-PH201); Workshop/Manufacturing Practices (ES-ME292)

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Course Code : BS-PH101/ BS-PH201	Category : Basic Science Courses
Course Title : Physics-I	Semester : First/ Second
L-T-P : 3-1-0	Credit:4
Pre-Requisites:	

Course objectives :

Basic concepts of mechanics, optics and its applications, electricity, magnetism and qualitative understanding of concepts of quantum physics and statistical mechanics.

1. Mechanics (7L)

Problems including constraints & friction. Basic ideas of vector calculus and partial differential equations. Potential energy function $F = -\text{grad } V$, equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy & momentum. Non-inertial frames of reference. Harmonic oscillator; Damped harmonic motion forced oscillations and resonance. Motion of a rigid body in a plane and in 3D. Angular velocity vector. Moment of inertia.

2. Optics (5L)

- Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits (only the expressions for max;min, & intensity and qualitative discussion of fringes); diffraction grating(resolution formulac only), characteristics of diffraction grating and its applications.
- Polarisation : Introduction, polarisation by reflection, polarisation by double reflection, scattering of light, circular and elliptical polarisation, optical activity.
- Lasers : Principles and working of laser : population inversion, pumping, various modes, threshold population inversion with examples .

3. Electromagnetism and Dielectric Magnetic Properties of Materials (8L)

- Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielecrrics, internal fields in a solid, Clausius- Mossotti equation(expression only), applications of dielectrics.
- Magnetisation , permeability and susceptibility, classificationof magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.

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4. Quantum Mechanics (16L)

- Introduction to quantum physics, black body radiation, explanation using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.

5. Statistical Mechanics (8L)

- Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics.

Course outcomes:

Students will be familiar with

- Basic concepts of mechanics
- Bragg's Law and introduction to the principles of lasers, types of lasers and applications.
- Various terms related to properties of materials such as, permeability, polarization, etc.
- Some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials.
- Simple quantum mechanics calculations.
-

Learning Resources:

1. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited
2. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker, Wiley
3. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press
4. Engineering Mechanics (In SI Units) (SIE), S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati, McGraw Hill Education
5. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education
6. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education
7. Engineering Mechanics, M.K. Harbola, Cengage India
8. An Introduction to Mechanics (SIE), David Kleppner, Robert Kolenkow, McGraw Hill Education
9. Principles of mechanics, John L. Synge and Byron A. Griffith, New York, McGraw-Hill
10. Mechanics (Dover Books on Physics), J. P. Den Hartog, Dover Publications Inc.
11. Engineering Mechanics: Dynamics, L.G. Kraige J.L. Meriam, Wiley
12. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, Robert Eisberg, Robert Resnick, Wiley
13. Introduction to Quantum Mechanics, J. Griffiths David, Pearson Education
14. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press
15. Optics, Hecht, Pearson Education
16. Optics, Ghatak, McGraw Hill Education India Private Limited
17. Fundamentals of Statistical and Thermal Physics, Reif, Sarat Book Distributors
18. Statistical Mechanics, Pathria, Elsevier
19. Statistical Physics, L.D. Landau, E.M. Lifshitz, Butterworth-Heinemann

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Course Code : BS-CH101/ BS-CH201	Category : Basic Science Courses
Course Title : Chemistry-I	Semester : First/ Second
L-T-P : 3-1-0	Credit:4
Pre-Requisites:	

Detailed contents

i) Atomic and molecular structure (10 lectures)

Schrodinger equation. Particle in a box solutions and their applications for simple sample. Molecular orbitals of diatomic molecules (e.g.H₂). Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

ii) Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

iii) Intermolecular forces and potential energy surfaces (4 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena.

iv) Use of free energy in chemical equilibria (8 lectures)

First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

v) Periodic properties (4 Lectures)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

vi) Stereochemistry (4 lectures)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

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vii) Organic reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

Learning Resources:

1. Engineering Chemistry, Satyaprakash, Khanna Book Publishing, Delhi
2. University chemistry, by B. H. Mahan
3. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
4. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
5. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
6. Physical Chemistry, by P. W. Atkins
7. Spectroscopy of Organic Compounds, by P.S.Kalsi, New Age International Pvt Ltd Publishers
8. Physical Chemistry, P. C. Rakshit, Sarat Book House
9. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition
<http://bcs.whfreeman.com/vollhardtschore5e/default.asp>

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Course Code : BS-M101	Category : Basic Science Course
Course Title : Mathematics – I A	Semester : First (CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic	Lectures Hours
1	<i>Calculus (Integration):</i> Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	<i>Calculus (Differentiation):</i> Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	<i>Matrices:</i> Matrices, Vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.	7
4	<i>Vector Spaces:</i> Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem, composition of linear maps, Matrix associated with a linear map.	9
5	<i>Vector Spaces (Continued):</i> Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.	10

Course Outcomes:

The students will be able to:

Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

Understand the domain of applications of mean value theorems to engineering problems.

Learn different types of matrices, concept of rank, methods of matrix inversion and their applications.

Understand linear spaces, its basis and dimension with corresponding applications in the field of computer science.

Learn and apply the concept of eigen values, eigen vectors, diagonalisation of matrices and orthogonalization in inner product spaces for understanding physical and engineering problems

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Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. S.K. Mapa, Higher Algebra: Abstract and Linear, Sarat Book House Pvt.Ltd.
8. Hoffman and Kunze: Linear algebra, PHI.

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Course Code : BS-M102	Category : Basic Science Course
Course Title : Mathematics –I B	Semester : First (All stream except CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic	Lectures Hours
1	<i>Calculus (Integration):</i> Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	<i>Calculus (Differentiation):</i> Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	<i>Sequence and Series:</i> Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.	11
4	<i>Multivariate Calculus:</i> Limit, continuity and partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, Curl and Divergence.	9
5	<i>Matrices:</i> Inverse and rank of a matrix, Rank-nullity theorem; System of linear equations; Symmetric, Skew-symmetric and Orthogonal matrices; Determinants; Eigenvalues and Eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.	8

Course Outcomes:

After completing the course the student will be able to

Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

Understand the domain of applications of mean value theorems to engineering problems.

Learn the tools of power series and Fourier series to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.

Apply the knowledge for addressing the real life problems which comprises of several variables or attributes and identify extremum points of different surfaces of higher dimensions.

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Understand different types of matrices, their eigen values, eigen vectors, rank and also their orthogonal transformations which are essential for understanding physical and engineering problems.

Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.

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Course Code : ES-EE101	Category : Engineering Science Courses
Course Title : Basic Electrical Engineering	Semester : First
L-T-P : 3-1-0	Credit: 4
Pre-Requisites:	

Detailed contents:

Module 1: DC Circuits (8 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers (6 hours)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 hours)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters (6 hours)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

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Course Outcomes

To understand and analyze basic electric and magnetic circuits

To study the working principles of electrical machines and power converters.

To introduce the components of low voltage electrical installations

Learning Recourses:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Book Publishing Co. (P) Ltd., Delhi.
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
4. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
5. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
6. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

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Course Code : BS-PH191/ BS-PH291	Category : Basic Science course
Course Title : Physics-I Laboratory	Semester : First/ Second
L-T-P : 0-0-3	Credit:1.5
Pre-Requisites:	

Choose 10 experiments including at least one from Optics, Electricity and Magnetism and Quantum Mechanics and at least a total of six from these three groups.

Experiments in Optics

1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of a monochromatic light by Newton's ring
3. Determination of wavelength of a monochromatic light by Fresnel's bi-prism
4. Determination of wavelength of the given laser source by diffraction method

Electricity & Magnetism experiments

1. Determination of thermo electric power of a given thermocouple.
2. Determination of specific charge (e/m) of electron by J.J. Thompson's method.
3. Determination of dielectric constant of a given dielectric material.
4. Determination of Hall coefficient of a semiconductor by four probe method.
5. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.
6. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
7. Determination of unknown resistance using Carey Foster's bridge
8. Study of Transient Response in LR, RC and LCR circuits using expeyes
9. Generating sound from electrical energy using expeyes

Experiments in Quantum Physics

1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Lande-g factor using Electron spin resonance spectrometer.
4. Determination of Rydberg constant by studying Hydrogen spectrum.
5. Determination of Band gap of semiconductor.
6. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

Miscellaneous experiments

1. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure
2. Determination of bending moment and shear force of a rectangular beam of uniform cross-section
3. Determination of modulus of rigidity of the material of a rod by static method
4. Determination of rigidity modulus of the material of a wire by dynamic method
5. To determine the moment of inertia of a body about an axis passing through its centre of gravity and to determine the modulus of rigidity of the material of the suspended wire
6. Determination of coefficient of viscosity by Poiseuille's capillary flow method

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Course Code : BS-CH191/ BS-CH291	Category : Basic Science Courses
Course Title : Chemistry-I Laboratory	Semester : First/ Second
L-T-P : 0-0-3	Credit:1.5
Pre-Requisites:	

Choose 10 experiments from the following:

1. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
2. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
3. Determination of dissolved oxygen present in a given water sample.
4. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution)
5. Determination of surface tension and viscosity
6. Thin layer chromatography
7. Ion exchange column for removal of hardness of water
8. Determination of the rate constant of a reaction
9. Determination of cell constant and conductance of solutions
10. Potentiometry - determination of redox potentials and emfs
11. Saponification/acid value of an oil
12. Chemical analysis of a salt
13. Determination of the partition coefficient of a substance between two immiscible liquids
14. Adsorption of acetic acid by charcoal
15. Use of the capillary viscosimeters to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

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Course Code : ES-EE191	Category : Engineering Science Courses
Course Title : Basic Electrical Engineering Laboratory	Semester : First
L-T-P : 0-0-2	Credit: 1
Pre-Requisites:	

Choose 10 experiments from the following:

1. First activity: Introduction to basic safety precautions and mentioning of the do's and Don'ts. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about the modalities of evaluation.
2. Introduction and uses of following instruments :
 - (a) Voltmeter
 - (b) Ammeter
 - (c) Multimeter
 - (d) Oscilloscope

Demonstration of real life resistors, capacitors with color code , inductors and autotransformer.

3. Demonstration of cut-out sections of machines: DC machine, Induction machine, Synchronous machine and single phase induction machine.
4. Calibration of ammeter and Wattmeter.
5. Determination of steady state and transient response of R-L, R-C and R-L-C circuit to a step change in voltage.
6. Determination of steady state response of R-L and R-C and R-L-C circuit and calculation of impedance and power factor.
7. Determination of resonance frequency and quality factor of series and parallel R-L-C circuit.
8. (a) Open circuit and short circuit test of a single-phase transformer
(b) Load test of the transformer and determination of efficiency and regulation
9. Demonstration of three phase transformer connections. Voltage and current relationship, phase shifts between the primary and secondary side.
10. Measurement of power in a three phase unbalanced circuit by two wattmeter method.
11. Determination of Torque –Speed characteristics of separately excited DC motor.
12. Determination of Torque speed characteristics and observation of direction reversal by change of phase sequence of connection of Induction motor.
13. Determination of operating characteristics of Synchronous generator.
14. Demonstration of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter for speed control of an Induction motor
15. Demonstration of components of LT switchgear.

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Course Code : ES-ME191/ ES-ME 291	Category : Engineering Science Courses
Course Title : Engineering Graphics & Design	Semester : First/ Second
L-T-P : 1-0-4	Credit: 3
Pre-Requisites:	

Sl. No.	Content	Lecture (L)	Practical (P)
1	INTRODUCTION TO ENGINEERING DRAWING Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes.	1	4
2	LETTERING, DIMENSIONING, SCALES Plain scale, Diagonal scale and Vernier Scales.	1	4
3	GEOMETRICAL CONSTRUCTION AND CURVES Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Archimedian Spiral.	1	4
4	PROJECTION OF POINTS, LINES, SURFACES Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle, pentagon, Hexagon etc.) inclined Planes - Auxiliary Planes.	1	4
5	PROJECTION OF REGULAR SOLIDS Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).	1	4
6	COMBINATION OF REGULAR SOLIDS, FLOOR PLANS Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.	1	4
7	ISOMETRIC PROJECTIONS Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;	1	4

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8	SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)	1	4
9	OVERVIEW OF COMPUTER GRAPHICS, CUSTOMISATION & CAD DRAWING listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;	1	4
	ANNOTATIONS, LAYERING & OTHER FUNCTIONS applying dimensions to objects, applying annotations to drawings;		
10	Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;	2	8

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11	DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).	2	8
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Course Outcomes

The student will learn:

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling

General Instructions

1. In every topic some problems are to be done in the class and some are to be given to students as home assignment.
2. The problems for class work are to be prepared on drawing sheet of A1 size in the class/ using AutoCAD software.
3. The problems for home assignments are to be prepared on drawing copy/ using AutoCAD software.
4. Print out of every assignment is to be taken for CAD Drawings on Drawing sheets (A4 Sheets).
5. A title block must be prepared in each sheet/ assignment.

Following is the list of drawing instruments that required for making engineering drawings on paper with perfection.

1. Drawing Board
2. Mini drafter/ Set-squares (45°–45° & 60°–90°), T-square
3. Protractor (180°, 360°)
4. Scales (Plain, Diagonal)
5. Compass (Small and Large)
6. Divider (Small and Large)

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7. French Curves
8. Drawing paper (A1 Size)
9. Drawing pencil (H, HB, B)
10. Sharpener
11. Eraser
12. Drawing pins & clips
13. Duster or handkerchief etc.

Learning Resources:

1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House
2. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
5. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
6. Corresponding set of CAD Software Theory and User Manuals

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Course Code : ES-ME192/ ES-ME 292	Category : Engineering Science Courses
Course Title : Workshop/ Manufacturing Practices	Semester : First/ Second
L-T-P : 1-0-4	Credit:3
Pre-Requisites:	

(i) Lectures & videos:

Detailed contents:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Electrical & Electronics
5. Carpentry
6. Plastic moulding, glass cutting
7. Metal casting
8. Welding (arc welding & gas welding), brazing

(ii) Workshop Practice:

Machine shop (8 hours)

Typical jobs that may be made in this practice module:

To make a pin from a mild steel rod in a lathe.

To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Fitting shop (8 hours)

Typical jobs that may be made in this practice module:

To make a Gauge from MS plate.

Carpentry (8 hours)

Typical jobs that may be made in this practice module:

To make wooden joints and/or a pattern or like.

Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs))

Typical jobs that may be made in this practice module:

ARC WELDING (4 hours): To join two thick (approx 6mm) MS plates by manual metal arc welding.

GAS WELDING (4 hours): To join two thin mild steel plates or sheets by gas welding.

Casting (8 hours)

Typical jobs that may be made in this practice module:

One/ two green sand moulds to prepare, and a casting be demonstrated.

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Smithy (4 hours) ~ 4 hours

Typical jobs that may be made in this practice module:

A simple job of making a square rod from a round bar or like.

Plastic moulding & Glass cutting (4 hours)

Typical jobs that may be made in this practice module:

For plastic moulding, making at least one simple plastic component should be made.

For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made.

Electrical & Electronics (8 hours)

Familiarization with LT switchgear elements, making its sketches and noting down its specification. Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable.

Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point.

Simple wiring exercise to be executed to understand the basic electrical circuit.

Simple soldering exercises to be executed to understand the basic process of soldering.

Fabrication of a single-phase full wave rectifier with a step down transformer using four diodes and electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes

Upon completion of this laboratory course, students will be able to fabricate components with their own hands.

They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

By assembling different components, they will be able to produce small devices of their interest.

Learning Resources:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. and Steven S. Schmid, “Manufacturing Engineering and Technology”, 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu, “Manufacturing Technology – I” Pearson Education, 2008.
4. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4th edition, Prentice Hall India, 1998.
5. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGrawHill House, 2017.

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Course Code : BS-M201	Category : Basic Science Course
Course Title : Mathematics – II A	Semester : Second (CSE &IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics and BS-M101	

Module No.	Description of Topic	Lectures Hours
1	Basic Probability: Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the Multinomial distribution, Poisson approximation to the Binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.	11
2	Continuous Probability Distributions: Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities.	4
3	Bivariate Distributions: Bivariate distributions and their properties, distribution of sums and quotients, Conditional densities, Bayes' rule.	5
4	Basic Statistics: Measures of Central tendency, Moments, Skewness and Kurtosis, Probability distributions: Binomial, Poisson and Normal and evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.	8
5	Applied Statistics: Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	8
6	Small samples: Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	4

Course Outcomes:

The students will be able to:

Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.

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Understand the basic ideas of statistics with different characterisation of a univariate and bivariate data set.

Apply statistical tools for analysing data samples and drawing inference on a given data set.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
3. S. Ross, A First Course in Probability, Pearson Education India
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.
5. John E. Freund, Ronald E. Walpole, Mathematical Statistics, Prentice Hall.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
7. N.G. Das, Statistical Methods (Combined Volume), Tata-McGraw Hill.

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Course Code : BS-M202	Category : Basic Science Course
Course Title : Mathematics – II B	Semester : Second (All stream except CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics and BS-M102	

Module No.	Description of Topic	Lectures Hours
1	<i>Multivariate Calculus (Integration):</i> Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, change of variables (Cartesian to Polar), Applications: Areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.	11
2	<i>First order ordinary differential equations:</i> Exact, linear and Bernoulli's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.	5
3	<i>Ordinary differential equations of higher orders:</i> Second order linear differential equations with constant coefficients, Use of D-operators, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.	9
4	<i>Complex Variable – Differentiation</i> Differentiation of complex functions, Cauchy-Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithmic) and their properties; Conformal mappings, Mobius transformations and their properties.	6
5	<i>Complex Variable – Integration</i> Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, Zeros of analytic functions, Singularities, Laurent's series; Residues, Cauchy residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.	9

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Course Outcomes:

The students will be able to:

Learn the methods for evaluating multiple integrals and their applications to different physical problems.

Understand different techniques to solve first and second order ordinary differential equations with its formulation to address the modelling of systems and problems of engineering sciences.

Learn different tools of differentiation and integration of functions of a complex variable that are used with various other techniques for solving engineering problems.

Apply different types of transformations between two 2- dimensional planes for analysis of physical or engineering problems.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. E. L. Ince, Ordinary Differential Equations, Dover Publications.
8. J. W. Brown and R. V. Churchill, Complex Variables and Applications, Mc-Graw Hill.

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Course Code : ES-CS201	Category : Engineering Science Courses
Course Title : Programming for Problem Solving	Semester : Second
L-T-P : 3-0-0	Credit :3
Pre-Requisites:	

Detailed contents

Unit 1: Introduction to Programming (4 lectures)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - **(1 lecture)**.

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. **(1 lecture)**

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- **(2 lectures)**

Unit 2: Arithmetic expressions and precedence (2 lectures)

Unit 3: Conditional Branching and Loops (6 lectures)

Writing and evaluation of conditionals and consequent branching **(3 lectures)**

Iteration and loops **(3 lectures)**

Unit 4: Arrays (6 lectures)

Arrays (1-D, 2-D), Character arrays and Strings

Unit 5: Basic Algorithms (6 lectures)

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 6: Function (5 lectures)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Unit 7: Recursion (4 -5 lectures)

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 8: Structure (4 lectures)

Structures, Defining structures and Array of Structures

Unit 9: Pointers (2 lectures)

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Unit 10: File handling (only if time is available, otherwise should be done as part of the lab)

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Course Outcomes

The student will learn

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical errors.
- To implement conditional branching, iteration and recursion.
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- To apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.

Learning Resources:

1. R. S. Salaria, Computer Concepts and Programming in C, Khanna Publishers
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

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Course Code : ES-CS291	Category : Engineering Science Courses
Course Title : Programming for Problem Solving	Semester : Second
L-T-P : 0-0-4	Credit:2
Pre-Requisites:	

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

Tutorial 12: File handling:

Lab 12: File operations

Laboratory Outcomes

To formulate the algorithms for simple problems

To translate given algorithms to a working and correct program

To be able to correct syntax errors as reported by the compilers

To be able to identify and correct logical errors encountered at run time

To be able to write iterative as well as recursive programs

To be able to represent data in arrays, strings and structures and manipulate them through a program

To be able to declare pointers of different types and use them in defining self-referential structures.

To be able to create, read and write to and from simple text files.

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Course Code : HM-HU201	Category : Humanities and Social Sciences including Management courses
Course Title : English	Semester : Second
L-T-P : 2-0-0	Credit:2
Pre-Requisites:	

Detailed contents

1. Vocabulary Building

- 1.1 The concept of Word Formation: Compounding, Backformation, Clipping, Blending.
- 1.2 Root words from foreign languages and their use in English
- 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
- 1.4 Synonyms, antonyms, and standard abbreviations: Acronyms

2. Basic Writing Skills

- 2.1 Sentence Structures & Types: Simple, Compound, Complex
- 2.2 Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration
- 2.3 Importance of proper punctuation
- 2.4 Creating coherence: Arranging paragraphs & Sentences in logical order
- 2.5 Creating Cohesion: Organizing principles of paragraphs in documents
- 2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

- 3.1 Subject-verb agreement
- 3.2 Noun-pronoun agreement
- 3.3 Misplaced modifiers
- 3.4 Articles
- 3.5 Prepositions
- 3.6 Redundancies
- 3.7 Clichés

4. Nature and Style of sensible Writing

- 4.1 Describing
- 4.2 Defining
- 4.3 Classifying
- 4.4 Providing examples or evidence
- 4.5 Writing introduction and conclusion

5. Writing Practices

- 5.1 Comprehension
- 5.2 Précis Writing
- 5.3 Essay Writing
- 5.4 Business Letter, Cover Letter & CV; E-mail

Addendum

Some examples of English words with foreign roots

Greek Root/Affix	Examples
Anti	Antisocial, antiseptic

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Auto	Automatic, autograph
Anthropos	Anthropology, philanthropy
Bio	Biography
Chronos	Time
Di	Dilemma
Bio	Biology
Biblio	Bibliography
Chron	Chronology
Cracy	Contradiction
Geo	Geology
Hyper	Hyperactive
Mania	Kleptomania
Mega	Megaserial
Eu	Eulogy, euphoria
Geo	Geology
Graph	autograph, photograph
Hetero	Heterogeneous
Hyper	Hyperactive
Hypo	hypodermic, hypoglycemia
Macro	Macrocosm
Mega	megalomania
Micro	microcosm

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Mono	Monarch
Pan	Panorama
Pathos	Pathetic
Phobia	Hydrophobia
Pod (Gk), ped (Latin)	Pseudopodia
Poly	polyglot
Tele	Telephone
Theo	Theology, theist
Latin Root	Examples
Aud	Audible
Bene	Beneficial
Brev	abbreviate, brief
circum	Circulate
Contra	Contradict
Cred	Credible
Dict	Diction
Femina	Feminine
Inter	Internet, interval
Magna	Magnificent
Mal	Malnutrition
Multi	multinational
Nova	Novel
Multi	Multiple, multiplex
Non	Nonstop

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Pre	Previous, predicate
Re	Redo, rewind
Scrib	Scripture
Spect	Spectator
Trans	Transport
Uni	Unity
Omni	Omnipotent
Semi	Semicircle
Sub	Subway
somnus	Insomnia,
Super	Superman
Sym	Sympathy
scribe	Describe, scribble(write illegibly), inscribe
Trans	Transform
Un	Unnecessary
Uni	Universal

Learning Resources:

- (i) Kulbushan Kumar, R S Salaria, Effective Communication Skills, Khanna Publishing House, Delhi.
- (ii) Practical English Usage. Michael Swan. OUP. 1995.
- (iii) Remedial English Grammar. F.T. Wood. Macmillan. 2007
- (iv) On Writing Well. William Zinsser. Harper Resource Book. 2001
- (v) Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- (vi) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
- (vii) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
- (viii) Universal English Prof. Prasad Kataria Publications, 2019.
- (ix) "Communication Skills for Professionals"-Nira Konar, Prentice Hall of India 2nd edition, New Delhi, 2011
- (x) Gajendra Singh Chauhan, Smita Kashiramka and L. Thimmesha. Functional English. Cengage , 2019.

Course Outcomes

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Course Code : HM-HU291	Category : Humanities and Social Sciences including Management courses
Course Title : Language Laboratory	Semester : Second
L-T-P : 0-0-2	Credit:1
Pre-Requisites:	

- | | |
|---|----|
| 1) Honing 'Listening Skill' and its sub skills through Language Lab Audio device; | 3P |
| 2) Honing 'Speaking Skill' and its sub skills | 2P |
| 3) Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/
Voice modulation/ Stress/ Intonation/ Pitch & Accent) of connected speech | 2P |
| 4) Honing 'Conversation Skill' using Language Lab Audio –Visual input;
Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone &
Role Play Mode) | 2P |
| 5) Introducing 'Group Discussion' through audio –Visual input and acquainting them
with key strategies for success | 2P |
| 6) G D Practice Sessions for helping them internalize basic Principles
(turn- taking, creative intervention, by using correct body language, courtesies &
other soft skills) of GD | 4P |
| 7) Honing 'Reading Skills' and its sub skills using Visual / Graphics/
Diagrams /Chart Display/Technical/Non Technical Passages
Learning Global / Contextual / Inferential Comprehension; | 2P |
| 8) Honing 'Writing Skill' and its sub skills by using
Language Lab Audio –Visual input; Practice Sessions | 2P |

Course Outcomes

- The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

MOOCs for B. Tech Honours



Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal

Notice

1st May, 2018

MOOCs for B.Tech Honours (Applicable from the session 2018-2019)

Preamble

All India Council for Technical Education (AICTE) has introduced Model Curriculum for Bachelor of Technology programme with 160 credits in the entire programme of 4 years, and additional 20 credits will be required to be done for the degree of Bachelor of Technology with Honours. These additional 20 credits will have to be acquired with online courses (MOOCs) as per AICTE. So students will have to complete additional 20 credits through MOOCs within 4 years of time. This creates an excellent opportunity for students to acquire the necessary skill set for employability through massive online courses where the rare expertise of world famous experts from academics and industry are available. Maulana Abul Kalam Azad University of Technology, West Bengal (MAKAUT,WB) has thus decided to introduce AICTE model curriculum for its B.Tech Programmes and suggest baskets for MOOCs available year wise for the four-year long B.Tech programme from the sessions 2018-2019. The basket for MOOCs will be a dynamic one, as courses keep on updating with time. Few essential skill sets required for employability are also identified year wise by MAKAUT,WB. For MOOCs platforms where examination or assessment is absent (like SWAYAM) or where certification is costly (like Coursera or edX), faculty members of the Institutes are to audit the courses and prepare the examination question papers, for the courses undertaken by the students of respective Institutes, so that MAKAUT,WB can conduct examination for the course. The total of 20 credits that is required to be attained for B.Tech Honours degree are distributed over four years in the following way:

For first year	:	8 credits
For second year	:	4 credits
For third year	:	4 credits
For fourth year	:	4 credits

A student of first year has to cover courses from at least three skills :

1. Computer Programing with Python / R
2. Soft skill
3. Ethics

Courses are * marked in the above areas

If a student is unable to cover the credits assigned for the first year, he/she can do these courses in either of the subsequent years, but he/she has to choose the courses from the basket of MOOCs announced by MAKAUT,WB from time to time. The same rule will be applicable for the other years of the programme.

The basket for MOOCs for the 1st year B. Tech for the session 2018-2019 are made available herewith.

By order.

MOOCs for First Year, Engineering and Technology

Sl. No	Course	Provider	Duration	Credits	Name of University / Institution
1.	Presentation Skills: Designing Presentation Slides	Coursera *	4 weeks	1	Tomsk State University
2.	Effective Problem-Solving and Decision-Making	Coursera	4 weeks	1	University of California
3.	Communication in the 21st Century Workplace	Coursera *	4 weeks	1	University of California
4.	Psychology at Work	Coursera *	6 weeks	2	University of Western Australia
5.	Critical Thinking & Problem Solving	EdX *	3 weeks	3	Rochester Institute of Technology
6.	Successful Career Development	Coursera	7 weeks	2	University System of Georgia
7.	Working in Teams: A Practical Guide	edX	4 weeks	1	University of Queensland
8.	Communication theory: bridging academia and practice	Coursera	9 weeks	3	Higher School of Economics
9.	Speaking Effectively	NPTEL *	8 weeks	3	Indian Institute of Technology, Kharagpur
10.	Introduction to Philosophy	Coursera	5 weeks	1	University of Edinburgh
11.	Moralities of Everyday Life	Coursera	6 weeks	2	Yale University
12.	Introduction to Logic	Coursera *	10 weeks	3	Stanford University
13	Write Professional Emails in English	Coursera *	5 weeks	2	Georgia Institute of Technology
14	Technical Writing	Coursera	5 weeks	1	Moscow Institute of Physics and Technology
15	Learn to Program: The Fundamentals	Coursera	7 weeks	2	University of Toronto
16	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
17	Introduction to Problem Solving and Programming	NPTEL	12 weeks	4	NPTEL
18	The Science of Well Being	Coursera	6 weeks	2	Yale University
19	Developing Soft Skills and Personality	NPTEL	8 weeks	3	
20	Programming Basics	edX	9 weeks	3	IIT Bombay
21	Introduction to Python: Absolute Beginner	EdX *	5 weeks	2	Microsoft
22	Inferential Statistics	Coursera *	7 weeks	2	University of Amsterdam
23	Linear Regression and Modelling	Coursera	4 weeks	1	Duke University
24	Foundation of Data Structures	edX	6 weeks	2	IIT Bombay
25	Introduction to Logic	NPTEL	12 weeks	4	NPTEL
26	Introduction to Probability and Data	Coursera *	5 weeks	1	Duke University
27	Ethics	NPTEL *	12 weeks	4	
28	Science, Technology and Society	NPTEL	12 weeks	4	
29	Creating Innovation	Coursera	6 weeks	2	Macquarie University
30	Ethical Leadership Through Giving Voice to Values	Coursera *	4 weeks	2	University of Virginia
31	Creativity, Innovation, and Change	Coursera *	6 weeks	2	Pennsylvania State University
32	Interpersonal Communication for Engineering Leaders	Coursera	4 weeks	1	Rice University

33	Learn to Program: The Fundamentals	Coursera *	7 weeks	3	University of Toronto
34	Introduction to Mathematical Thinking	Coursera *	9 weeks	3	Stanford University
35	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
36	A Life of Happiness and Fulfillment	Coursera	6 weeks	2	Indian School of Business
37	Model Thinking	Coursera	12 weeks	4	University of Michigan
38	Introduction to Philosophy: God, Knowledge, and Consciousness	edX	12 weeks	4	MIT
39	Soft skills	NPTEL *	12 Weeks	4	IIT Roorkee
40	Developing Soft Skills and Personality	NPTEL *	8 weeks	3	IIT Kanpur
41	Indian Fiction in English	NPTEL	12 Weeks	4	IIT Madras
42	Development of Sociology in India	NPTEL	4 Weeks	1	IIT Kanpur
43	Intellectual Property	NPTEL	12 Weeks	4	IIT Madras
44	Essential Statistics for Data Analysis using Excel	EdX *	Self Paced	3	Microsoft
45	Ethics and Law in Data and Analytics	edX	Self Paced	4	Microsoft
46	Climate Change Mitigation in Developing Countries	Coursera *	6 weeks	3	University of Cape town
47	Web Design for Everybody (Basics of Web Development and Coding) Specialization	Coursera	15weeks	4	University of Michigan
48	Ecology: Ecosystem Dynamics and Conservation	Coursera	5 weeks	1	American Museum of Natural History, Howard Hughes Medical Institute
49	Environmental Studies: A Global Perspective	EdX *	Self Paced	4	Curtin University
50	Introduction to Computer Science and Programming Using Python	edX *	Self Paced	4	MIT, USA
51	Statistics and R	edX *	Self Paced	4	Harvard University
52	Introduction to Programming in C	Coursera *	4 weeks	4	Duke University
53	Java Programming: Solving Problems with Software	Coursera	4 weeks	4	Duke University
54	Grammar and Punctuation	Coursera	4 weeks	1	University of California
55	How to Write an Essay	Coursera *	5 weeks	1	University of California, Berkeley
56	Conversational English Skills	EdX *	10 weeks	3	Tsinghua University
57	Advanced Writing	Coursera *	4 weeks	1	University of California, Irvine
58	Speak English Professionally: In Person, Online & On the Phone	Coursera *	5 weeks	1	Georgia Institute of Technology
59	English for Science, Technology, Engineering, and Mathematics	Coursera	5 weeks	1	University of Pennsylvania
60	English Composition	edX	8 weeks	3	Arizona State University
61	Take Your English Communication Skills to the Next Level	Coursera *	4 weeks	1	Georgia Institute of Technology

**Guidelines regarding
Mandatory Induction Program for
the new students**



Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Date: 06.12.2017

Maulana Abul Kalam Azad University of Technology, West Bengal

Guidelines regarding Induction Programme for the new students

(As per Model Curriculum for 1st Year UG degrees courses in Engineering & Technology, November 2017)

To be followed from the 2018-19 academic session

Preamble: Engineering education has evolved globally in a continuous manner to address the twin needs of industry and society. It is now an accepted fact that the institutions imparting technical education should aspire to create manpower who will possess strong technical knowledge and skill, have leadership qualities and be a team player, capable of coming up with innovative solutions and be alive to societal and community concerns.

The aim of the Induction Programme is to acclimatize the students to the environment of their engineering institution, give them a flavour of the exciting new world of education that they are entering, provide them with mentoring schemes, and make them aware of their neighbourhood, society and people. This will allow them to evolve as well rounded individuals.

The following schedule is laid down by the University to implement the three week long Induction Programme:

Week 1	1 st Half	Day 1	Overall introduction of the new students to the Institution, its different Departments & Faculty Members
	2 nd Half	Day 1	(a) Assignment of faculty mentors to the new students (b) Assessment and allotment for mentoring by senior students preferably from the second year
	2 hrs	Day 2, 3, 4, 5	Lectures by eminent personalities on different areas such as (a) Introduction to Engineering (b) Various topics of science and technology (c) Innovation and entrepreneurship (d) Creative and performing arts (e) Social issues
	2 hrs.	Day 2, 3, 4, 5	Participation in Games, Yoga, Meditation etc.
	2 hrs	Day 2, 3, 4, 5	Visit to the different Departments of the Institute
Week 2 (All Days)	2hrs		Scheduled class lectures as per time table.
	2hrs		Students to be conducted through proficiency modules to be prepared by respective Colleges for ascertaining English skills & Computer knowledge of the students

			and to prepare a report on the same
	2hrs		Participation in Games, Sports, Yoga, Creative arts etc.
Week 3	2hrs		Scheduled class lectures as per time table
		Day 1	Visits to neighbourhood locations
		Day 2	Visits to natural spots in adjoining areas to understand the effect of nature on society
		Day 3	Visits to Science Museum / laboratories
		Day 4	Visits to NGOs
		Day 5	

Any other activity, as deemed fit by the Director/Principal of the affiliated Colleges, may be proposed and discussed with the Academic Coordinator of the University, by sending email to the following address: academics.makaut@gmail.com.

Note: 1) If necessary, networking may be established with NGOs to facilitate the different components and aspects of the Induction Programme.

Mandatory Additional Requirement for earning B. Tech Degree



Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal
BF-142, Sector-I, Saltlake

Notice

Mandatory Additional Requirement for earning B.Tech Degree

Addressing the needs of the industry and the society: Globally, engineering education systems have continuously evolved, in order to address the needs of the industry and the society. It is becoming imperative that every University should create opportunities for the students to inculcate attributes, which are not restricted only to engineering knowledge and acumen. Industry needs professionals who can work successfully in teams, who have leadership qualities, who are alive to social and community needs and who can bring innovation and creativity to their work and who are also digitally proficient. Hence, in order to prepare its students to match these multiple requirements, MAKAUT, WB has created a unique mechanism of awarding 100 Activity Points over and above the academic grades. It is planned that the students at MAKAUT, WB will be able to reap benefits from these activities at their own pace and comfort. It is expected that by the time MAKAUT, WB's students reach their Final Year, they would have developed themselves so well both through their studies in the respective technological field and through their active participation in the co-curricular and extra-curricular activities as also through SAWYAM based learning activities that they would be well-prepared for contributing to building the India and the world of their dreams.

The additional requirement applies to: Every student, who is admitted to the 4 years B.Tech program from the academic year 2018-19 onwards, is required to earn minimum 100 Activity Points in addition to the required academic grades, for getting MAKAUT, WB's B.Tech degree. Similarly, it is mandatory to earn 75 Activity Points, in addition to the academic grades, for getting B.Tech degree by a student (Lateral Entry) who is admitted to the B.Tech program from the academic year 2018-19 onwards. *(Please see Table 1 for details.)* [Lateral Entry students will have a multiplying factor of 1.33 to bring uniformity in score].

Level of Entry in B.Tech Course	Total duration for earning Points	Minimum Points
1 st Year from the academic year 2018-19 onwards	1 st to 4 th Year	100
2 nd Year from the academic year 2018-19 onwards (Lateral Entry)	2 nd to 4 th Year	75

Table – I

For existing Students (except students in the 4th year): Every student, who is admitted to the 4 years B.Tech program prior to the academic year 2018-19, is required to earn minimum number of Activity Points as per Table II in addition to the required academic grades, for getting MAKAUT, WB's B.Tech degree.

Current Semester	Total Points to be earned During the full course
2 nd	100
4 th	75
6 th	50

Table –II

These points must be earned on the basis of active participation in co-curricular and extracurricular activities spanning through all the semesters of study. Every student may choose, as per his/her liking, activities in order to achieve the mandatory points (as per Table-III, depending on his/her entry level), before becoming eligible for award of the Degree. These activities can be spread over the years, as per convenience of the student.

Notes:

- **Current 4th year students who are going to sit for Final Semester examination in May-June, 2018 are outside the preview of this Mandatory Additional Requirement**
- Every student shall participate in the co-curricular and extra-curricular activities and produce documentary proof to the designated Faculty Members appointed by the Head of Department / Principal / Director in the respective college. Thereby the student should earn the required Points before *her* she appears for his/ her Final Examinations.
- A student's result of his/her Final Examinations will be withheld until he/she completes the minimum Activity Points by the end of his/her B.Tech Program.
- In every semester, every student is required to prepare a file containing documentary proofs of activities, done by him / her. This file will be duly verified and Activity Points will be assigned by the teachers as appointed above, at the end of every semester.
- The college will form a 3 members committee and finalize the Activity Points for each student before entering them into the Online Point Entry System (at the URL, as specified by the COE of the University).
- Every student has to earn at least 100 activity points. The points students has earned will be reflected in the student's marksheet.
- Activity points earned by Lateral Entry students will be multiplied by 1.33.

Table III provides a List of Activity Heads and Sub-Activity Heads along with their capping of the Activity Points that can be earned by the students during the entire B.Tech duration.

Sl. No.	Name of the Activity	Points	Maximum Points Allowed
1.	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) (per course)	20	40
2.	Tech Fest/Teachers Day/Freshers Welcome		
	Organizer	5	10
	Participants	3	6
5.	Rural Reporting	5	10
6.	Tree Plantation (per tree)	1	10
7.	Participation in Relief Camps	20	40
8.	Participation in Debate/Group Discussion/ Tech quiz	10	20
9.	Publication of Wall magazine in institutional level (magazine/article/internet)	10	20
10.	Publication in News Paper, Magazine & Blogs	10	20
11.	Research Publication (per publication)	15	30
12.	Innovative Projects (other than course curriculum)	30	60
13.	Blood donation	8	16
	Blood donation camp Organization	10	20
15.	Participation in Sports/Games		
	College level	5	10
	University Level	10	20
	District Level	12	24
	State Level	15	30
	National/International Level	20	20
21.	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20
22.	Member of Professional Society	10	20
23.	Student Chapter	10	20
24.	Relevant Industry Visit & Report	10	20
25.	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	5	10
26.	Participation in Yoga Camp (Certificate to be submitted)	5	10
27.	Self-Entrepreneurship Programme	20	20
28.	Adventure Sports with Certification	10	20
29.	Training to under privileged/Physically challenged	15	30
30.	Community Service & Allied Activities	10	20

Suggestions from the College Principals will be considered to append in the above Table-III.

Sd/-

Registrar(Acting)
MAKAUT,WB

Maulana Abul Kalam Azad University of Technology, West Bengal
Record of Activities for Mandatory Additional Requirement

Annexure-I
Rev:00

College Name (College Code):						Department:						
Student Name:				University Roll No:			Registration No:					
Sl No	Activity	Points	Max. Points Allowed	Points Earned								
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	Total
1	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) per course											
	For 12 weeks duration	20	40									
	For 8 weeks duration	16										
2	Tech Fest/Teachers Day/Freshers Welcome											
	Organizer	5	10									
	Participants	3	6									
3	Rural Reporting	5	10									
4	Tree Plantation and up keeping (per tree)	1	10									
5	Participation in Relief Camps	20	40									
6	Participation in Debate/Group Discussion/ Tech quiz	10	20									
7	Publication of Wall magazine in institutional level (magazine/article/internet)											
	Editor	10	20									
	Writer	6	12									
8	Publication in News Paper, Magazine & Blogs	10	20									
9	Research Publication (per publication)	15	30									
10	Innovative Projects (other than course curriculum)	30	60									
11	Blood donation	8	16									
	Blood donation camp Organization	10	20									

Maulana Abul Kalam Azad University of Technology, West Bengal
Record of Activities for Mandatory Additional Requirement

Annexure-I
Rev:00

Sl No	Activity	Points	Max. Points Allowed	Points Earned								Total
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	
12	<i>Participation in Sports/Games</i>											
	College level	5	10									
	University Level	10	20									
	District Level	12	24									
	State Level	15	30									
	National/International Level	20	20									
13	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20									
14	Member of Professional Society	10	20									
15	Student Chapter	10	20									
16	Relevant Industry Visit & Report	10	20									
17	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	5	10									
18	Participation in Yoga Camp (Certificate to be submitted)	5	10									
19	Self-Entrepreneurship Programme	20	20									
20	Adventure Sports with Certification	10	20									
21	Training to under privileged / Differently abled	15	30									
22	Community Service & Allied Activities	10	20									
Total Points												
Signature of Mentor												
Signature of HOD												
*Please abide strictly to the Notes at the end of the Notice by Registrar, MAKAUT, WB regarding Mandatory Additional Requirement for earning B.Tech Degree												
* <i>Annexure-I</i> is to be retained in the Institute records with all documentary proofs of activities (<i>to be verified by the University as and when required</i>).												

1st Year Curriculum for B.Tech courses in Engineering & Technology

(Applicable from the academic session 2018-2019)



Maulana Abul Kalam Azad University of Technology, West Bengal
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BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits

B. Range of credits :

A range of credits from 150 to 160 for a student to be eligible to get B.Tech Degree in Engineering. A student will be eligible to get B.Tech Degree *with Honours*, if he/she completes an additional 20 credits. These could be acquired through Massive Open Online Courses (MOOCs).

C. MOOCs for B. Tech Honours

The additional 20 credits (for obtaining B. Tech with Honours) are to be gained through MOOCs. The complete description of the MOOCs relevant for the first year course are given in *Annexure-I*. The courses for subsequent years of study will be posted subsequently.

D. Guidelines regarding Mandatory Induction Program for the new students

All concerned are requested to follow the guidelines given in *Annexure-II* (Notice dt.06/12/2017) concerning Mandatory Induction Program. The colleges/ Institute may also refer to the AICTE Model Curriculum for Undergraduate Degree Courses in Engineering & Technology (January 2018) -Volume I (Page No.31-38), if necessary.

E. Mandatory Additional Requirement for earning B. Tech Degree

All concerned are requested to follow the guidelines in *Annexure-III* concerning Mandatory Additional Requirements.

F. Group division:

Group-A:

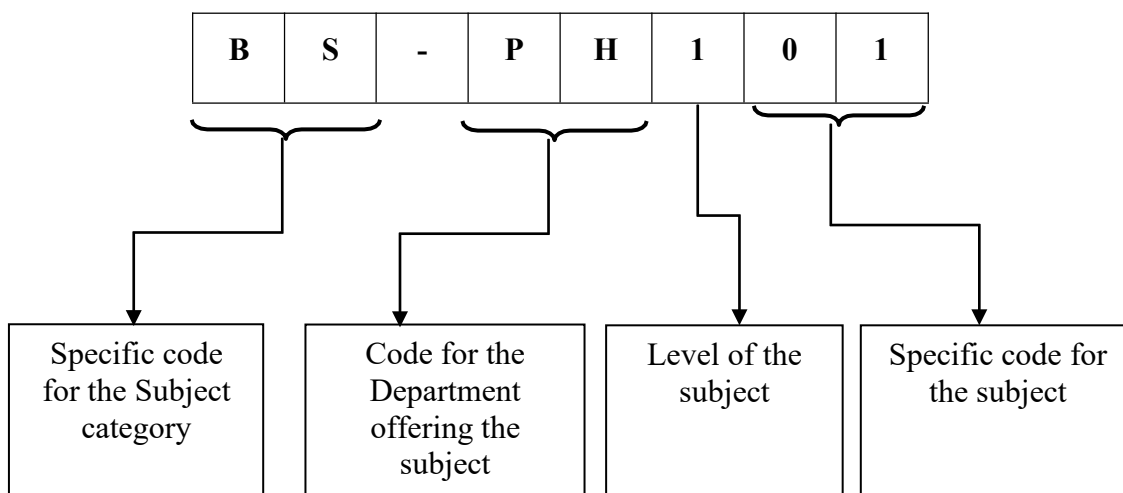
Chemistry based subjects: [Bio-Technology, Food Technology, Leather Technology, Textile Technology, Ceramic Technology, Chemical Engineering and any other Engineering that chooses to be Chemistry based] + Physics based subjects: [Mechanical Engineering, Production Engineering, Civil Engineering, Automobile Engineering, Marine Engineering, Apparel Production Engineering, Computer Science & Engineering, Information Technology.]

Group-B:

All Physics based subjects which are also Electrical & Electronics based [Electrical Engineering, Electronics & Communication Engineering, Applied Electronics & Instrumentation Engineering, Power Engineering, Electrical & Electronics Engineering, Bio-Medical Engineering, Instrumentation & Control Engineering]

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

G. Subject Numbering Scheme:



List of Codes for Subject Category	
Code	Category Name
BS	Basic Science Courses
ES	Engineering Science Courses
HM	Humanities and Social Sciences including Management courses
PC	Professional core courses
PE	Professional Elective courses
OE	Open Elective courses
MC	Mandatory courses
PW	Project

List of Codes for Departments			
Code	Name of the Department	Code	Name of the Department
APM	Apparel Production Engineering	ECE	Electronics & Communication Engineering
AEIE	Applied Electronics & Instrumentation Engineering	FT	Food Technology
AUE	Automobile Engineering	IT	Information Technology
BME	Bio-Medical Engineering	ICE	Instrumentation & Control Engineering
BT	Bio-Technology	LT	Leather Technology
CT	Ceramic Technology	MRE	Marine Engineering
CHE	Chemical Engineering	ME	Mechanical Engineering
CE	Civil Engineering	PWE	Power Engineering
CSE	Computer Science & Engineering	PE	Production Engineering
EEE	Electrical & Electronics Engineering	TT	Textile Technology
EE	Electrical Engineering		

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

First Year First Semester							
Mandatory Induction Program- 3 weeks duration							
Sl No.	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science course	BS-PH101/ BS-CH101	Physics-I (Gr-A)/ Chemistry-I(Gr-B)	3	1	0	4
2	Basic Science course	BS-M101/ BS-M102	Mathematics –IA*/ Mathematics –IB *	3	1	0	4
3	Engineering Science Courses	ES-EE101	Basic Electrical Engineering	3	1	0	4
	Total Theory			9	3	0	12
Practical							
1	Basic Science course	BS-PH191/ BS-CH191	Physics-I Laboratory (Gr-A)/ Chemistry-I Laboratory (Gr-B)	0	0	3	1.5
2	Engineering Science Courses	ES-EE191	Basic Electrical Engineering Laboratory	0	0	2	1
3	Engineering Science Courses	ES-ME191/ ES-ME192	Engineering Graphics & Design(Gr-B)/ Workshop/Manufacturing Practices(Gr-A)	1	0	4	3
	Total Practical			1		9	5.5
	Total of First Semester			10	3	9	17.5

* Mathematics –IA (BS-M101) - CSE & IT
 Mathematics –IB (BS-M102) - All stream except CSE & IT

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

First Year Second Semester							
Sl No.	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science courses	BS-PH201/ BS-CH201	Physics-I (Gr-B)/ Chemistry-I (Gr-A)	3	1	0	4
2	Basic Science courses	BS-M201/ BS-M202	Mathematics –IIA [#] / Mathematics –IIB [#]	3	1	0	4
3	Engineering Science Courses	ES-CS201	Programming for Problem Solving	3	0	0	3
4	Humanities and Social Sciences including Management courses	HM-HU201	English	2	0	0	2
	Total Theory			11	2	0	13
Practical							
1	Basic Science courses	BS-PH291/ BS-CH291	Physics-I Laboratory (Gr-B)/ Chemistry-I Laboratory (Gr-A)	0	0	3	1.5
2	Engineering Science Courses	ES-CS291	Programming for Problem Solving	0	0	4	2
3	Engineering Science Courses	ES-ME291/ ES-ME292	Engineering Graphics & Design(Gr-A)/ Workshop/Manufacturing Practices(Gr-B)	1	0	4	3
4	Humanities and Social Sciences including Management courses	HM-HU291	Language Laboratory	0	0	2	1
	Total Practical			1	0	13	7.5
	Total of Second Semester			12	2	13	20.5

Mathematics –II (BS-M201) - CSE & IT
 Mathematics –II (BS-M202) - All stream except CSE & IT

	Group-A	Group-B
1 st Year 1 st Semester	Physics-I (BS-PH101); Workshop/Manufacturing Practices (ES-ME192)	Chemistry-I (BS-CH101); Engineering Graphics & Design (ES-ME191)
1 st Year 2 nd Semester	Chemistry-I (BS-CH201); Engineering Graphics & Design (ES-ME291)	Physics-I (BS-PH201); Workshop/Manufacturing Practices (ES-ME292)

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Course Code : BS-PH101/ BS-PH201	Category : Basic Science Courses
Course Title : Physics-I	Semester : First/ Second
L-T-P : 3-1-0	Credit:4
Pre-Requisites:	

Course objectives :

Basic concepts of mechanics, optics and its applications, electricity, magnetism and qualitative understanding of concepts of quantum physics and statistical mechanics.

1. Mechanics (7L)

Problems including constraints & friction. Basic ideas of vector calculus and partial differential equations. Potential energy function $F = -\text{grad } V$, equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy & momentum. Non-inertial frames of reference. Harmonic oscillator; Damped harmonic motion forced oscillations and resonance. Motion of a rigid body in a plane and in 3D. Angular velocity vector. Moment of inertia.

2. Optics (5L)

- Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits (only the expressions for max;min, & intensity and qualitative discussion of fringes); diffraction grating(resolution formulac only), characteristics of diffraction grating and its applications.
- Polarisation : Introduction, polarisation by reflection, polarisation by double reflection, scattering of light, circular and elliptical polarisation, optical activity.
- Lasers : Principles and working of laser : population inversion, pumping, various modes, threshold population inversion with examples .

3. Electromagnetism and Dielectric Magnetic Properties of Materials (8L)

- Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielectrics, internal fields in a solid, Clausius- Mossotti equation(expression only), applications of dielectrics.
- Magnetisation , permeability and susceptibility, classificationof magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.

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4. Quantum Mechanics (16L)

- Introduction to quantum physics, black body radiation, explanation using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.

5. Statistical Mechanics (8L)

- Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics.

Course outcomes:

Students will be familiar with

- Basic concepts of mechanics
- Bragg's Law and introduction to the principles of lasers, types of lasers and applications.
- Various terms related to properties of materials such as, permeability, polarization, etc.
- Some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials.
- Simple quantum mechanics calculations.
-

Learning Resources:

1. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited
2. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker, Wiley
3. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press
4. Engineering Mechanics (In SI Units) (SIE), S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati, McGraw Hill Education
5. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education
6. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education
7. Engineering Mechanics, M.K. Harbola, Cengage India
8. An Introduction to Mechanics (SIE), David Kleppner, Robert Kolenkow, McGraw Hill Education
9. Principles of mechanics, John L. Synge and Byron A. Griffith, New York, McGraw-Hill
10. Mechanics (Dover Books on Physics), J. P. Den Hartog, Dover Publications Inc.
11. Engineering Mechanics: Dynamics, L.G. Kraige J.L. Meriam, Wiley
12. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, Robert Eisberg, Robert Resnick, Wiley
13. Introduction to Quantum Mechanics, J. Griffiths David, Pearson Education
14. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press
15. Optics, Hecht, Pearson Education
16. Optics, Ghatak, McGraw Hill Education India Private Limited
17. Fundamentals of Statistical and Thermal Physics, Reif, Sarat Book Distributors
18. Statistical Mechanics, Pathria, Elsevier
19. Statistical Physics, L.D. Landau, E.M. Lifshitz, Butterworth-Heinemann

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Course Code : BS-CH101/ BS-CH201	Category : Basic Science Courses
Course Title : Chemistry-I	Semester : First/ Second
L-T-P : 3-1-0	Credit:4
Pre-Requisites:	

Detailed contents

i) Atomic and molecular structure (10 lectures)

Schrodinger equation. Particle in a box solutions and their applications for simple sample. Molecular orbitals of diatomic molecules (e.g.H₂). Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

ii) Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

iii) Intermolecular forces and potential energy surfaces (4 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena.

iv) Use of free energy in chemical equilibria (8 lectures)

First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

v) Periodic properties (4 Lectures)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

vi) Stereochemistry (4 lectures)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

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vii) Organic reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

Learning Resources:

1. Engineering Chemistry, Satyaprakash, Khanna Book Publishing, Delhi
2. University chemistry, by B. H. Mahan
3. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
4. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
5. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
6. Physical Chemistry, by P. W. Atkins
7. Spectroscopy of Organic Compounds, by P.S.Kalsi, New Age International Pvt Ltd Publishers
8. Physical Chemistry, P. C. Rakshit, Sarat Book House
9. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition
<http://bcs.whfreeman.com/vollhardtschore5e/default.asp>

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Course Code : BS-M101	Category : Basic Science Course
Course Title : Mathematics – I A	Semester : First (CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic	Lectures Hours
1	<i>Calculus (Integration):</i> Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	<i>Calculus (Differentiation):</i> Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	<i>Matrices:</i> Matrices, Vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.	7
4	<i>Vector Spaces:</i> Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem, composition of linear maps, Matrix associated with a linear map.	9
5	<i>Vector Spaces (Continued):</i> Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.	10

Course Outcomes:

The students will be able to:

Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

Understand the domain of applications of mean value theorems to engineering problems.

Learn different types of matrices, concept of rank, methods of matrix inversion and their applications.

Understand linear spaces, its basis and dimension with corresponding applications in the field of computer science.

Learn and apply the concept of eigen values, eigen vectors, diagonalisation of matrices and orthogonalization in inner product spaces for understanding physical and engineering problems

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Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. S.K. Mapa, Higher Algebra: Abstract and Linear, Sarat Book House Pvt.Ltd.
8. Hoffman and Kunze: Linear algebra, PHI.

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Course Code : BS-M102	Category : Basic Science Course
Course Title : Mathematics –I B	Semester : First (All stream except CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic	Lectures Hours
1	<i>Calculus (Integration):</i> Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	<i>Calculus (Differentiation):</i> Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	<i>Sequence and Series:</i> Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.	11
4	<i>Multivariate Calculus:</i> Limit, continuity and partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, Curl and Divergence.	9
5	<i>Matrices:</i> Inverse and rank of a matrix, Rank-nullity theorem; System of linear equations; Symmetric, Skew-symmetric and Orthogonal matrices; Determinants; Eigenvalues and Eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.	8

Course Outcomes:

After completing the course the student will be able to

Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

Understand the domain of applications of mean value theorems to engineering problems.

Learn the tools of power series and Fourier series to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.

Apply the knowledge for addressing the real life problems which comprises of several variables or attributes and identify extremum points of different surfaces of higher dimensions.

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Understand different types of matrices, their eigen values, eigen vectors, rank and also their orthogonal transformations which are essential for understanding physical and engineering problems.

Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.

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Course Code : ES-EE101	Category : Engineering Science Courses
Course Title : Basic Electrical Engineering	Semester : First
L-T-P : 3-1-0	Credit: 4
Pre-Requisites:	

Detailed contents:

Module 1: DC Circuits (8 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers (6 hours)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 hours)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters (6 hours)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

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Course Outcomes

To understand and analyze basic electric and magnetic circuits

To study the working principles of electrical machines and power converters.

To introduce the components of low voltage electrical installations

Learning Recourses:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Book Publishing Co. (P) Ltd., Delhi.
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
4. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
5. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
6. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

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Course Code : BS-PH191/ BS-PH291	Category : Basic Science course
Course Title : Physics-I Laboratory	Semester : First/ Second
L-T-P : 0-0-3	Credit:1.5
Pre-Requisites:	

Choose 10 experiments including at least one from Optics, Electricity and Magnetism and Quantum Mechanics and at least a total of six from these three groups.

Experiments in Optics

1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of a monochromatic light by Newton's ring
3. Determination of wavelength of a monochromatic light by Fresnel's bi-prism
4. Determination of wavelength of the given laser source by diffraction method

Electricity & Magnetism experiments

1. Determination of thermo electric power of a given thermocouple.
2. Determination of specific charge (e/m) of electron by J.J. Thompson's method.
3. Determination of dielectric constant of a given dielectric material.
4. Determination of Hall coefficient of a semiconductor by four probe method.
5. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.
6. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
7. Determination of unknown resistance using Carey Foster's bridge
8. Study of Transient Response in LR, RC and LCR circuits using expeyes
9. Generating sound from electrical energy using expeyes

Experiments in Quantum Physics

1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Lande-g factor using Electron spin resonance spectrometer.
4. Determination of Rydberg constant by studying Hydrogen spectrum.
5. Determination of Band gap of semiconductor.
6. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

Miscellaneous experiments

1. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure
2. Determination of bending moment and shear force of a rectangular beam of uniform cross-section
3. Determination of modulus of rigidity of the material of a rod by static method
4. Determination of rigidity modulus of the material of a wire by dynamic method
5. To determine the moment of inertia of a body about an axis passing through its centre of gravity and to determine the modulus of rigidity of the material of the suspended wire
6. Determination of coefficient of viscosity by Poiseuille's capillary flow method

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Course Code : BS-CH191/ BS-CH291	Category : Basic Science Courses
Course Title : Chemistry-I Laboratory	Semester : First/ Second
L-T-P : 0-0-3	Credit:1.5
Pre-Requisites:	

Choose 10 experiments from the following:

1. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
2. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
3. Determination of dissolved oxygen present in a given water sample.
4. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution)
5. Determination of surface tension and viscosity
6. Thin layer chromatography
7. Ion exchange column for removal of hardness of water
8. Determination of the rate constant of a reaction
9. Determination of cell constant and conductance of solutions
10. Potentiometry - determination of redox potentials and emfs
11. Saponification/acid value of an oil
12. Chemical analysis of a salt
13. Determination of the partition coefficient of a substance between two immiscible liquids
14. Adsorption of acetic acid by charcoal
15. Use of the capillary viscosimeters to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

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Course Code : ES-EE191	Category : Engineering Science Courses
Course Title : Basic Electrical Engineering Laboratory	Semester : First
L-T-P : 0-0-2	Credit: 1
Pre-Requisites:	

Choose 10 experiments from the following:

1. First activity: Introduction to basic safety precautions and mentioning of the do's and Don'ts. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about the modalities of evaluation.
2. Introduction and uses of following instruments :
 - (a) Voltmeter
 - (b) Ammeter
 - (c) Multimeter
 - (d) Oscilloscope

Demonstration of real life resistors, capacitors with color code , inductors and autotransformer.

3. Demonstration of cut-out sections of machines: DC machine, Induction machine, Synchronous machine and single phase induction machine.
4. Calibration of ammeter and Wattmeter.
5. Determination of steady state and transient response of R-L, R-C and R-L-C circuit to a step change in voltage.
6. Determination of steady state response of R-L and R-C and R-L-C circuit and calculation of impedance and power factor.
7. Determination of resonance frequency and quality factor of series and parallel R-L-C circuit.
8. (a) Open circuit and short circuit test of a single-phase transformer
(b) Load test of the transformer and determination of efficiency and regulation
9. Demonstration of three phase transformer connections. Voltage and current relationship, phase shifts between the primary and secondary side.
10. Measurement of power in a three phase unbalanced circuit by two wattmeter method.
11. Determination of Torque –Speed characteristics of separately excited DC motor.
12. Determination of Torque speed characteristics and observation of direction reversal by change of phase sequence of connection of Induction motor.
13. Determination of operating characteristics of Synchronous generator.
14. Demonstration of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter for speed control of an Induction motor
15. Demonstration of components of LT switchgear.

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Course Code : ES-ME191/ ES-ME 291	Category : Engineering Science Courses
Course Title : Engineering Graphics & Design	Semester : First/ Second
L-T-P : 1-0-4	Credit: 3
Pre-Requisites:	

Sl. No.	Content	Lecture (L)	Practical (P)
1	INTRODUCTION TO ENGINEERING DRAWING Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes.	1	4
2	LETTERING, DIMENSIONING, SCALES Plain scale, Diagonal scale and Vernier Scales.	1	4
3	GEOMETRICAL CONSTRUCTION AND CURVES Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Archimedian Spiral.	1	4
4	PROJECTION OF POINTS, LINES, SURFACES Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle, pentagon, Hexagon etc.) inclined Planes - Auxiliary Planes.	1	4
5	PROJECTION OF REGULAR SOLIDS Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).	1	4
6	COMBINATION OF REGULAR SOLIDS, FLOOR PLANS Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.	1	4
7	ISOMETRIC PROJECTIONS Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;	1	4

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8	SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)	1	4
9	OVERVIEW OF COMPUTER GRAPHICS, CUSTOMISATION & CAD DRAWING listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;	1	4
	ANNOTATIONS, LAYERING & OTHER FUNCTIONS applying dimensions to objects, applying annotations to drawings;		
10	Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;	2	8

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11	DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).	2	8
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Course Outcomes

The student will learn:

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling

General Instructions

1. In every topic some problems are to be done in the class and some are to be given to students as home assignment.
2. The problems for class work are to be prepared on drawing sheet of A1 size in the class/ using AutoCAD software.
3. The problems for home assignments are to be prepared on drawing copy/ using AutoCAD software.
4. Print out of every assignment is to be taken for CAD Drawings on Drawing sheets (A4 Sheets).
5. A title block must be prepared in each sheet/ assignment.

Following is the list of drawing instruments that required for making engineering drawings on paper with perfection.

1. Drawing Board
2. Mini drafter/ Set-squares (45°–45° & 60°–90°), T-square
3. Protractor (180°, 360°)
4. Scales (Plain, Diagonal)
5. Compass (Small and Large)
6. Divider (Small and Large)

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7. French Curves
8. Drawing paper (A1 Size)
9. Drawing pencil (H, HB, B)
10. Sharpener
11. Eraser
12. Drawing pins & clips
13. Duster or handkerchief etc.

Learning Resources:

1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House
2. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
5. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
6. Corresponding set of CAD Software Theory and User Manuals

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Course Code : ES-ME192/ ES-ME 292	Category : Engineering Science Courses
Course Title : Workshop/ Manufacturing Practices	Semester : First/ Second
L-T-P : 1-0-4	Credit:3
Pre-Requisites:	

(i) Lectures & videos:

Detailed contents:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Electrical & Electronics
5. Carpentry
6. Plastic moulding, glass cutting
7. Metal casting
8. Welding (arc welding & gas welding), brazing

(ii) Workshop Practice:

Machine shop (8 hours)

Typical jobs that may be made in this practice module:

To make a pin from a mild steel rod in a lathe.

To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Fitting shop (8 hours)

Typical jobs that may be made in this practice module:

To make a Gauge from MS plate.

Carpentry (8 hours)

Typical jobs that may be made in this practice module:

To make wooden joints and/or a pattern or like.

Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs))

Typical jobs that may be made in this practice module:

ARC WELDING (4 hours): To join two thick (approx 6mm) MS plates by manual metal arc welding.

GAS WELDING (4 hours): To join two thin mild steel plates or sheets by gas welding.

Casting (8 hours)

Typical jobs that may be made in this practice module:

One/ two green sand moulds to prepare, and a casting be demonstrated.

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Smithy (4 hours) ~ 4 hours

Typical jobs that may be made in this practice module:

A simple job of making a square rod from a round bar or like.

Plastic moulding & Glass cutting (4 hours)

Typical jobs that may be made in this practice module:

For plastic moulding, making at least one simple plastic component should be made.

For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made.

Electrical & Electronics (8 hours)

Familiarization with LT switchgear elements, making its sketches and noting down its specification. Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable.

Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point.

Simple wiring exercise to be executed to understand the basic electrical circuit.

Simple soldering exercises to be executed to understand the basic process of soldering.

Fabrication of a single-phase full wave rectifier with a step down transformer using four diodes and electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes

Upon completion of this laboratory course, students will be able to fabricate components with their own hands.

They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

By assembling different components, they will be able to produce small devices of their interest.

Learning Resources:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. and Steven S. Schmid, “Manufacturing Engineering and Technology”, 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu, “Manufacturing Technology – I” Pearson Education, 2008.
4. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4th edition, Prentice Hall India, 1998.
5. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGrawHill House, 2017.

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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
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Course Code : BS-M201	Category : Basic Science Course
Course Title : Mathematics – II A	Semester : Second (CSE &IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics and BS-M101	

Module No.	Description of Topic	Lectures Hours
1	Basic Probability: Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the Multinomial distribution, Poisson approximation to the Binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.	11
2	Continuous Probability Distributions: Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities.	4
3	Bivariate Distributions: Bivariate distributions and their properties, distribution of sums and quotients, Conditional densities, Bayes' rule.	5
4	Basic Statistics: Measures of Central tendency, Moments, Skewness and Kurtosis, Probability distributions: Binomial, Poisson and Normal and evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.	8
5	Applied Statistics: Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	8
6	Small samples: Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	4

Course Outcomes:

The students will be able to:

Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.

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Understand the basic ideas of statistics with different characterisation of a univariate and bivariate data set.

Apply statistical tools for analysing data samples and drawing inference on a given data set.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
3. S. Ross, A First Course in Probability, Pearson Education India
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.
5. John E. Freund, Ronald E. Walpole, Mathematical Statistics, Prentice Hall.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
7. N.G. Das, Statistical Methods (Combined Volume), Tata-McGraw Hill.

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Course Code : BS-M202	Category : Basic Science Course
Course Title : Mathematics – II B	Semester : Second (All stream except CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics and BS-M102	

Module No.	Description of Topic	Lectures Hours
1	<i>Multivariate Calculus (Integration):</i> Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, change of variables (Cartesian to Polar), Applications: Areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.	11
2	<i>First order ordinary differential equations:</i> Exact, linear and Bernoulli's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.	5
3	<i>Ordinary differential equations of higher orders:</i> Second order linear differential equations with constant coefficients, Use of D-operators, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.	9
4	<i>Complex Variable – Differentiation</i> Differentiation of complex functions, Cauchy-Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithmic) and their properties; Conformal mappings, Mobius transformations and their properties.	6
5	<i>Complex Variable – Integration</i> Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, Zeros of analytic functions, Singularities, Laurent's series; Residues, Cauchy residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.	9

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Course Outcomes:

The students will be able to:

Learn the methods for evaluating multiple integrals and their applications to different physical problems.

Understand different techniques to solve first and second order ordinary differential equations with its formulation to address the modelling of systems and problems of engineering sciences.

Learn different tools of differentiation and integration of functions of a complex variable that are used with various other techniques for solving engineering problems.

Apply different types of transformations between two 2- dimensional planes for analysis of physical or engineering problems.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. E. L. Ince, Ordinary Differential Equations, Dover Publications.
8. J. W. Brown and R. V. Churchill, Complex Variables and Applications, Mc-Graw Hill.

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

Course Code : ES-CS201	Category : Engineering Science Courses
Course Title : Programming for Problem Solving	Semester : Second
L-T-P : 3-0-0	Credit:3
Pre-Requisites:	

Detailed contents

Unit 1: Introduction to Programming (4 lectures)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - **(1 lecture)**.

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. **(1 lecture)**

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- **(2 lectures)**

Unit 2: Arithmetic expressions and precedence (2 lectures)

Unit 3: Conditional Branching and Loops (6 lectures)

Writing and evaluation of conditionals and consequent branching **(3 lectures)**

Iteration and loops **(3 lectures)**

Unit 4: Arrays (6 lectures)

Arrays (1-D, 2-D), Character arrays and Strings

Unit 5: Basic Algorithms (6 lectures)

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 6: Function (5 lectures)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Unit 7: Recursion (4 -5 lectures)

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 8: Structure (4 lectures)

Structures, Defining structures and Array of Structures

Unit 9: Pointers (2 lectures)

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Unit 10: File handling (only if time is available, otherwise should be done as part of the lab)

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Course Outcomes

The student will learn

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical errors.
- To implement conditional branching, iteration and recursion.
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- To apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.

Learning Resources:

1. R. S. Salaria, Computer Concepts and Programming in C, Khanna Publishers
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

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Course Code : ES-CS291	Category : Engineering Science Courses
Course Title : Programming for Problem Solving	Semester : Second
L-T-P : 0-0-4	Credit:2
Pre-Requisites:	

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

Tutorial 12: File handling:

Lab 12: File operations

Laboratory Outcomes

To formulate the algorithms for simple problems

To translate given algorithms to a working and correct program

To be able to correct syntax errors as reported by the compilers

To be able to identify and correct logical errors encountered at run time

To be able to write iterative as well as recursive programs

To be able to represent data in arrays, strings and structures and manipulate them through a program

To be able to declare pointers of different types and use them in defining self-referential structures.

To be able to create, read and write to and from simple text files.

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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
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Course Code : HM-HU201	Category : Humanities and Social Sciences including Management courses
Course Title : English	Semester : Second
L-T-P : 2-0-0	Credit:2
Pre-Requisites:	

Detailed contents

1. Vocabulary Building

- 1.1 The concept of Word Formation: Compounding, Backformation, Clipping, Blending.
- 1.2 Root words from foreign languages and their use in English
- 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
- 1.4 Synonyms, antonyms, and standard abbreviations: Acronyms

2. Basic Writing Skills

- 2.1 Sentence Structures & Types: Simple, Compound, Complex
- 2.2 Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration
- 2.3 Importance of proper punctuation
- 2.4 Creating coherence: Arranging paragraphs & Sentences in logical order
- 2.5 Creating Cohesion: Organizing principles of paragraphs in documents
- 2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

- 3.1 Subject-verb agreement
- 3.2 Noun-pronoun agreement
- 3.3 Misplaced modifiers
- 3.4 Articles
- 3.5 Prepositions
- 3.6 Redundancies
- 3.7 Clichés

4. Nature and Style of sensible Writing

- 4.1 Describing
- 4.2 Defining
- 4.3 Classifying
- 4.4 Providing examples or evidence
- 4.5 Writing introduction and conclusion

5. Writing Practices

- 5.1 Comprehension
- 5.2 Précis Writing
- 5.3 Essay Writing
- 5.4 Business Letter, Cover Letter & CV; E-mail

Addendum

Some examples of English words with foreign roots

Greek Root/Affix	Examples
Anti	Antisocial, antiseptic

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Auto	Automatic, autograph
Anthropos	Anthropology, philanthropy
Bio	Biography
Chronos	Time
Di	Dilemma
Bio	Biology
Biblio	Bibliography
Chron	Chronology
Cracy	Contradiction
Geo	Geology
Hyper	Hyperactive
Mania	Kleptomania
Mega	Megaserial
Eu	Eulogy, euphoria
Geo	Geology
Graph	autograph, photograph
Hetero	Heterogeneous
Hyper	Hyperactive
Hypo	hypodermic, hypoglycemia
Macro	Macrocosm
Mega	megalomania
Micro	microcosm

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Mono	Monarch
Pan	Panorama
Pathos	Pathetic
Phobia	Hydrophobia
Pod (Gk), ped (Latin)	Pseudopodia
Poly	polyglot
Tele	Telephone
Theo	Theology, theist
Latin Root	Examples
Aud	Audible
Bene	Beneficial
Brev	abbreviate, brief
circum	Circulate
Contra	Contradict
Cred	Credible
Dict	Diction
Femina	Feminine
Inter	Internet, interval
Magna	Magnificent
Mal	Malnutrition
Multi	multinational
Nova	Novel
Multi	Multiple, multiplex
Non	Nonstop

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Pre	Previous, predicate
Re	Redo, rewind
Scrib	Scripture
Spect	Spectator
Trans	Transport
Uni	Unity
Omni	Omnipotent
Semi	Semicircle
Sub	Subway
somnus	Insomnia,
Super	Superman
Sym	Sympathy
scribe	Describe, scribble(write illegibly), inscribe
Trans	Transform
Un	Unnecessary
Uni	Universal

Learning Resources:

- (i) Kulbushan Kumar, R S Salaria, Effective Communication Skills, Khanna Publishing House, Delhi.
- (ii) Practical English Usage. Michael Swan. OUP. 1995.
- (iii) Remedial English Grammar. F.T. Wood. Macmillan. 2007
- (iv) On Writing Well. William Zinsser. Harper Resource Book. 2001
- (v) Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- (vi) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
- (vii) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
- (viii) Universal English Prof. Prasad Kataria Publications, 2019.
- (ix) "Communication Skills for Professionals"-Nira Konar, Prentice Hall of India 2nd edition, New Delhi, 2011
- (x) Gajendra Singh Chauhan, Smita Kashiramka and L. Thimmesha. Functional English. Cengage , 2019.

Course Outcomes

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

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Course Code : HM-HU291	Category : Humanities and Social Sciences including Management courses
Course Title : Language Laboratory	Semester : Second
L-T-P : 0-0-2	Credit:1
Pre-Requisites:	

- | | |
|---|----|
| 1) Honing 'Listening Skill' and its sub skills through Language Lab Audio device; | 3P |
| 2) Honing 'Speaking Skill' and its sub skills | 2P |
| 3) Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/
Voice modulation/ Stress/ Intonation/ Pitch & Accent) of connected speech | 2P |
| 4) Honing 'Conversation Skill' using Language Lab Audio –Visual input;
Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone &
Role Play Mode) | 2P |
| 5) Introducing 'Group Discussion' through audio –Visual input and acquainting them
with key strategies for success | 2P |
| 6) G D Practice Sessions for helping them internalize basic Principles
(turn- taking, creative intervention, by using correct body language, courtesies &
other soft skills) of GD | 4P |
| 7) Honing 'Reading Skills' and its sub skills using Visual / Graphics/
Diagrams /Chart Display/Technical/Non Technical Passages
Learning Global / Contextual / Inferential Comprehension; | 2P |
| 8) Honing 'Writing Skill' and its sub skills by using
Language Lab Audio –Visual input; Practice Sessions | 2P |

Course Outcomes

- The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

MOOCs for B. Tech Honours



Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

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Maulana Abul Kalam Azad University of Technology, West Bengal

Notice

1st May, 2018

MOOCs for B.Tech Honours (Applicable from the session 2018-2019)

Preamble

All India Council for Technical Education (AICTE) has introduced Model Curriculum for Bachelor of Technology programme with 160 credits in the entire programme of 4 years, and additional 20 credits will be required to be done for the degree of Bachelor of Technology with Honours. These additional 20 credits will have to be acquired with online courses (MOOCs) as per AICTE. So students will have to complete additional 20 credits through MOOCs within 4 years of time. This creates an excellent opportunity for students to acquire the necessary skill set for employability through massive online courses where the rare expertise of world famous experts from academics and industry are available. Maulana Abul Kalam Azad University of Technology, West Bengal (MAKAUT,WB) has thus decided to introduce AICTE model curriculum for its B.Tech Programmes and suggest baskets for MOOCs available year wise for the four-year long B.Tech programme from the sessions 2018-2019. The basket for MOOCs will be a dynamic one, as courses keep on updating with time. Few essential skill sets required for employability are also identified year wise by MAKAUT,WB. For MOOCs platforms where examination or assessment is absent (like SWAYAM) or where certification is costly (like Coursera or edX), faculty members of the Institutes are to audit the courses and prepare the examination question papers, for the courses undertaken by the students of respective Institutes, so that MAKAUT,WB can conduct examination for the course. The total of 20 credits that is required to be attained for B.Tech Honours degree are distributed over four years in the following way:

For first year	:	8 credits
For second year	:	4 credits
For third year	:	4 credits
For fourth year	:	4 credits

A student of first year has to cover courses from at least three skills :

1. Computer Programing with Python / R
2. Soft skill
3. Ethics

Courses are * marked in the above areas

If a student is unable to cover the credits assigned for the first year, he/she can do these courses in either of the subsequent years, but he/she has to choose the courses from the basket of MOOCs announced by MAKAUT,WB from time to time. The same rule will be applicable for the other years of the programme.

The basket for MOOCs for the 1st year B. Tech for the session 2018-2019 are made available herewith.

By order.

MOOCs for First Year, Engineering and Technology

Sl. No	Course	Provider	Duration	Credits	Name of University / Institution
1.	Presentation Skills: Designing Presentation Slides	Coursera *	4 weeks	1	Tomsk State University
2.	Effective Problem-Solving and Decision-Making	Coursera	4 weeks	1	University of California
3.	Communication in the 21st Century Workplace	Coursera *	4 weeks	1	University of California
4.	Psychology at Work	Coursera *	6 weeks	2	University of Western Australia
5.	Critical Thinking & Problem Solving	EdX *	3 weeks	3	Rochester Institute of Technology
6.	Successful Career Development	Coursera	7 weeks	2	University System of Georgia
7.	Working in Teams: A Practical Guide	edX	4 weeks	1	University of Queensland
8.	Communication theory: bridging academia and practice	Coursera	9 weeks	3	Higher School of Economics
9.	Speaking Effectively	NPTEL *	8 weeks	3	Indian Institute of Technology, Kharagpur
10.	Introduction to Philosophy	Coursera	5 weeks	1	University of Edinburgh
11.	Moralities of Everyday Life	Coursera	6 weeks	2	Yale University
12.	Introduction to Logic	Coursera *	10 weeks	3	Stanford University
13	Write Professional Emails in English	Coursera *	5 weeks	2	Georgia Institute of Technology
14	Technical Writing	Coursera	5 weeks	1	Moscow Institute of Physics and Technology
15	Learn to Program: The Fundamentals	Coursera	7 weeks	2	University of Toronto
16	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
17	Introduction to Problem Solving and Programming	NPTEL	12 weeks	4	NPTEL
18	The Science of Well Being	Coursera	6 weeks	2	Yale University
19	Developing Soft Skills and Personality	NPTEL	8 weeks	3	
20	Programming Basics	edX	9 weeks	3	IIT Bombay
21	Introduction to Python: Absolute Beginner	EdX *	5 weeks	2	Microsoft
22	Inferential Statistics	Coursera *	7 weeks	2	University of Amsterdam
23	Linear Regression and Modelling	Coursera	4 weeks	1	Duke University
24	Foundation of Data Structures	edX	6 weeks	2	IIT Bombay
25	Introduction to Logic	NPTEL	12 weeks	4	NPTEL
26	Introduction to Probability and Data	Coursera *	5 weeks	1	Duke University
27	Ethics	NPTEL *	12 weeks	4	
28	Science, Technology and Society	NPTEL	12 weeks	4	
29	Creating Innovation	Coursera	6 weeks	2	Macquarie University
30	Ethical Leadership Through Giving Voice to Values	Coursera *	4 weeks	2	University of Virginia
31	Creativity, Innovation, and Change	Coursera *	6 weeks	2	Pennsylvania State University
32	Interpersonal Communication for Engineering Leaders	Coursera	4 weeks	1	Rice University

33	Learn to Program: The Fundamentals	Coursera *	7 weeks	3	University of Toronto
34	Introduction to Mathematical Thinking	Coursera *	9 weeks	3	Stanford University
35	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
36	A Life of Happiness and Fulfillment	Coursera	6 weeks	2	Indian School of Business
37	Model Thinking	Coursera	12 weeks	4	University of Michigan
38	Introduction to Philosophy: God, Knowledge, and Consciousness	edX	12 weeks	4	MIT
39	Soft skills	NPTEL *	12 Weeks	4	IIT Roorkee
40	Developing Soft Skills and Personality	NPTEL *	8 weeks	3	IIT Kanpur
41	Indian Fiction in English	NPTEL	12 Weeks	4	IIT Madras
42	Development of Sociology in India	NPTEL	4 Weeks	1	IIT Kanpur
43	Intellectual Property	NPTEL	12 Weeks	4	IIT Madras
44	Essential Statistics for Data Analysis using Excel	EdX *	Self Paced	3	Microsoft
45	Ethics and Law in Data and Analytics	edX	Self Paced	4	Microsoft
46	Climate Change Mitigation in Developing Countries	Coursera *	6 weeks	3	University of Cape town
47	Web Design for Everybody (Basics of Web Development and Coding) Specialization	Coursera	15weeks	4	University of Michigan
48	Ecology: Ecosystem Dynamics and Conservation	Coursera	5 weeks	1	American Museum of Natural History, Howard Hughes Medical Institute
49	Environmental Studies: A Global Perspective	EdX *	Self Paced	4	Curtin University
50	Introduction to Computer Science and Programming Using Python	edX *	Self Paced	4	MIT, USA
51	Statistics and R	edX *	Self Paced	4	Harvard University
52	Introduction to Programming in C	Coursera *	4 weeks	4	Duke University
53	Java Programming: Solving Problems with Software	Coursera	4 weeks	4	Duke University
54	Grammar and Punctuation	Coursera	4 weeks	1	University of California
55	How to Write an Essay	Coursera *	5 weeks	1	University of California, Berkeley
56	Conversational English Skills	EdX *	10 weeks	3	Tsinghua University
57	Advanced Writing	Coursera *	4 weeks	1	University of California, Irvine
58	Speak English Professionally: In Person, Online & On the Phone	Coursera *	5 weeks	1	Georgia Institute of Technology
59	English for Science, Technology, Engineering, and Mathematics	Coursera	5 weeks	1	University of Pennsylvania
60	English Composition	edX	8 weeks	3	Arizona State University
61	Take Your English Communication Skills to the Next Level	Coursera *	4 weeks	1	Georgia Institute of Technology

**Guidelines regarding
Mandatory Induction Program for
the new students**



Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Date: 06.12.2017

Maulana Abul Kalam Azad University of Technology, West Bengal

Guidelines regarding Induction Programme for the new students

(As per Model Curriculum for 1st Year UG degrees courses in Engineering & Technology, November 2017)

To be followed from the 2018-19 academic session

Preamble: Engineering education has evolved globally in a continuous manner to address the twin needs of industry and society. It is now an accepted fact that the institutions imparting technical education should aspire to create manpower who will possess strong technical knowledge and skill, have leadership qualities and be a team player, capable of coming up with innovative solutions and be alive to societal and community concerns.

The aim of the Induction Programme is to acclimatize the students to the environment of their engineering institution, give them a flavour of the exciting new world of education that they are entering, provide them with mentoring schemes, and make them aware of their neighbourhood, society and people. This will allow them to evolve as well rounded individuals.

The following schedule is laid down by the University to implement the three week long Induction Programme:

Week 1	1 st Half	Day 1	Overall introduction of the new students to the Institution, its different Departments & Faculty Members
	2 nd Half	Day 1	(a) Assignment of faculty mentors to the new students (b) Assessment and allotment for mentoring by senior students preferably from the second year
	2 hrs	Day 2, 3, 4, 5	Lectures by eminent personalities on different areas such as (a) Introduction to Engineering (b) Various topics of science and technology (c) Innovation and entrepreneurship (d) Creative and performing arts (e) Social issues
	2 hrs.	Day 2, 3, 4, 5	Participation in Games, Yoga, Meditation etc.
	2 hrs	Day 2, 3, 4, 5	Visit to the different Departments of the Institute
Week 2 (All Days)	2hrs		Scheduled class lectures as per time table.
	2hrs		Students to be conducted through proficiency modules to be prepared by respective Colleges for ascertaining English skills & Computer knowledge of the students

			and to prepare a report on the same
	2hrs		Participation in Games, Sports, Yoga, Creative arts etc.
Week 3	2hrs		Scheduled class lectures as per time table
		Day 1	Visits to neighbourhood locations
		Day 2	Visits to natural spots in adjoining areas to understand the effect of nature on society
		Day 3	Visits to Science Museum / laboratories
		Day 4	Visits to NGOs
		Day 5	

Any other activity, as deemed fit by the Director/Principal of the affiliated Colleges, may be proposed and discussed with the Academic Coordinator of the University, by sending email to the following address: academics.makaut@gmail.com.

Note: 1) If necessary, networking may be established with NGOs to facilitate the different components and aspects of the Induction Programme.

Mandatory Additional Requirement for earning B. Tech Degree



Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal
BF-142, Sector-I, Saltlake

Notice

Mandatory Additional Requirement for earning B.Tech Degree

Addressing the needs of the industry and the society: Globally, engineering education systems have continuously evolved, in order to address the needs of the industry and the society. It is becoming imperative that every University should create opportunities for the students to inculcate attributes, which are not restricted only to engineering knowledge and acumen. Industry needs professionals who can work successfully in teams, who have leadership qualities, who are alive to social and community needs and who can bring innovation and creativity to their work and who are also digitally proficient. Hence, in order to prepare its students to match these multiple requirements, MAKAUT, WB has created a unique mechanism of awarding 100 Activity Points over and above the academic grades. It is planned that the students at MAKAUT, WB will be able to reap benefits from these activities at their own pace and comfort. It is expected that by the time MAKAUT, WB's students reach their Final Year, they would have developed themselves so well both through their studies in the respective technological field and through their active participation in the co-curricular and extra-curricular activities as also through SAWYAM based learning activities that they would be well-prepared for contributing to building the India and the world of their dreams.

The additional requirement applies to: Every student, who is admitted to the 4 years B.Tech program from the academic year 2018-19 onwards, is required to earn minimum 100 Activity Points in addition to the required academic grades, for getting MAKAUT, WB's B.Tech degree. Similarly, it is mandatory to earn 75 Activity Points, in addition to the academic grades, for getting B.Tech degree by a student (Lateral Entry) who is admitted to the B.Tech program from the academic year 2018-19 onwards. *(Please see Table 1 for details.)* [Lateral Entry students will have a multiplying factor of 1.33 to bring uniformity in score].

Level of Entry in B.Tech Course	Total duration for earning Points	Minimum Points
1 st Year from the academic year 2018-19 onwards	1 st to 4 th Year	100
2 nd Year from the academic year 2018-19 onwards (Lateral Entry)	2 nd to 4 th Year	75

Table – I

For existing Students (except students in the 4th year): Every student, who is admitted to the 4 years B.Tech program prior to the academic year 2018-19, is required to earn minimum number of Activity Points as per Table II in addition to the required academic grades, for getting MAKAUT, WB's B.Tech degree.

Current Semester	Total Points to be earned During the full course
2 nd	100
4 th	75
6 th	50

Table –II

These points must be earned on the basis of active participation in co-curricular and extracurricular activities spanning through all the semesters of study. Every student may choose, as per his/her liking, activities in order to achieve the mandatory points (as per Table-III, depending on his/her entry level), before becoming eligible for award of the Degree. These activities can be spread over the years, as per convenience of the student.

Notes:

- **Current 4th year students who are going to sit for Final Semester examination in May-June, 2018 are outside the preview of this Mandatory Additional Requirement**
- Every student shall participate in the co-curricular and extra-curricular activities and produce documentary proof to the designated Faculty Members appointed by the Head of Department / Principal / Director in the respective college. Thereby the student should earn the required Points before *her* she appears for his/ her Final Examinations.
- A student's result of his/her Final Examinations will be withheld until he/she completes the minimum Activity Points by the end of his/her B.Tech Program.
- In every semester, every student is required to prepare a file containing documentary proofs of activities, done by him / her. This file will be duly verified and Activity Points will be assigned by the teachers as appointed above, at the end of every semester.
- The college will form a 3 members committee and finalize the Activity Points for each student before entering them into the Online Point Entry System (at the URL, as specified by the COE of the University).
- Every student has to earn at least 100 activity points. The points students has earned will be reflected in the student's marksheet.
- Activity points earned by Lateral Entry students will be multiplied by 1.33.

Table III provides a List of Activity Heads and Sub-Activity Heads along with their capping of the Activity Points that can be earned by the students during the entire B.Tech duration.

Sl. No.	Name of the Activity	Points	Maximum Points Allowed
1.	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) (per course)	20	40
2.	Tech Fest/Teachers Day/Freshers Welcome		
	Organizer	5	10
	Participants	3	6
5.	Rural Reporting	5	10
6.	Tree Plantation (per tree)	1	10
7.	Participation in Relief Camps	20	40
8.	Participation in Debate/Group Discussion/ Tech quiz	10	20
9.	Publication of Wall magazine in institutional level (magazine/article/internet)	10	20
10.	Publication in News Paper, Magazine & Blogs	10	20
11.	Research Publication (per publication)	15	30
12.	Innovative Projects (other than course curriculum)	30	60
13.	Blood donation	8	16
	Blood donation camp Organization	10	20
15.	Participation in Sports/Games		
	College level	5	10
	University Level	10	20
	District Level	12	24
	State Level	15	30
	National/International Level	20	20
21.	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20
22.	Member of Professional Society	10	20
23.	Student Chapter	10	20
24.	Relevant Industry Visit & Report	10	20
25.	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	5	10
26.	Participation in Yoga Camp (Certificate to be submitted)	5	10
27.	Self-Entrepreneurship Programme	20	20
28.	Adventure Sports with Certification	10	20
29.	Training to under privileged/Physically challenged	15	30
30.	Community Service & Allied Activities	10	20

Suggestions from the College Principals will be considered to append in the above Table-III.

Sd/-

Registrar(Acting)
MAKAUT,WB

Maulana Abul Kalam Azad University of Technology, West Bengal
Record of Activities for Mandatory Additional Requirement

Annexure-I
Rev:00

College Name (College Code):					Department:							
Student Name:			University Roll No:			Registration No:						
Sl No	Activity	Points	Max. Points Allowed	Points Earned								
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	Total
1	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) per course											
	For 12 weeks duration	20	40									
	For 8 weeks duration	16										
2	Tech Fest/Teachers Day/Freshers Welcome											
	Organizer	5	10									
	Participants	3	6									
3	Rural Reporting	5	10									
4	Tree Plantation and up keeping (per tree)	1	10									
5	Participation in Relief Camps	20	40									
6	Participation in Debate/Group Discussion/ Tech quiz	10	20									
7	Publication of Wall magazine in institutional level (magazine/article/internet)											
	Editor	10	20									
	Writer	6	12									
8	Publication in News Paper, Magazine & Blogs	10	20									
9	Research Publication (per publication)	15	30									
10	Innovative Projects (other than course curriculum)	30	60									
11	Blood donation	8	16									
	Blood donation camp Organization	10	20									

Maulana Abul Kalam Azad University of Technology, West Bengal
Record of Activities for Mandatory Additional Requirement

Annexure-I
Rev:00

Sl No	Activity	Points	Max. Points Allowed	Points Earned								Total
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	
12	<i>Participation in Sports/Games</i>											
	College level	5	10									
	University Level	10	20									
	District Level	12	24									
	State Level	15	30									
	National/International Level	20	20									
13	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20									
14	Member of Professional Society	10	20									
15	Student Chapter	10	20									
16	Relevant Industry Visit & Report	10	20									
17	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	5	10									
18	Participation in Yoga Camp (Certificate to be submitted)	5	10									
19	Self-Entrepreneurship Programme	20	20									
20	Adventure Sports with Certification	10	20									
21	Training to under privileged / Differently abled	15	30									
22	Community Service & Allied Activities	10	20									
Total Points												
Signature of Mentor												
Signature of HOD												
*Please abide strictly to the Notes at the end of the Notice by Registrar, MAKAUT, WB regarding Mandatory Additional Requirement for earning B.Tech Degree												
* <i>Annexure-I</i> is to be retained in the Institute records with all documentary proofs of activities (<i>to be verified by the University as and when required</i>).												

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
 (Applicable from the academic session 2018-2019)

SEMESTER – III

Analog & Digital Electronics

Code: ESC-301

Contact: 3L

Name of the Course:	Analog & Digital Electronics		
Course Code: ESC-301	Semester: III		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: hrs./week		End Semester Exam : 70 Marks	
Credit Points:	3		
Objective:			
1	To acquire the basic knowledge of different analog components and their applications		
2	To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.		
3	To prepare students to perform the analysis and design of various digital electronic circuits		
Pre-Requisite:			
1	Basic Electronics Parts I & II learned in the First year, semesters 1 & 2. Basic BJTs,.		
2	Basic concept of the working of P-N diodes, Schottky diodes,		
3	Basic FETs and OPAMP as a basic circuit component. Concept of Feedback		

Unit	Content	Hrs/Unit	Marks/Unit
1	Different Classes of Amplifiers - (Class-A, B, AB and C - basic concepts, power, efficiency; Recapitulation of basic concepts of Feedback and Oscillation, Phase Shift, Wein Bridge oscillators Astable & Monostable Multivibrators; Schmitt Trigger circuits, 555 Timer.	9	
2	Binary Number System & Boolean Algebra (recapitulation); BCD, ASCII, EBCDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic, Venn diagram, Boolean algebra (recapitulation); Representation in SOP and POS forms; Minimization of logic	11	

Maulana Abul Kalam Azad University of Technology, West Bengal
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Syllabus for B. Tech in Information Technology

(Applicable from the academic session 2018-2019)

	expressions by algebraic method. Combinational circuits - Adder and Subtractor circuits (half & full adder & subtractor); Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator		
3	Sequential Circuits - Basic Flip-flop & Latch, Flip-flops -SR, JK, D, T and JK Master-slave Flip Flops, Registers (SISO, SIPO, PIPO, PISO) Ring counter, Johnson counter Basic concept of Synchronous and Asynchronous counters (detail design of circuits excluded), Design of Mod N Counter	10	
4.	A/D and D/A conversion techniques - Basic concepts (D/A :R-2-R only [2L] A/D: successive approximation [2L]) Logic families- TTL, ECL, MOS and CMOS - basic concepts. (2L)	6	

Text book and Reference books:

1. I.G.Nagrath, Analog Electronics, PHI
2. Analog Electronics, A.K. Maini, Khanna Publishing House
3. Microelectronics Engineering –Sedra & Smith-Oxford.
4. Principles of Electronic Devices & circuits—B L Thereja & Sedha—S Chand
5. Digital Electronics – Kharate – Oxford
6. Digital Electronics – Logic & Systems by J.Bigmeil & R.Donovan; Cambridge Learning.
7. Digital Logic and State Machine Design (3rd Edition) – D.J.Comer, OUP
8. Electronic Devices & Circuit Theory – Boyelstad & Nashelsky - PHI
9. Bell-Linear IC & OP AMP—Oxford
10. P.Raja- Digital Electronics- Scitech Publications
11. Morries Mano- Digital Logic Design- PHI
12. R.P.Jain—Modern Digital Electronics, 2/e ,McGraw Hill
13. H.Taub & D.Shilling, Digital Integrated Electronics- McGraw Hill.
14. D.RayChaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers
15. Tocci, Widmer, Moss- Digital Systems,9/e- Pearson
16. J.Bignell & R.Donovan-Digital Electronics-5/e- Cenage Learning.
17. Leach & Malvino—Digital Principles & Application, 5/e, McGraw Hill
18. Floyed & Jain- Digital Fundamentals-Pearson.

Course Outcomes:

On completion of the course students will be able to

- ESC-301.1 Realize the basic operations of different analog components.
- ESC-301.2 Realize basic gate operations and laws Boolean algebra.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Information Technology

(Applicable from the academic session 2018-2019)

ESC-301.3 Understand basic structure of digital computer, stored program concept and different arithmetic and control unit operations.

Data Structure & Algorithm

Code: PCC-CS301

Contacts: 3L

Name of the Course:	Data Structure & Algorithm		
Course Code: PCC-CS301	Semester: III		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance : 5 marks	
Practical: hrs./week		End Semester Exam :70 Marks	
Credit Points:	3		
Objective:			
1	To learn the basics of abstract data types.		
2	To learn the principles of linear and nonlinear data structures.		
3	To build an application using sorting and searching		
Pre-Requisite:			
1	CS 201 (Basic Computation and Principles of C		
2	M101 & M201 (Mathematics), basics of set theory		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Technique sand their complexity analysis.	10	
2	Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.	9	
3	Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from	10	

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	linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis. Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis		
4.	Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing. Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.	9	

Text book and Reference books:

1. "Data Structures and Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung.
2. "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed.
3. "Data Structures in C" by Aaron M. Tenenbaum.
4. "Data Structures" by S. Lipschutz.
5. "Data Structures" by R.S. Salaria, Khanna Publishing House
6. "Data Structures through C" by Yashwant Kanitkar, BPB House
7. "Data Structures Using C" by Reema Thareja.
8. "Data Structure Using C", 2/e by A.K. Rath, A. K. Jagadev.
9. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein

Course Outcomes:

On completion of the course students will be able to

PCC-CS301.1 Differentiate how the choices of data structure & algorithm methods impact the performance of program.

PCC-CS301.2 Solve problems based upon different data structure & also write programs.

PCC-CS301.3 Identify appropriate data structure & algorithmic methods in solving problem.

PCC-CS301.4 Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing

PCC-CS301.5 Compare and contrast the benefits of dynamic and static data structures implementations.

Maulana Abul Kalam Azad University of Technology, West Bengal
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Computer Organization
Code: PCC-CS302
Contacts: 3L

Name of the Course:	Computer Organization		
Course Code: PCC-CS302	Semester: III		
Duration:6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz : 10 marks	
		Attendance: 5 marks	
Practical: hrs./week		End Semester Exam: 70 Marks	
Credit Points:	3		
Objective:			
1	To prepare students to perform the analysis and design of various digital electronic circuits.		
2	To know how Computer Systems work & its basic principles		
3	To know how I/O devices are being accessed and its principles etc		
Pre-Requisite:			
1	Concept of basic components of a digital computer, Basic concept of Fundamentals & Programme structures. Boolean Algebra		
2	Basic number systems, Binary numbers, representation of signed and unsigned numbers, Binary Arithmetic as covered in Basic Computation & Principles of Computer Programming		
3	Boolean Algebra		

Unit	Content	Hrs/Unit	Marks/Unit
1	Basic organization of the stored program computer and operation sequence for execution of a program. Role of operating systems and compiler/assembler. Fetch, decode and execute cycle, Concept of operator, operand, registers and storage, Instruction format. Instruction sets and addressing modes. [7L] Commonly used number systems. Fixed and floating point representation of numbers. [1L]	8	
2	Overflow and underflow. Design of adders - ripple carry and carry look ahead principles. [3L] Design of ALU. [1L] Fixed point multiplication -Booth's algorithm. [1L]	8	

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Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

	Fixed point division - Restoring and non-restoring algorithms. [2L] Floating point - IEEE 754 standard. [1L]		
3	Memory unit design with special emphasis on implementation of CPU-memory interfacing. [2L] Memory organization, static and dynamic memory, memory hierarchy, associative memory. [3L] Cache memory, Virtual memory. Data path design for read/write access. [5L]	10	
4.	Design of control unit - hardwired and microprogrammed control. [3L] Introduction to instruction pipelining. [2L] Introduction to RISC architectures. RISC vs CISC architectures. [2L] I/O operations - Concept of handshaking, Polled I/O, interrupt and DMA. [3L]	10	

Text book and Reference books:

1. Mano, M.M., "Computer System Architecture", PHI.
2. Behrooz Parhami "Computer Architecture", Oxford University Press
3. Hayes J. P., "Computer Architecture & Organisation", McGraw Hill,
4. Hamacher, "Computer Organisation", McGraw Hill,
5. N. senthil Kumar, M. Saravanan, S. Jeevananthan, "Microprocessors and Microcontrollers" OUP
6. Chaudhuri P. Pal, "Computer Organisation & Design", PHI,
7. P N Basu- "Computer Organization & Architecture" ,Vikas Pub
8. B. Ram, "Computer Organization & Architecture", Newage Publications
9. I. Singh – "Computer Organization & Architecture", Khanna Publishing House

Course Outcomes:

On completion of the course students will be able to

- PCC-CS302.1 Understand basic structure of digital computer, stored program concept and different arithmetic and control unit operations.
- PCC-CS302.2 Understand basic structure of different combinational circuits- multiplexer, decoder, encoder etc.
- PCC-CS302.3 Perform different operations with sequential circuits.
- PCC-CS302.4 Understand memory and I/O operations.

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Syllabus for B. Tech in Information Technology
 (Applicable from the academic session 2018-2019)

Mathematics-III (Differential Calculus)

Code: BSC-301

Contacts: 2L

Name of the Course:	Mathematics-III (Differential Calculus)		
Course Code: BSC-301	Semester: III		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory:2 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam: 70 Marks	
Credit Points:	2		
Objective:			
1	To know Convergence of sequence and series		
2	To know Limit, continuity and partial derivatives, Chain rule, Implicit function		
3	To know First Order Differential Equation, Exact, Linear and Bernoulli's equations, Basic Concept of graph, Walk, Path Circuit, Euler and Hamiltonian graph, diagraph		
Pre-Requisite:			
1	Concept Linear Algebra Determinant and its properties (up to third order)		
2	Minor and cofactors, Matrices, addition, multiplication and transpose of a matrix, Symmetric and skew-symmetric		

Unit	Content	Hrs/Unit	Marks/Unit
1	Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions.	8	
2	Limit, continuity and partial derivatives, Chain rule, Implicit function, Jacobian, Directional derivatives, Total derivative; Maxima, minima and saddle points; Gradient, curl and divergence and related problems.	7	
3	Double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar). Theorems of Green, Gauss and Stokes (Statement only) and related problems.	8	
4.	First Order Differential Equation, Exact, Linear and Bernoulli's equations, Equations of first order but not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's form, general & singular solution. [5L]	9	

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Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

	Second order linear differential equations with constant coefficients, D-operator method, method of variation of parameters, Cauchy-Euler equation. [4L]		
5	Basic Concept of graph, Walk, Path Circuit, Euler and Hamiltonian graph, diagraph. Matrix Representation: Incidence & Adjacency matrix. Tree: Basic Concept of tree, Binary tree, Spanning Tree, KrusKal and Prim's algorithm for finding the minimal spanning tree.	8	

Text book and Reference books:

1. Higher Algebra, S. K. Mapa, Levant Books.
2. Advanced Higher Algebra, Chakravorty and Ghosh, U N Dhar Pvt. Ltd.
3. Co-ordinate Geometry, S. L. Loney
4. Integral Calculus, Das and Mukherjee, U N Dhar Pvt. Ltd.
5. Differential Calculus, Das and Mukherjee, U N Dhar Pvt. Ltd.
6. Advanced Engineering Mathematics, E Kreyszig,
7. Advanced Engineering Mathematics, Chandrika Prasad, Khanna Publishing House
8. Differential Calculas, Shanti Narayan, S.Chand Publications

Course Outcomes:

On completion of the course students will be able to

BSC-301.1 Express a logic sentence in terms of predicates, quantifiers, and logical connectives.

BSC-301.2 Apply the rules of inference and methods of proof including direct and indirect proof forms, proof by contradiction, and mathematical induction.

BSC-301.3 Use tree and graph algorithms to solve problems

BSC-301.4 Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
 (Applicable from the academic session 2018-2019)

Economics for Engineers (Humanities-II)

Code: HSMC-301

Contacts: 3L

Name of the Course:	Economics for Engineers (Humanities-II)		
Course Code: HSMC-301	Semester: III		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam: 70 Marks	
Credit Points:	3		
Objective:			
1	Understand the role and scope of Engineering Economics and the process of economic decision making		
2	Understand the different concepts of cost and different cost estimation techniques		
3	Familiarization with the concepts of cash flow, time value of money and different interest formulas		
4	Appreciation of the role of uncertainty in future events and using different concepts from probability to deal with uncertainty		
5	Understand the concepts of Depreciation and Replacement analysis along with their methods of calculation		
6	Familiarization with the phenomenon of inflation and the use of price indices in engineering Economics		
7	Introduction to basic concepts of Accounting and Financial Management		
Pre-Requisite:			
1	Mathematics		

Unit	Content	Hrs/Unit	Marks/Unit
1	1. Economic Decisions Making – Overview, Problems, Role, Decision making process. 2. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits.	9	
2	3. Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value of	9	

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	<p>Money, Debt repayment, Nominal & Effective Interest.</p> <p>4. Cash Flow & Rate of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing an Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity and Breakeven Analysis. Economic Analysis In The Public Sector -Quantifying And Valuing Benefits & drawbacks.</p>		
3	<p>5. Inflation and Price Change – Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates.</p> <p>6. Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.</p> <p>7. Uncertainty In Future Events - Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options.</p>	9	
4.	<p>8. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances.</p> <p>9. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems.</p> <p>10. Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.</p>	9	

Text book and Reference books:

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1. James L.Riggs, David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , Tata McGraw-Hill
2. Donald Newnan, Ted Eschembach, Jerome Lavelle: Engineering Economics Analysis, OUP
3. John A. White, Kenneth E. Case, David B. Pratt : Principle of Engineering Economic Analysis, John Wiley
4. Premvir Kapoor, Sociology & Economics for Engineers, Khanna Publishing House
5. Sullivan and Wicks: Engineering Economy, Pearson
6. R.Paneer Seelvan: Engineering Economics, PHI
7. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub

Course Outcome:

On completion of the course students will be able to

HSMC-301.1 Make different economic decisions and estimate engineering costs by applying different cost estimation models.

HSMC-301.2 Create cash flow diagrams for different situations and use different interest formulae to solve associated problems.

HSMC-301.3 Take decisions regarding different engineering projects by using various criteria like rate of return analysis, present worth analysis, cost-benefit analysis etc.

HSMC-301.4 Incorporate the effect of uncertainty in economic analysis by using various concepts like expected value, estimates and simulation.

HSMC-301.5 Understand the concepts of depreciation and replacement analysis and solve associated problems.

HSMC-301.6 Understand the process of inflation and use different price indices to adjust for its effect.

HSMC-301.7 Apply the various concepts of Accounting like balance sheet and ratio analysis.

HSMC-301.8 Understand the scope of Finance and the role of financial planning and management.

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PRACTICAL SYLLABUS
Semester III

Analog & Digital Electronics Lab

Code: ESC-391

Contacts: 4P

Name of the Course:	Analog & Digital Electronics Lab
Course Code: ESC-391	Semester: III
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Course Outcomes:	
1	ESC-301.1
2	ESC-301.2
3	ESC-301.3
Pre-Requisite:	
Pre-requisites as in ESC-301	

Laboratory Experiments:	
Analog Electronics	
1	Design a Class A amplifier
2	Design a Phase-Shift Oscillator
3	Design of a Schmitt Trigger using 555 timer
Digital Electronics	
4	Design a Full Adder using basic gates and verify its output / Design a Full Subtractor circuit using basic gates and verify its output.
5	Construction of simple Decoder & Multiplexer circuits using logic gates.
6	Realization of RS / JK / D flip flops using logic gates
7	Design of Shift Register using J-K / D Flip Flop
8	Realization of Synchronous Up/Down counter
9	Design of MOD- N Counter
10	Study of DAC

Any experiment specially designed by the college
 (Detailed instructions for Laboratory Manual to be followed for further guidance)

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Data Structure & Algorithm Lab

Code: PCC-CS391

Contacts: 4P

Name of the Course:	Data Structure & Algorithm Lab
Course Code: PCC-CS391	Semester: III
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Course Outcomes:	
1	PCC-CS301.1
2	PCC-CS301.2
3	PCC-CS301.3
4	PCC-CS301.4
5	PCC-CS301.5
Pre-Requisite:	
Pre-requisites as in PCC-CS301	

Laboratory Experiments:	
Linear Data Structure	
1	Implementation of array operations
2	Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements
3	Merging Problem: Evaluation of expressions operations on Multiple stacks & queues:
4	Implementation of linked lists: inserting, deleting, inverting a linked list. Implementation of stacks & queues using linked lists
5	Polynomial addition, Polynomial multiplication
Non Linear Data Structure	
6	Recursive and Non-recursive traversal of Trees
7	Threaded binary tree traversal. AVL tree implementation
8	Application of Trees. Application of sorting and searching algorithms
9	Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

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Computer Organization Lab
Code: PCC-CS392
Contacts: 4P

Name of the Course:	Computer Organization Lab
Course Code: PCC-CS392	Semester: III
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Course Outcomes:	
1	PCC-CS302.1
2	PCC-CS302.2
3	PCC-CS302.3
4	PCC-CS302.4
Pre-Requisite:	
Pre-requisites as in PCC-CS302	

Laboratory Experiments:	
1	Familiarity with IC-chips: a) Multiplexer, b) Decoder, c) Encoder b) Comparator Truth Table verification and clarification from Data-book.
2	Design an Adder/Subtractor composite unit.
3	Design a BCD adder.
4	Design of a 'Carry-Look-Ahead' Adder circuit.
5	Use a multiplexer unit to design a composite ALU
6	Use ALU chip for multibit arithmetic operation
7	Implement read write operation using RAM IC
8	8. (a) & (b) Cascade two RAM ICs for vertical and horizontal expansion.

Any experiment specially designed by the college
 (Detailed instructions for Laboratory Manual to be followed for further guidance)

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IT Workshop (Sci Lab/MATLAB/Python/R)

Code: PCC-CS393

Contacts: 4P

Name of the Course:	IT Workshop
Course Code: PCC-CS392	Semester: III
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: NIL	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Course Outcomes:	
1	To master an understanding of scripting & the contributions of scripting languages
2	Design real life problems and think creatively about solutions
3	Apply a solution in a program using R/Matlab/Python.
4	To be exposed to advanced applications of mathematics, engineering and natural sciences to program real life problems.
Pre-Requisite:	
1.	Knowledge of Programming Logic
2.	Experience with a high level language (C/C++,) is suggested.
3.	Prior knowledge of a scripting language and Object-Oriented concepts is helpful but not mandatory.

Practical Syllabus

Programming in R

1. Introduction to mechanism for statistics, data analysis, and machine learning; Introduction of R Programming, How to install and run R, Use of R help files, R Sessions, R Objects – Vectors, Attributes, Matrices, Array, Class, List, Data Frames etc. Operators in R.
2. R Programming Structures, Control Statements, Loops, Repeat and Break, R-Function, R-Vector Function, Recursive Function in R.
3. R Packages (Install and Use), Input/Output Features in R, Reading or Writing in File. Data Manipulation in R. Rearranging data, Random Number and Simulation, Statistical methods like min, max, median, mean, length, Linear Regression, Normal Distribution, Decision tree
4. Graphics, Creating Graphs, The Workhorse of R Base Graphics, Graphical Functions – Customizing Graphs, Saving Graphs to Files, Pie chart, Bar Chart, Histogram.

Programming in Matlab

Introduction

Why MATLAB?, History, Its strengths, Competitors, Starting MATLAB, Using MATLAB as a calculator, Quitting MATLAB

Basics

Familiar with MATLAB windows, Basic Operations, MATLAB-Data types, Rules about variable names, Predefined variables

Programming-I

Vector, Matrix, Array Addressing, Built-in functions, Mathematical Operations, Dealing with strings (Array of characters), Array of array (cell) concept

Programming-II

Script file, Input commands, Output commands, Structure of function file, Inline functions, Feval command, Comparison between script file and function file

Conditional statements and Loop

Relational and Logical Operators, If-else statements, Switch-case statements, For loop, While loop, Special commands (Break and continue), Import data from large database, Export data to own file or database

2D Plotting

In-built functions for plotting, Multiple plotting with special graphics, Curve fitting, Interpolation, Basic fitting interface

3D Plotting

Use of meshgrid function, Mesh plot, Surface plot, Plots with special graphics

Programming with Python

Introduction

History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator

Conditional Statements

If, If- else, Nested if-else, Looping, For, While, Nested loops

Control Statements

Break, Continue, Pass

String Manipulation

Accessing Strings, Basic Operations, String slices, Function and Methods

Lists

Introduction, Accessing list, Operations, Working with lists, Function and Methods

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Tuple

Introduction, Accessing tuples, Operations, Working, Functions and Methods

Dictionaries

Introduction, Accessing values in dictionaries, Working with dictionaries, Properties

Functions

Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables

Modules

Importing module, Math module, Random module, Packages, Composition, Input-Output
Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files, Functions

Exception Handling

Exception, Exception Handling, Except clause, Try? finally clause, User Defined Exceptions.

Laboratory Experiments:	
1	Practical Assignments related with implementation of PCC-CS393

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SEMESTER – IV

Discrete Mathematics

Code: PCC-CS401

Contacts: 3L+1T

Name of the Course:	Discrete Mathematics		
Course Code: PCC-CS401	Semester: IV		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: 1 hour/week		Assignment and Quiz : 10 marks	
		Attendance : 5 marks	
Practical: NIL		End Semester Exam :70 Marks	
Credit Points:	4		
Objective:			
1	Use mathematically correct terminology and notation.		
2	Construct correct direct and indirect proofs.		
3	To know Syntax, Semantics, Validity and Satisfiability, Graphs and Trees		
4	Use counterexamples. Apply logical reasoning to solve a variety of problems.		
Pre-Requisite:			
1	Some concepts from basic math – algebra, geometry, pre-calculus		

Unit	Content	Hrs/Unit	Marks/Unit
1	<p>Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem.</p> <p>Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.</p>	8	
2	Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination	5	
3	Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables,	8	

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	Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.		
4.	Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form	7	
5	Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.	8	

Text book and Reference books:

1. Russell Merris, Combinatorics, Wiley-Interscience series in Discrete Mathematics and Optimisation
2. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI
3. Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics for Computer Science, CENGAGE Learning
4. Gary Chartrand and Ping Zhang – Introduction to Graph Theory, TMH
5. J.K. Sharma, Discrete Mathematics, Macmillan
6. Winfried Karl Grassmann and Jean-Paul Tremblay, Logic and Discrete Mathematics, PEARSON.
7. S. K. Chakraborty and B. K. Sarkar, Discrete Mathematics, OXFORD University Press.
8. Douglas B. West, Introduction to graph Theory, PHI
9. C. L. Liu, Elements of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 2000.
10. R. C. Penner, Discrete Mathematics: Proof Techniques and Mathematical Structures, World Scientific, 1999.
11. R. L. Graham, D. E. Knuth, and O. Patashnik, Concrete Mathematics, 2nd Ed., Addison-Wesley, 1994.
12. N. Deo, Graph Theory, Prentice Hall of India, 1974.
13. S. Lipschutz and M. L. Lipson, Schaum's Outline of Theory and Problems of Discrete

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Mathematics, 2nd Ed., Tata McGraw-Hill, 1999.

14. J. P. Tremblay and R. P. Manohar, Discrete Mathematics with Applications to Computer Science, Tata McGraw-Hill, 1997.

15. Russell Merris, Combinatorics, Wiley-Interscience series in Discrete Mathematics and Optimisation

16. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI

17. Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics for Computer Science, CENGAGE Learning

18. Gary Chartrand and Ping Zhang – Introduction to Graph Theory, TMH

19. S.B. Singh, Discrete Structures, KPH

20. S.B. Singh, Combinatorics & Graph Theory, Khanna Book Publishing Co. (P) Ltd. Delhi

Course Outcome(s)

On completion of the course students will be able to

PCC-CS401.1 Express a logic sentence in terms of predicates, quantifiers, and logical connectives

PCC-CS401.2 Derive the solution for a given problem using deductive logic and prove the solution based on logical inference

PCC-CS401.3 Classify its algebraic structure for a given a mathematical problem,

PCC-CS401.4 Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra

PCC-CS401.5 Develop the given problem as graph networks and solve with techniques of graph theory.

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Computer Architecture

Code: PCC-CS402

Contacts: 3L

Name of the Course:	Computer Architecture		
Course Code: PCC-CS402	Semester: IV		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: hrs./week		End Semester Exam: 70 Marks	
Credit Points:	3		
Objective:			
1	To learn the basics of stored program concepts.		
2	To learn the principles of pipelining		
3	To learn mechanism of data storage		
4	To distinguish between the concepts of serial, parallel, pipeline architecture.		
Pre-Requisite:			
1	Basic Structure of Computers, Functional units, software, performance issues software, machine instructions		
2	RAM, ROM, Memory management		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Review of basic computer architecture (Revisited), Quantitative techniques in computer design, measuring and reporting performance. (3L) Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques; Compiler techniques for improving performance. (9L)	12	
2	Hierarchical memory technology: Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies. (8L)	8	
3	Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, super-pipelined and VLIW processor architectures. Array	6	

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	and vector processors. (6L)		
4.	Multiprocessor architecture: taxonomy of parallel architectures; Centralized shared- memory architecture: synchronization, memory consistency, interconnection networks. Distributed shared-memory architecture. Cluster computers. (8L) Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures. (4L)	7	

Text/Reference Books:

1. V. Carl, G. Zvonko and S. G. Zaky, "Computer organization", McGraw Hill, 1978.
2. B. Brey and C. R. Sarma, "The Intel microprocessors", Pearson Education, 2000.
3. J. L. Hennessy and D. A. Patterson, "Computer Architecture A Quantitative Approach", Morgan Kauffman, 2011.
4. W. Stallings, "Computer organization", PHI, 1987.
5. P. Barry and P. Crowley, "Modern Embedded Computing", Morgan Kaufmann, 2012.
6. N. Mathivanan, "Microprocessors, PC Hardware and Interfacing", Prentice Hall, 2004.
7. Y. C. Lieu and G. A. Gibson, "Microcomputer Systems: The 8086/8088 Family", Prentice Hall India, 1986.
8. J. Uffenbeck, "The 8086/8088 Design, Programming, Interfacing", Prentice Hall, 1987.
9. B. Govindarajalu, "IBM PC and Clones", Tata McGraw Hill, 1991.
10. P. Able, "8086 Assembly Language Programming", Prentice Hall India
6. Winfried Karl Grassmann and Jean-Paul Tremblay, Logic and Discrete Mathematics, PEARSON.

Course Outcomes:

On completion of the course students will be able to

PCC-CS402.1 Learn pipelining concepts with a prior knowledge of stored program methods

PCC-CS402.2 Learn about memory hierarchy and mapping techniques.

PCC-CS402.3 Study of parallel architecture and interconnection network

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Formal Language & Automata Theory

Code: PCC-CS403

Contacts: 3L

Name of the Course:	Formal Language & Automata Theory		
Course Code: PCC-CS403	Semester: IV		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam: 70 Marks	
Credit Points:	3		
Objective:			
1	Be able to construct finite state machines and the equivalent regular expressions.		
2	Be able to prove the equivalence of languages described by finite state machines and regular expressions		
3	Be able to construct pushdown automata and the equivalent context free grammars. And Be able to prove the equivalence of languages described by pushdown automata and context free grammars.		
4	Be able to construct Turing machines and Post machines. Be able to prove the equivalence of languages described by Turing machines and Post machines		
Pre-Requisite:			
1	Grammar and its classification (Context Free Grammar)		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.	6	
2	Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata)	7	
	Context-free languages and pushdown automata:		

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3	Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic push down automata, closure properties of CFLs.	6	
4.	Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.	6	
5	Turing machines: The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators	6	
6	Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice's theorem, undecidable problems about languages	6	

Text books/ reference books:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.
2. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.
3. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
4. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.
5. John Martin, Introduction to Languages and The Theory of Computation, TataMcGraw Hill, PEARSON.
6. Dr. R.B. Patel, Theory of Computation, Khanna Publishing House
7. Mishra, Theory of Computers, PHI Publications

Course Outcomes:

On completion of the course students will be able to

- PCC-CS403.1 Write a formal notation for strings, languages and machines.
- PCC-CS403.2 Design finite automata to accept a set of strings of a language.
- PCC-CS403.3 For a given language determine whether the given language is regular or not.
- PCC-CS403.4 Design context free grammars to generate strings of context free language.
- PCC-CS403.5 Determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars

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PCC-CS403.6 Write the hierarchy of formal languages, grammars and machines.

PCC-CS403.7 Distinguish between computability and non-computability and Decidability and undecidability

Design and Analysis of Algorithms

Code: PCC-CS404

Contacts: 3L

Name of the Course:	Design and Analysis of Algorithms		
Course Code: PCC-CS404	Semester: IV		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: hrs./week		End Semester Exam: 70 Marks	
Credit Points:	3		
Objective:			
1	The aim of this module is to learn how to develop efficient algorithms for simple computational tasks and reasoning about the correctness of them		
2	Through the complexity measures, different range of behaviors of algorithms and the notion of tractable and intractable problems will be understood.		
Pre-Requisite:			
1	To know data-structure and basic programming ability		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem	8	
2	Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branch and-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics –characteristics and their application domains.	8	
	Graph and Tree Algorithms: Traversal algorithms:		

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3	Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.	6	
4.	Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.	10	
5	Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE	4	

Text books/ reference books:

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.
4. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
5. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
6. Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA
7. Gajendra Sharma, Design & Analysis of Algorithms, Khanna Publishing House, Delhi

Course Outcomes

On completion of the course students will be able to

PCC-CS404.1 For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.

PCC-CS404.2 Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.

PCC-CS404.3 Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.

PCC-CS404.4 Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and

PCC-CS404.5 develop the dynamic programming algorithms, and analyze it to determine its computational complexity.

PCC-CS404,6 For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.

PCC-CS404.7 Explain the ways to analyze randomized algorithms (expected running time, probability of error).

PCC-CS404.8 Explain what an approximation algorithm is. Compute the approximation factor of an approximation algorithm (PTAS and FPTAS).

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Biology

Code: BSC 401

Contacts: 2L+1T

Name of the Course:		Biology	
Course Code: BSC-401		Semester: IV	
Duration: 6 months		Maximum Marks:100	
Teaching Scheme		Examination Scheme	
Theory: 2hrs./week		Mid Semester exam: 15	
Tutorial: 1 hour		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam: 70 Marks	
Credit Points:		3	
Objective:			
1	Bring out the fundamental differences between science and engineering		
2	Discuss how biological observations of 18 th Century that lead to major discoveries		
Pre-Requisite:			
1	Basic knowledge of Physics ,Chemistry and mathematics		

Unit	Content	Hrs/Unit	Marks/Unit
1	To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18 th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.	2	
2	The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c)	3	

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	energy and Carbon utilisation -Autotrophs, heterotrophs, lithotrophs (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e) Habitata- aquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus		
3	To convey that “Genetics is to biology what Newton’s laws are to Physical Sciences” Mendel’s laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.	4	
4.	Biomolecules: To convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA.Two carbon units and lipids.	4	
5	Enzymes: To convey that without catalysis life would not have existed on earth Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyse reactions? Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.	4	
6	Information Transfer:The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA	4	

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	structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.		
7	Macromolecular analysis: How to analyse biological processes at the reductionist level Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.	5	
8	Metabolism: The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergonic reactions. Concept of K_{eq} and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to $CO_2 + H_2O$ (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge	4	
9	Microbiology Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.	3	

Text books/ reference books:

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers
6. Biology for Engineers, McGraw Hill (ISBN: 978-11-21439-931)

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Course Outcomes:

On completion of the course students will be able to

BSC-401.1 Describe how biological observations of 18th Century that lead to major discoveries.

BSC-401.2 Convey that classification *per se* is not what biology is all about but highlight the underlying

criteria, such as morphological, biochemical and ecological

BSC-401.3 Highlight the concepts of recessiveness and dominance during the passage of genetic material

from parent to offspring

BSC-401.4 Convey that all forms of life have the same building blocks and yet the manifestations are as

diverse as one can imagine

BSC-401.5 Classify enzymes and distinguish between different mechanisms of enzyme action.

BSC-401.6 Identify DNA as a genetic material in the molecular basis of information transfer.

BSC-401.7 Analyse biological processes at the reductionistic level

BSC-401.8 Apply thermodynamic principles to biological systems.

BSC-401.9 Identify and classify microorganisms.

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Environmental Sciences

Code: MC-401

Contacts: 1L

Name of the Course:	Environmental Sciences		
Course Code: MC-401	Semester: IV		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:1hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz : 10 marks	
		Attendance : 5 marks	
Practical: NIL		End Semester Exam :70 Marks	
Credit Points:	1		
Objective:			
1	Be able to understand the natural environment and its relationships with human activities.		
2	Be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.		
3	Be able to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.		
4	Be able to solve scientific problem-solving related to air, water, noise & land pollution		
Pre-Requisite:			
1	Basic knowledge of Environmental science		

Unit	Content	Hrs/Unit	Marks/Unit
1	<p>Basic ideas of environment, basic concepts, man, society & environment, their interrelationship (1L)</p> <p>Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development. (2L)</p> <p>Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function. (1L)</p> <p>Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic</p>	6	

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	degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering. (2L)		
2	<p>Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. (1L)</p> <p>Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web.(2L)</p> <p>Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. (1L)</p> <p>Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.(2L)</p>	6	
3	<p>Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. (1L)</p> <p>Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.(1L)</p> <p>Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth's heat budget.(1L)</p> <p>Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).(2L)</p> <p>Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.(2L)</p> <p>Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria</p>	11	

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	<p>pollutant. Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. (2L)</p> <p>Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green-house gases, effect of ozone modification. (1L)</p> <p>Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP, cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference). (1L)</p>		
4.	<p>Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. (2L)</p> <p>River/Lake/ground water pollution: River: DO, 5-day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenation, reaeration], COD, Oil, Greases, pH. (2L)</p> <p>Lake: Eutrophication [Definition, source and effect]. (1L)</p> <p>Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only)(1L)</p> <p>Standard and control: Waste water standard [BOD, COD, Oil, Grease],</p> <p>Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. (2L)</p> <p>Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic (1L)</p>	9	
5	Lithosphere; Internal structure of earth, rock and soil (1L)	3	

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	Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste).(2L)		
6	Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] (1L) Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L_{10} (18hr Index) , L_d . Noise pollution control. (1L)	3	
7	Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. (2L)	2	

Text books/ reference books:

1. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd., 1991.
2. Erach Bharucha, Environmental Studies, University Press
3. M.P. Poonia, Environmental Studies, Khanna Publishing House
4. De, A. K., "Environmental Chemistry", New Age International
5. Rajagopalan, Environmental Studies, Oxford University Press

Course Outcomes:

On completion of the course students will be able to

MC-401.1 To understand the natural environment and its relationships with human activities.

MC-401.2 To apply the fundamental knowledge of science and engineering to assess environmental and health risk.

MC-401.3 To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations.

MC-401.4 Acquire skills for scientific problem-solving related to air, water, noise & land pollution.

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PRACTICAL SYLLABUS
Semester IV

Computer Architecture Lab
Code: PCC-CS492
Contacts: 4P

Name of the Course:	Computer Architecture Lab
Course Code: PCC-CS492	Semester: IV
Duration: 6 months	Maximum Marks:100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assesement: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Course Outcomes:	
1	PCC-CS402.1
2	PCC-CS402.2
3	PCC-CS402.3
Pre-Requisite:	
1	The hardware based design has been done in 1.the Analog & Digital Electronics laboratory
2	Computer Organisation laboratory

Laboratory Experiments:	
1	HDL introduction.
2	Basic digital logic base programming with HDL
3	8-bit Addition, Multiplication, Division
4	8-bit Register design
5	Memory unit design and perform memory operations.
6	8-bit simple ALU design
7	8-bit simple CPU design
8	Interfacing of CPU and Memory.

Any experiment specially designed by the college
 (Detailed instructions for Laboratory Manual to be followed for further guidance)

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Design & Analysis Algorithm Lab

Code: PCC-CS494

Contact: 4P

Name of the Course:	Design & Analysis Algorithm Lab
Course Code: PCC-CS494	Semester: IV
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Course Outcomes:	
1	PCC-CS402.1
2	PCC-CS402.2
3	PCC-CS402.3
Pre-Requisite:	
Pre-Requisite as in : PCC-CS404	

Laboratory Experiments:	
Divide and Conquer:	
1	Implement Binary Search using Divide and Conquer approach Implement Merge Sort using Divide and Conquer approach
2	Implement Quick Sort using Divide and Conquer approach Find Maximum and Minimum element from a array of integer using Divide and Conquer approach
3	Find the minimum number of scalar multiplication needed for chain of matrix
4	Implement all pair of Shortest path for a graph (Floyed- Warshall Algorithm) Implement Traveling Salesman Problem
5	Implement Single Source shortest Path for a graph (Dijkstra , Bellman Ford Algorithm)
Brunch and Bound:	
6	Implement 15 Puzzle Problem
Backtracking:	
7	Implement 8 Queen problem
8	Graph Coloring Problem Hamiltonian Problem
Greedy method	
9	Knapsack Problem Job sequencing with deadlines
10	Minimum Cost Spanning Tree by Prim's Algorithm Minimum Cost Spanning Tree by Kruskal's Algorithm
Graph Traversal Algorithm:	
11	Implement Breadth First Search (BFS)

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	Implement Depth First Search (DFS)
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Any experiment specially designed by the college

(Detailed instructions for Laboratory Manual to be followed for further guidance)

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SEMESTER – V

Software Engineering

Code: ESC501

Contact: 3L

Name of the Course:	Software Engineering		
Course Code: ESC501	Semester: V		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: hrs./week		End Semester Exam:70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Overview of System Analysis & Design , Business System Concept, System Development Life Cycle, Waterfall Model , Spiral Model, Feasibility Analysis, Technical Feasibility, Cost- Benefit Analysis, COCOMO model. [10L]	10	
2	System Design – Context diagram and DFD, Problem Partitioning, Top-Down And Bottom-Up design; Decision tree, decision table and structured English; Functional vs. Object- Oriented approach. [5L]	5	
3	Coding & Documentation – Structured Programming, OO Programming, Information Hiding, Reuse, System Documentation. [4L]	12	
	Testing – Levels of Testing, Integration Testing, Test case Specification, Reliability Assessment, Validation & Verification Metrics, Monitoring & Control. [8L]		
4.	Software Project Management – Project Scheduling, Staffing, Software Configuration Management, Quality Assurance, Project Monitoring. [7L]	7	

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5	Static and dynamic models, why modeling, UML diagrams: Class diagram, interaction diagram: collaboration diagram, sequence diagram, state chart diagram, activity diagram, implementation diagram. [10 L]	10	
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Text book and Reference books:

1. Pressman, Software Engineering : A practitioner's approach– (TMH)
 2. Pankaj Jalote, Software Engineering- (Wiley-India)
 3. N.S. Gill, Software Engineering – (Khanna Publishing House)
 4. Rajib Mall, Software Engineering- (PHI)
 5. Agarwal and Agarwal, Software Engineering – (PHI)
 6. Sommerville, Software Engineering – Pearson
 7. Martin L. Shooman, Software Engineering – TMH
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Compiler Design
Code: PCC-CS501
Contact: 3L

Name of the Course:	Compiler Design		
Course Code: PCC-CS501	Semester:V		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam:70 Marks	
Credit Points:	3		
Objective:			
1	To understand and list the different stages in the process of compilation.		
2	Identify different methods of lexical analysis		
3	Design top-down and bottom-up parsers		
4	Identify synthesized and inherited attributes		
5	Develop syntax directed translation schemes		
6	Develop algorithms to generate code for a target machine		

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Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction to Compiling [3L] Compilers, Analysis of the source program, The phases of the compiler, Cousins of the compiler.	3	
2	Lexical Analysis [6L] The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, Finite automata, From a regular expression to an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).	6	
3	Syntax Analysis [9L] The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.	9	
4	Syntax directed translation [5L] Syntax director definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.	5	
5	Type checking [4L] Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions	4	
6	Run time environments [5L] Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.	5	
7	Intermediate code generation [4L] Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).	4	

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8	Code optimization [5L] Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representation of basic blocks, The principle sources of optimization, Loops in flow graph, Peephole optimization.	5	
9	Code generations [4L] Issues in the design of code generator, a simple code generator, Register allocation & assignment.	4	

Text book and Reference books:

1. Aho, Sethi, Ullman - "Compiler Principles, Techniques and Tools" - Pearson Education.
2. Holub - "Compiler Design in C" - PHI.

Course Outcomes:

On completion of the course students will be able to

1. Understand given grammar specification develop the lexical analyser
2. Design a given parser specification design top-down and bottom-up parsers
3. Develop syntax directed translation schemes
4. Develop algorithms to generate code for a target machine

Operating Systems

Code: PCC-CS502

Contacts: 3L

Name of the Course:		Operating Systems	
Course Code: PCC-CS502		Semester: V	
Duration: 6 months		Maximum Marks:100	
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance : 5 marks	
Practical: hrs./week		End Semester Exam :70 Marks	
Credit Points:		3	
Objective:			
1	To learn the mechanisms of OS to handle processes and threads and their communication		
2	To learn the mechanisms involved in memory management in contemporary OS		
3	To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols		
4	To know the components and management aspects of concurrency management		

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Pre-Requisite:	
1	Computer Organization & Architecture

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.	3	
2	Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.	10	
3.	Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problem etc.	5	
4.	Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.	5	
5.	Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation– Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation –Page allocation Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty	8	

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	bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used(LRU).		
6.	I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks	6	

Text book and Reference books:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.
3. Operating System Concepts, Ekta Walia, Khanna Publishing House, New Delhi (AICTE Recommended Textbook – 2018)
4. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
5. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
6. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
7. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

Course Outcomes:

On completion of the course students will be able to

1. Create processes and threads.
2. Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response

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Time.

3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time. Design and implement file management system.
4. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Object Oriented Programming

Code: PCC-CS503

Contacts: 3L

Name of the Course:	Computer Organization		
Course Code: PCC-CS503	Semester: V		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz : 10 marks	
		Attendance: 5 marks	
Practical: hrs./week		End Semester Exam:70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Abstract data types and their specification. How to implement an ADT. Concrete state space, concrete invariant, abstraction function. Implementing operations, illustrated by the Text example.	8	
2	Features of object-oriented programming. Encapsulation, object identity, polymorphism – but not inheritance.	8	
3	Inheritance in OO design. Design patterns. Introduction and classification. The iterator pattern.	6	

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4	Model-view-controller pattern. Commands as methods and as objects. Implementing OO language features. Memory management.	6	
5	Generic types and collections GUIs. Graphical programming with Scale and Swing . The software development process	6	

Text book and Reference books:

1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
2. Ali Bahrami – "Object Oriented System Development" – Mc Graw Hill
3. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" – TMH
4. R.K Das – "Core Java For Beginners" – VIKAS PUBLISHING
5. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson
6. Ivor Horton's Beginning Java 2 SDK – Wrox
7. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH

Course Outcomes:

On completion of the course students will be able to

1. Specify simple abstract data types and design implementations, using abstraction functions to document them.
2. Recognise features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.
3. Name and apply some common object-oriented design patterns and give examples of their use.
4. Design applications with an event-driven graphical user interface.

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Introduction to Industrial Management (Humanities III)

Code: HSMC-501

Contacts: 3L

Name of the Course:	Introduction to Industrial Management (Humanities III)	
Course Code: HSMC-501	Semester: V	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		Examination Scheme
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz : 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	<p>Introduction</p> <p>System- concept, definition, types, parameters, variables and behavior.</p> <p>Management – definition and functions.</p> <p>Organization structure:</p> <ol style="list-style-type: none"> Definition. Goals. Factors considered in formulating structure. Types. Advantages and disadvantages. Applications. <p>Concept, meaning and importance of division of labor, scalar & functional processes, span of control, delegation of authority, centralization and decentralization in industrial management.</p> <p>Organizational culture and climate – meaning, differences and factors affecting them.</p> <p>Moral-factors affecting moral.</p> <p>Relationship between moral and productivity.</p> <p>Job satisfaction- factors influencing job satisfaction.</p> <p>Important provisions of factory act and labor laws.</p>	6	

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2	<p>Critical Path Method (CPM) and Programme Evaluation Review Technique (PERT):</p> <p>2.1 CPM & PERT-meaning, features, difference, applications. 2.2 Understand different terms used in network diagram. Draw network diagram for a real life project containing 10-15 activities, computation of LPO and EPO.(Take minimum three examples). Determination of critical path on network. Floats, its types and determination of floats. Crashing of network, updating and its applications.</p>	8	
3	<p>Materials Management:</p> <p>Material management-definition, functions, importance, relationship with other departments. Purchase - objectives, purchasing systems, purchase procedure, terms and forms used in purchase department. Storekeeping- functions, classification of stores as centralized and decentralized with their advantages, disadvantages and application in actual practice. Functions of store, types of records maintained by store, various types and applications of storage equipment, need and general methods for codification of stores. Inventory control: i. Definition. ii. Objectives. iii. Derivation for expression for Economic Order Quantity (EOQ) and numeric examples. iv. ABC analysis and other modern methods of analysis. v. Various types of inventory models such as Wilson's inventory model, replenishment model and two bin model. (Only sketch and understanding, no derivation.). 3.6 Material Requirement Planning (MRP)- concept, applications and brief details about software packages available in market.</p>	6	

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4	<p>Production planning and Control (PPC):</p> <p>Types and examples of production. PPC : i. Need and importance. ii. Functions. iii. Forms used and their importance. iv. General approach for each type of production. Scheduling- meaning and need for productivity and utilisation. Gantt chart- Format and method to prepare. Critical ratio scheduling-method and numeric examples. Scheduling using Gantt Chart (for at least 5-7 components having 5-6 machining operations, with processes, setting and operation time for each component and process, resources available, quantity and other necessary data), At least two examples. Bottlenecking- meaning, effect and ways to reduce.</p>	8	
5	<p>Value Analysis (VA) and Cost Control: 5.1 VA-definition, terms used, process and importance. 5.2 VA flow diagram. DARSIRI method of VA. Case study of VA-at least two. Waste-types, sources and ways to reduce them. Cost control-methods and important guide lines.</p>	4	
6	<p>Recent Trends in IM: ERP (Enterprise resource planning) - concept, features and applications. Important features of MS Project. Logistics- concept, need and benefits. Just in Time (JIT)-concept and benefits. Supply chain management-concept and benefits.</p>	4	

Text book and Reference books:

1. L.S.Srinath– “CPM & PERT principles and Applications”.
2. S.C. Sharma – “Engineering Management”.
3. Buffa – “Modern Production Management”.
4. N. Nair – “Materials Management”.
5. O. P. Khanna – “Industrial Engineering & Management”.
6. Mikes – “Value Analysis”.

Course Outcomes:

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On completion of the course students will be able to

1. Interpret given organization structure, culture, climate and major provisions of factory acts and laws.
2. Explain material requirement planning and store keeping procedure.
3. Plot and analyze inventory control models and techniques.
4. Prepare and analyze CPM and PERT for given activities.
5. List and explain PPC functions.

Theory of Computation

Code: PEC-IT501A

Contacts: 3L

Name of the Course:	Theory of Computation
Course Code: PEC-IT501A	Semester: V
Duration: 6 months	Maximum Marks:100
Teaching Scheme	Examination Scheme
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance : 5 marks
Practical: NIL	End Semester Exam :70 Marks
Credit Points:	3

Unit	Content	Hrs/Unit	Marks/Unit
1	Fundamentals: Basic definition of sequential circuit, block diagram, mathematical representation, concept of transition table and transition diagram (Relating of Automata concept to sequential circuit concept) Design of sequence detector, Introduction to finite state model [2L] Finite state machine: Definitions, capability & state equivalent, kth-equivalent concept [1L] Merger graph, Merger table, Compatibility graph [1L] Finite memory definiteness, testing table & testing graph. [1L] Deterministic finite automaton and non deterministic finite automaton. [1L] Transition diagrams and Language recognizers. [1L] Finite Automata: NFA with $\hat{\Gamma}$ transitions - Significance, acceptance of languages. [1L] Conversions and Equivalence: Equivalence between NFA with and without $\hat{\Gamma}$ transitions. NFA to DFA conversion. [2L] Minimization of FSM, Equivalence between two FSM's , Limitations of FSM [1L] Application of finite automata, Finite Automata with output- Moore &	13	

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	Melay machine. [2L]		
2	Regular Languages : Regular sets. [1L] Regular expressions, identity rules. Arden's theorem state and prove [1L] Constructing finite Automata for a given regular expressions, Regular string accepted by NFA/DFA [1L] Pumping lemma of regular sets. Closure properties of regular sets (proofs not required). [1L] Grammar Formalism: Regular grammars-right linear and left linear 9grammars. [1L] Equivalence between regular linear grammar and FA. [1L] Inter conversion, Context free grammar. [1L] Derivation trees, sentential forms. Right most and leftmost derivation of strings. (Concept only) [1L]	8	
3.	Context Free Grammars, Ambiguity in context free grammars. [1L] Minimization of Context Free Grammars. [1L] Chomsky normal form and Greibach normal form. [1L] Pumping Lemma for Context Free Languages. [1L] Enumeration of properties of CFL (proofs omitted). Closure property of CFL, Ogden's lemma & its applications [1L] Push Down Automata: Push down automata, definition. [1L] Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. [1L] Equivalence of CFL and PDA, interconversion. (Proofs not required). [1L] Introduction to DCFL and DPDA. [1L]	9	
5.	Turing Machine : Turing Machine, definition, model [1L] Design of TM, Computable functions [1L] Church's hypothesis, counter machine [1L] Types of Turing machines (proofs not required) [1 L] Universal Turing Machine, Halting problem [2L]	5	

Text book and Reference books:

1. "Introduction to Automata Theory Language and Computation", Hopcroft H.E. and Ullman J. D., Pearson education.
2. "Theory of Computation", R.B. Patel & Prem Nath, Khanna Book Publishing.
3. "Theory of Computer Science ", Automata Languages and computation", Mishra and Chandra shekaran, 2nd edition, PHI.
4. "Formal Languages and Automata Theory", C.K.Nagpal, Oxford
5. "Switching & Finite Automata", ZVI Kohavi, 2nd Edn., Tata McGraw Hill
6. "Introduction to Computer Theory", Daniel I.A. Cohen, John Wiley
7. "Introduction to languages and the Theory of Computation", John C Martin, TMH
8. "Elements of Theory of Computation", Lewis H.P. & Papadimitrou C.H. Pearson, PHI.

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Course Outcomes:

On completion of the course students will be able to

1. Define a system and recognize the behavior of a system. They will be able to minimize a system and compare different systems
2. Convert Finite Automata to regular expression. Students will be able to check equivalence between regular linear grammar and FA.
3. Minimize context free grammar. Student will be able to check equivalence of CFL and PDA. They
4. Will be able to design Turing Machine.
5. Design Turing machine.

Artificial Intelligence

Code: PEC-IT501B

Contacts: 3L

Name of the Course:	Artificial Intelligence	
Course Code: PEC-IT501B	Semester: V	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		Examination Scheme
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance : 5 marks
Practical: NIL		End Semester Exam :70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction [2] Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem. Intelligent Agents [2] Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents. Problem Solving [2] Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.	6	
2.	Search techniques [5]	13	

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	<p>Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.</p> <p>Heuristic search strategies [5] Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.</p> <p>Adversarial search [3] Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.</p>		
3	<p>Knowledge & reasoning [3] Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.</p>	3	
4	<p>Using predicate logic [2] Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.</p> <p>Probabilistic reasoning [4] Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.</p>	6	
5	<p>Natural Language processing [2] Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing.</p> <p>Learning [2] Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.</p> <p>Expert Systems [2] Representing and using domain knowledge, expert system shells, knowledge acquisition.</p>	6	

Text book and Reference books:

1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3. Artificial Intelligence, A Classical Approach, Munish Chandra Trivedi, Khanna Publishing
4. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
5. Poole, Computational Intelligence, OUP
6. Logic & Prolog Programming, Saroj Kaushik, New Age International
7. Expert Systems, Giarranto, VIKAS

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Advanced Computer Architecture

Code: PEC-IT501C

Contacts: 3L

Name of the Course:	Advanced Computer Architecture
Course Code: PEC-IT501C	Semester: V
Duration: 6 months	Maximum Marks:100
Teaching Scheme	Examination Scheme
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance : 5 marks
Practical: NIL	End Semester Exam :70 Marks
Credit Points:	3

Unit	Content	Hrs/Unit	Marks/Unit
1	Computer Architecture and Organization-Review, Fundamentals of Computer Design, Technology Trends Cost Performance Analysis (3L) Parallel Processing Architectures- Taxonomy- SISD, MISD, SIMD,MIMD, PRAM models (3L)	6	
2.	Data and Resource Dependencies, Program Partitioning and Scheduling, Control Flow vs. Data Flow (3L) Network topologies-Static, Dynamic, Types of Networks (3L) RISC vs. CISC, Memory Hierarchy, Virtual Memory (4L)	10	
3	Concepts of Pipelining, Instruction Pipelining, dynamic pipelining, arithmetic pipelines. (4L) Multiprocessors- Multistage Networks, Cache Coherence, Synchronization, Message- passing (4L) Vector Processing Principles- Instruction types, Compound, Vector Loops, Chaining (4L)	12	
4	Array Processors- Structure, Algorithms (3L) Data Flow Architecture- Graphs. Petri Nets, Static and Dynamic DFA, VLSI Computations (4L) Parallel Programming Models, Languages, Compilers (4L)	11	

Text book and Reference books:

1. Computer Architecture and Parallel Processing- Kai Hwang and A. Briggs International Edition, McGraw Hill
2. Advanced Computer Architecture: D. Sima, T. fountain, P. Kacsuk, Pearson
3. Parallel Computer Architecture: D. Culler, J.P.Singh, A.Gupta, Elsevier

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Computer Graphics
Code: PEC-IT501D
Contacts: 3L

Name of the Course:	Computer Graphics		
Course Code: PEC-IT501D	Semester: V		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance : 5 marks	
Practical: NIL		End Semester Exam :70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	<p>Introduction to computer graphics & graphics systems [6L]: Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics software.</p> <p>Scan conversion [8L]: Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.</p>	14	
2	<p>2D transformation & viewing [15L]: Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline, Window to view port co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse. Cohen and Sutherland line clipping, Sutherland-Hodgeman Polygon clipping, Cyrus-beck clipping method</p> <p>3D transformation & viewing [5L]: 3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, view port clipping, 3D viewing.</p>	20	

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3.	Curves [3L]: Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves. Hidden surfaces [3L]: Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Painter's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry. Color & shading models [2L]: Light & color model; interpolative shading model; Texture. Introduction to Ray-tracing: [3L] Human vision and color, Lighting, Reflection and transmission models.	6	
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Text book and Reference books:

1. Hearn, Baker – “Computer Graphics (C version 2nd Ed.)” – Pearson education
2. Z. Xiang, R. Plastock – “Schaum's outlines Computer Graphics (2nd Ed.)” – TMH
3. D. F. Rogers, J. A. Adams – “Mathematical Elements for Computer Graphics (2nd Ed.)” – TMH

Constitution of India
Code: MC-IT501
Contacts: 3L

Name of the Course:	Constitution of India		
Course Code: MC-IT501	Semester: V		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance : 5 marks	
Practical: NIL			
Credit Points:	0		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Constitution' meaning of the term,, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy	3	
2	Union Government and its Administration : Structure of the Indian Union: Federalism, Centre- State relationship,	6	

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	President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha		
3.	State Government and its Administration Governor: Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions	6	
4.	Local Administration District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different 4.departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy	8	
5.	Election Commission Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women		

Text book and Reference books:

1. 'Indian Polity' by Laxmikanth
2. 'Indian Administration' by Subhash Kashyap
3. 'Indian Constitution' by D.D. Basu
4. 'Indian Administration' by Avasti and Avasti

PRACTICAL SYLLABUS

Software Engineering Lab
Code: ESC591
Contact: 4P

Name of the Course:	Software Engineering Lab
Course Code: ESC591	Semester: V
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Course Outcomes:	
1	To understand the software engineering methodologies involved in the phases for project development.
2	To gain knowledge about open source tools used for implementing software engineering methods.

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3	To exercise developing product-startups implementing software engineering methods.
4	Learn simple optimization techniques
Pre-Requisite:	

Laboratory Experiments:
<ul style="list-style-type: none"> • Problem Analysis and Project Planning -Thorough study of the problem – Identify Project scope, Objectives and Infrastructure. • Software Requirement Analysis – Describe the individual Phases/modules of the project and Identify deliverables. Identify functional and non-functional requirements. • Data Modeling – Use work products – data dictionary. • Software Designing - Develop use case diagrams and activity diagrams, build and test class diagrams, sequence diagrams and add interface to class diagrams. • Prototype model – Develop the prototype of the product. <p>The SRS and prototype model should be submitted for end semester examination.</p>

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Object Oriented Programming Lab

Code: PCC-CS593

Contacts: 4P

Name of the Course:	Object Oriented Programming Lab
Course Code: PCC-CS593	Semester: V
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2

Laboratory Experiments:
<ol style="list-style-type: none"> 1. Assignments on class, constructor, overloading, inheritance, overriding 2. Assignments on wrapper class, arrays 3. Assignments on developing interfaces- multiple inheritance, extending interfaces 4. Assignments on creating and accessing packages 5. Assignments on multithreaded programming 6. Assignments on applet programming <p>Note: Use Java for programming</p>

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

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Operating System Lab

Code: PCC-CS592

Contacts: 4P

Name of the Course:	Operating System Lab
Course Code: PCC-CS592	Semester: V
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2

Laboratory Experiments:

1. Managing Unix/Linux Operating System [8P]:

Creating a bash shell script, making a script executable, shell syntax (variables, conditions, control structures, functions, commands). Partitions, Swap space, Device files, Raw and Block files, Formatting disks, Making file systems, Superblock, I-nodes, File system checker, Mounting file systems, Logical Volumes, Network File systems, Backup schedules and methods Kernel loading, init and the inittab file, Run-levels, Run level scripts. Password file management, Password security, Shadow file, Groups and the group file, Shells, restricted shells, user-management commands, homes and permissions, default files, profiles, locking accounts, setting passwords, Switching user, Switching group, Removing users & user groups.

2. Process [4P]: starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.

3. Signal [4P]: signal handling, sending signals, signal interface, signal sets.

4. Semaphore [6P]: programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v).

5. POSIX Threads [6P]: programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)

6. Inter-process communication [6P]: pipes (use functions pipe, popen, pclose), named pipes (FIFOs, accessing FIFO), message passing & shared memory (IPC version V).

Any experiment specially designed by the college

(Detailed instructions for Laboratory Manual to be followed for further guidance)

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SEMESTER – VI

Database Management Systems

Code: PCCCS601

Contact: 3L

Name of the Course:	Database Management Systems		
Course Code: PCC-CS601	Semester: VI		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: hrs./week		End Semester Exam:70 Marks	
Credit Points:	3		
Objective:			
1	To understand the different issues involved in the design and implementation of a database system.		
2	To study the physical and logical database designs, database modeling, relational, hierarchical, and network models		
3	To understand and use data manipulation language to query, update, and manage a database		
4	To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.		
5	To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.		
6	To understand the different issues involved in the design and implementation of a database system.		

Unit	Content	Hrs/Unit	Marks/Unit
1	Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.	9	

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2	Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQLserver. Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design. Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.	13	
3	Storage strategies: Indices, B-trees, hashing.	3	
4.	Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.	5	
5	Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.	3	
6	Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.	3	

Text book and Reference books:

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.
2. "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press.
3. "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe,
4. Pearson Education "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley
5. Database Management Systems, R.P. Mahapatra, Khanna Publishing House

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Course Outcomes:

On completion of the course students will be able to

1. For a given query write relational algebra expressions for that query and optimize the developed expressions
2. For a given specification of the requirement design the databases using E R method and normalization.
3. For a given specification construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, and DB2.
4. For a given query optimize its execution using Query optimization algorithms
5. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.
6. Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

Computer Networks

Code: PCC-CS602

Contact: 3L

Name of the Course:	Computer Networks		
Course Code: PCC-CS602	Semester: VI		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: hrs./week		End Semester Exam:70 Marks	
Credit Points:	3		
Objective:			
1	To develop an understanding of modern network architectures from a design and performance perspective.		
2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).		
3	To provide an opportunity to do network programming		
4	To provide a WLAN measurement ideas.		

Unit	Content	Hrs/Unit	Marks/Unit
1	Data communication Components: Representation of data and its flow	9	

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	Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.		
2	Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA	8	
3	Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.	14	
4.	Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.	8	
5	Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.	8	

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Text book and Reference books:

1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
3. "Algorithm Design" by Kleinberg and Tardos.
4. "Design and Analysis of Algorithms" by Gajendra Sharma.

Course Outcomes:

On completion of the course students will be able to

1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasize the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Advanced Algorithms

Code: PEC-IT601 A

Contact: 3L

Name of the Course:		Advanced Algorithms	
Course Code: PEC-IT601A		Semester: VI	
Duration:6 months		Maximum Marks:100	
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam:70 Marks	
Credit Points:		3	
Objective:			
1	Introduce students to the advanced methods of designing and analyzing algorithms.		
2	The student should be able to choose appropriate algorithms and use it for a specific		

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	problem.
3	To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
4	Students should be able to understand different classes of problems concerning their computation difficulties.
5	To introduce the students to recent developments in the area of algorithmic design.
Pre-Requisite:	
1	Algorithm Design and Analysis

Unit	Content	Hrs/Unit	Marks/Unit
1	Sorting: Review of various sorting algorithms, topological sorting Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.	6	
2	Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST. Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.	8	
	Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm. Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.	9	
3	Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming. Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem. Discrete Fourier Transform (DFT): In complex field, DFT in modulo ring. Fast	10	

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	Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm		
4.	Linear Programming: Geometry of the feasibility region and Simplex algorithm NP-completeness: Examples, proof of NP-hardness and NP-completeness. One or more of the following topics based on time and interest Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm	10	
5	Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.	5	

Text book and Reference books:

1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
3. "Algorithm Design" by Kleinberg and Tardos.
4. "Design and Analysis of Algorithms" by Gajendra Sharma.

Course Outcomes:

On completion of the course students will be able to

1. Analyze the complexity/performance of different algorithms.
2. Determine the appropriate data structure for solving a particular set of problems.
3. Categorize the different problems in various classes according to their complexity.
4. Students should have an insight of recent activities in the field of the advanced data structure.

Distributed Systems

Code: PEC-IT601B

Contact: 3L

Name of the Course:	Distributed Systems	
Course Code: PEC-IT601B	Semester: VI	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme	Examination Scheme	
Theory: 3 hrs./week	Mid Semester exam: 15	
Tutorial: NIL	Assignment and Quiz: 10 marks	

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		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:	3	
Objective:		
1	To introduce the fundamental concepts and issues of managing large volume of shared data in a parallel and distributed environment, and to provide insight into related research problems.	
Pre-Requisite:		
1	Database Management Systems	

Unit	Content	Hrs/Unit	Marks/Unit
1	INTRODUCTION Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts DISTRIBUTED DATABASE MANAGEMENT SYSTEM ARCHITECTURE Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues	8	
2	DISTRIBUTED DATABASE DESIGN Alternative design strategies; Distributed design issues; Fragmentation; Data allocation SEMANTICS DATA CONTROL View management; Data security; Semantic Integrity Control QUERY PROCESSING ISSUES Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data	11	
3	DISTRIBUTED QUERY OPTIMIZATION Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms TRANSACTION MANAGEMENT The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models CONCURRENCY CONTROL Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management	11	

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4.	Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols Algorithm	8	
5	PARALLEL DATABASE SYSTEMS Parallel architectures; parallel query processing	6	
6	ADVANCED TOPICS Mobile Databases, Distributed Object Management, Multi-databases	4	

Text book and Reference books:

1. Principles of Distributed Database Systems, M.T. Ozu and PValduriez, Prentice-Hall, 1991.
2. Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley, 1992.

Course Outcomes:

On completion of the course students will be able to

1. Design trends in distributed systems.
2. Apply network virtualization.
3. Apply remote method invocation and objects.

Signals & Systems

Code: PEC-IT601C

Contacts: 3L

Name of the Course:	Signals & Systems	
Course Code: PEC-IT601C	Semester: VI	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		Examination Scheme
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:	3	

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Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction to Signals and Systems : Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.	3	
2	Behavior of continuous and discrete-time LTI systems (8 hours) Impulse response and step response, convolution, input-output behavior with periodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.	8	
3	Fourier, Laplace and z- Transforms Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete- Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.	10	

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4.	The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.	9	
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Text book and Reference books:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, “ Signalsand systems”, Prentice Hall India,1997.
2. J. G. Proakis and D. G. Manolakis, “ Digital Signal Processing: Principles, Algorithms, and Applications” , Pearson,2006.
3. H. P. Hsu, “ Signals and systems”, Schaum’sseries, McGraw Hill Education,2010.
4. S. Haykinand B. V. Veen, “ Signals and Systems”, John Wiley and Sons,2007.
5. A. V. Oppenheim and R. W. Schafer, “ Discrete-Time Signal Processing”, Prentice Hall,2009.
6. M. J. Robert “ Fundamentals of Signals and Systems”, McGraw Hill Education, 2007.
7. B. P. Lathi, “ LinearSystems and Signals”, Oxford University Press,2009.
8. A. V. Oppenheim and R. W. Schafer, “ Discrete-Time Signal Processing”, Prentice Hall,2009.
9. M. J. Robert “ Fundamentals of Signals and Systems”, McGraw Hill Education, 2007.
10. B. P. Lathi, “ LinearSystems and Signals”, Oxford University Press,2009.
11. R. Anand, “Signals and Systems, Khanna Publishing House, 2018.

Course Outcomes:

- On completion of the course students will be able to
- Understand the concepts of continuous time and discrete time systems.
- Analyse systems in complex frequency domain.
- Understand sampling theorem and its implications.
- Understand the concepts of continuous time and discrete time systems.

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Image Processing
Code:PEC-IT601 D
Contact: 3L

Name of the Course:	Image Processing
Course Code: PEC-IT601D	Semester: VI
Duration:6 months	Maximum Marks:100
Teaching Scheme	Examination Scheme
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks
Credit Points:	3

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction [3L] Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.	9	
2	Digital Image Formation [4L] A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform.	4	
3	Mathematical Preliminaries[9L] Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & SineTransform.	9	

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4.	Image Enhancement [8L] Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High-pass Filtering, High- boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.	8	
5	Image Restoration [7L] Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation - Spatial Transformation, Gray Level Interpolation.	7	
6	Image Segmentation [7L] Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection - Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.	7	

Text book and Reference books:

1. Hearn, Baker – “Computer Graphics (C version 2nd Ed.)” – Pearson education
2. Z. Xiang, R. Plastock – “Schaum’s outlines Computer Graphics (2nd Ed.)” – TMH
3. D. F. Rogers, J. A. Adams – “Mathematical Elements for Computer Graphics (2nd Ed.)” – TMH

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Parallel and Distributed Algorithms

Code: PEC-IT602A

Contacts: 3L

Name of the Course:	Parallel and Distributed Algorithms		
Course Code PEC-IT602A	Semester: VI		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam:70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	UNIT-I : Basic Techniques, Parallel Computers for increase Computation speed, Parallel & Cluster Computing	8	
2	UNIT-II : Message Passing Technique- Evaluating Parallel programs and debugging, Portioning and Divide and Conquer strategies examples	8	
3	UNIT-III : Pipelining- Techniques computing platform, pipeline programs examples	8	
4.	UNIT-IV: Synchronous Computations, load balancing, distributed termination examples, programming with shared memory, shared memory multiprocessor constructs for specifying parallelism sharing data parallel programming languages and constructs, open MP	11	
5	UNIT-V : Distributed shared memory systems and programming achieving constant memory distributed shared memory programming primitives, algorithms – sorting and numerical algorithms.	9	

Text book and Reference books:

1. Parallel Programming, Barry Wilkinson, Michael Allen, Pearson Education, 2nd Edition.
2. Introduction to Parallel algorithms by Jaja from Pearson, 1992.

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Data Warehousing and Data Mining

Code: PEC-IT602B

Contacts: 3L

Name of the Course:	Data Warehousing and Data Mining		
Course Code PEC-IT602B	Semester: VI		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam:70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Unit 1: Introduction to Data Warehousing; Data Mining: Mining frequent patterns, association and correlations; Sequential Pattern Mining concepts, primitives, scalable methods;	8	
2	Unit 2: Classification and prediction; Cluster Analysis – Types of Data in Cluster Analysis, Partitioning methods, Hierarchical Methods; Transactional Patterns and other temporal based frequent patterns,	8	
3	Unit 3: Mining Time series Data, Periodicity Analysis for time related sequence data, Trend analysis, Similarity search in Time-series analysis;	8	
4.	Unit 4: Mining Data Streams, Methodologies for stream data processing and stream data systems, Frequent pattern mining in stream data, Sequential Pattern Mining in Data Streams, Classification of dynamic data streams, Class Imbalance Problem; Graph Mining; Social Network Analysis;modulation for communication, filtering, feedback control systems.	11	
	Unit 5: Web Mining, Mining the web page layout structure,	9	

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	mining web link structure, mining multimedia data on the web, Automatic classification of web documents and web usage mining; Distributed Data Mining.		
	Unit 6: Recent trends in Distributed Warehousing and Data Mining, Class Imbalance Problem; Graph Mining; Social Network Analysis	5	

Text book and Reference books:

1. Data Warehousing Fundamentals for IT Professionals, Second Edition by Paulraj Ponniah, Wiley India.
1. Data Warehousing, Data Mining, & OLAP – Second Edition by Alex Berson and Stephen J. Smith, Tata McGraw Hill Education
2. Data warehouse Toolkit by Ralph Kimball, Wiley India
3. Jiawei Han and M Kamber, Data Mining Concepts and Techniques,, Second Edition, Elsevier Publication, 2011.
4. Vipin Kumar, Introduction to Data Mining - Pang-Ning Tan, Michael Steinbach, Addison Wesley, 2006.
4. G Dong and J Pei, Sequence Data Mining, Springer, 2007.

Course Outcomes:

After completion of course, students would be:

1. Study of different sequential pattern algorithms
2. Study the technique to extract patterns from time series data and its application in real world.
3. Can extend the Graph mining algorithms to Web mining
4. Help in identifying the computing framework for Big Data

Human Computer Interaction

Code: PEC-IT602C

Contacts: 3L

Name of the Course:	Human Computer Interaction		
Course Code: PEC-IT602C	Semester: VI		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance : 5 marks	
Practical: NIL		End Semester Exam :70 Marks	
Credit Points:	3		
Objective:			

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1	Learn the foundations of Human Computer Interaction
2	Be familiar with the design technologies for individuals and persons with disabilities
3	Be aware of mobile Human Computer interaction
4	Learn the guidelines for user interface.
Pre-Requisite:	
1	Computer Organization & Architecture

Unit	Content	Hrs/Unit	Marks/Unit
1	Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.	9	
2	Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.	11	
3.	Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.	8	
4.	Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.	8	
5.	Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.	8	
6.	Recent Trends: Speech Recognition and Translation, Multimodal System	3	

Text book and Reference books:

1. Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett

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2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security, Addison Wesley.

Course Outcomes:

On completion of the course students will be able to

1. Differentiate between various software vulnerabilities.
2. Software process vulnerabilities for an organization.
3. Monitor resources consumption in a software.
4. Interrelate security and software development process.

Pattern Recognition

Code:PEC-IT602D

Contact: 3L

Name of the Course:	Pattern Recognition		
Course Code: PEC-IT602D	Semester: VI		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam:70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Basics of pattern recognition	2	
2	Bayesian decision theory 8L Classifiers, Discriminant functions, Decision surfaces Normal density and discriminant functions Discrete features	8	
3	Parameter estimation methods 6L Maximum-Likelihood estimation Gaussian mixture models Expectation-maximization method Bayesian estimation	6	
	Hidden Markov models for sequential pattern	8	

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4.	classification 8L Discrete hidden Markov models Continuous density hidden Markov models		
5	Dimension reduction methods 3L 5.1. Fisher discriminant analysis 5.2 Principal component analysis . Parzen-window method K-Nearest Neighbour method	3	
6	Non-parametric techniques for density estimation	2	
7	Linear discriminant function based classifier 5L Perceptron Support vector machines	5	
8	Non-metric methods for pattern classification 4L Non-numeric data or nominal data Decision trees	4	
9	Unsupervised learning and clustering 2L Criterion functions for clustering Algorithms for clustering: K-means, Hierarchical and other methods	2	

Text book and Reference books:

1. R. O. Duda, P. E. Hart and D. G. Stork: Pattern Classification, John Wiley, 2001.
2. S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.
3. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

Numerical Methods

Code: OEC-IT601A

Contact: 3L

Name of the Course:	Numerical Methods	
Course Code: OEC-IT601A	Semester: VI	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		Examination Scheme
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	3	

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Unit	Content	Hrs/Unit	Marks/Unit
1	Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors.	2	
2	Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation.	8	
3	Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.	3	
4.	Numerical solution of a system of linear equations: Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method.	8	
5	Numerical solution of Algebraic equation: Bisection method, Regula-Falsi method, Newton-Raphson method.	3	
6	Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method.	2	

Text book and Reference books:

1. C.Xavier: C Language and Numerical Methods.
2. R.S. Salaria: Computer Oriented Numerical Methods.
3. Dutta & Jana: Introductory Numerical Analysis.
4. J.B.Scarborough: Numerical Mathematical Analysis.
5. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).
6. Balagurusamy: Numerical Methods, Scitech.
7. Baburam: Numerical Methods, Pearson Education.
8. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.

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Human Resource Development and Organizational Behavior

Code: OEC-IT601 B

Contact: 3L

Name of the Course:	Human Resource Development and Organizational Behavior		
Course Code: OEC-IT601 B	Semester: VI		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam:70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Organizational Behaviour: Definition, Importance, Historical Background, Fundamental Concepts of OB, Challenges and Opportunities for OB. [2] Personality and Attitudes: Meaning of personality, Personality Determinants and Traits, Development of Personality, Types of Attitudes, Job Satisfaction.	4	
2	Perception: Definition, Nature and Importance, Factors influencing Perception, Perceptual Selectivity, Link between Perception and Decision Making. [2] 4. Motivation: Definition, Theories of Motivation - Maslow's Hierarchy of Needs Theory, McGregor's Theory X & Y, Herzberg's Motivation-Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory.	8	
3	Group Behaviour: Characteristics of Group, Types of Groups, Stages of Group Development, Group Decision Making. [2] Communication: Communication Process, Direction	4	

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	of Communication, Barriers to Effective Communication. [2] Leadership: Definition, Importance, Theories of Leadership Styles.		
4.	Organizational Politics: Definition, Factors contributing to Political Behaviour. [2] Conflict Management: Traditional vis-a-vis Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation – Bargaining Strategies, Negotiation Process. [2] Organizational Design: Various Organizational Structures and their Effects on Human Behaviour, Concepts of Organizational Climate and Organizational Culture.	8	

Text book and Reference books:

1. Robbins, S. P. & Judge, T.A.: Organizational Behavior, Pearson Education, 15th Edn.
2. Luthans, Fred: Organizational Behavior, McGraw Hill, 12th Edn.
3. Shukla, Madhukar: Understanding Organizations – Organizational Theory & Practice in India, PHI
4. Fincham, R. & Rhodes, P.: Principles of Organizational Behaviour, OUP, 4th Edn.
5. Hersey, P., Blanchard, K.H., Johnson, D.E.- Management of Organizational Behavior Leading Human Resources, PHI, 10th Edn.

Research Methodology

Code: PROJ- CS601

Contact: 3L

Name of the Course:	Research Methodology		
Course Code: PROJ- CS601	Semester: VI		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam:70 Marks	
Credit Points:	3		

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Unit	Content	Hrs/Unit	Marks/Unit
1	RESEARCH FORMULATION AND DESIGN Motivation and objectives – Research methods vs. Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, concept of applied and basic research process, criteria of good research. Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review-primary and secondary sources, reviews, monograph, patents, research databases, web as a source, searching the web, critical literature review, identifying gap areas from literature and research database, development of working hypothesis.	9	
2	DATA COLLECTION AND ANALYSIS Accepts of method validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies and tools, data analysis with statically package (Sigma STAT, SPSS for student t-test, ANOVA, etc.), hypothesis testing.	9	
3	RESEARCH ETHICS, IPR AND SCHOLARY PUBLISHING Ethics-ethical issues, ethical committees (human & animal); IPR- intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS); scholarly publishing- IMRAD concept and design of research paper, citation and acknowledgement, plagiarism, reproducibility and accountability.	9	
4.	INTERPRETATION AND REPORT WRITING Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Project Report, Layout of the Project/Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Project/Research Report, Precautions for Writing Research Reports, Conclusions.	9	

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Text book and Reference books:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
3. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
4. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
5. Wadehra, B.L. 2000. Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.

Additional reading

1. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
2. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.
3. Coley, S.M. and Scheinberg, C. A., 1990, "Proposal Writing", Sage Publications.
4. Day, R.A., 1992. How to Write and Publish a Scientific Paper, Cambridge University Press.
5. Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications
6. Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall.
7. Satarkar, S.V., 2000. Intellectual property rights and Copy right. Ess Ess Publications.

PRACTICAL SYLLABUS

Database Management System Lab

Code: PCC-CS691

Contacts: 4P

Name of the Course:	Database Management System Lab
Course Code: PCC-CS691	Semester: VI
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2

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Laboratory Experiments:

Structured Query Language

1. Creating Database

- ☐ Creating a Database
- ☐ Creating a Table
- ☐ Specifying Relational Data Types
- ☐ Specifying Constraints
- ☐ Creating Indexes

2. Table and Record Handling

- ☐ INSERT statement
- ☐ Using SELECT and INSERT together
- ☐ DELETE, UPDATE, TRUNCATE statements
- ☐ DROP, ALTER statements

3. Retrieving Data from a Database

1. The SELECT statement
2. Using the WHERE clause
3. Using Logical Operators in the WHERE clause
4. Using IN, BETWEEN, LIKE, ORDER BY, GROUP BY and HAVING Clause

5. Using Aggregate Functions

6. Combining Tables Using JOINS

7. Subqueries

4. Database Management

- Creating Views
- Creating Column Aliases
- Creating Database Users
- Using GRANT and REVOKE

Cursors in Oracle PL / SQL

Writing Oracle PL / SQL Stored Procedures

Any experiment specially designed by the college
 (Detailed instructions for Laboratory Manual to be followed for further guidance)

Computer Networks Lab

Code: PCC-CS692

Contacts: 4P

Name of the Course:	Computer Networks Lab
Course Code: PCC-CS692	Semester: VI
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment

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Tutorial: NIL	External Assessment:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2

Laboratory Experiments:

- 1) NIC Installation & Configuration (Windows/Linux)
- 2) Understanding IP address, subnet etc
Familiarization with
 - Networking cables (CAT5, UTP)
 - Connectors (RJ45, T-connector)
 - Hubs, Switches
- 3) TCP/UDP Socket Programming
 - Simple, TCP based, UDP based
 - Multicast & Broadcast Sockets
 - Implementation of a Prototype Multithreaded Server
- 4) Implementation of
 - ☐ ☐ Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)
 - ☐ ☐ Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)
 - ☐ ☐ Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)
- 5) Server Setup/Configuration
FTP, TelNet, NFS, DNS, Firewall

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

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SEMESTER – VII

Internet Technology
Code: PEC-IT701A
Contacts: 3L

Name of the Course:	Internet Technology		
Course Code: PEC-IT701A	Semester: VII		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam: 70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction to Internet Technology(6L) : Overview, Network of Networks, Intranet, Extranet and Internet., World Wide Web: Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. Review of TCP/IP: Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6. IP Subnetting and addressing : Classful and Classless Addressing, Subnetting. NAT, IP masquerading, IP tables, Internet Routing Protocol .Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast. Electronic Mail POP3, SMTP.	6	
2	HTML, Image Maps ,XML, CGI Scripts(9L): Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Color name, Color value, map, area, attributes of image area. Extensible Markup Language, Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief. Introduction, Environment Variable, GET and POST Methods	9	
3	Perl, JavaScript, Java applets(10L) Introduction, Variable, Condition, Loop, Array,	10	

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	Implementing data structure, Hash, String, Regular Expression, File handling, I/O handling. ,Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array, Boolean, reg-ex. Function, Errors, Validation. Definition of cookies, Create and Store a cookie with example. Container Class, Components, Applet Life Cycle, Update method; Parameter passing applet, Applications.		
4.	Client-Server programming In Java Threats, Network Security techniques(4L) Java Socket, Java RMI, Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks. Password and Authentication; VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH), Introduction, Packet filtering, Stateful, Application layer, Proxy	4	
5	Internet Telephony, Multimedia Applications, Multimedia Applications(5L): Introduction, VoIP. Multimedia Applications Multimedia over IP: RSVP, RTP, RTCP and RTSP. Streaming media, Codec and Plugins, IPTV. Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.	5	

Text book and Reference books:

1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013. (Chapters 1-5,7,8,9).
2. Internetworking Technologies, An Engineering Perspective, Rahul Banerjee, PHI Learning, Delhi, 2011. (Chapters 5,6,12)

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Quantum Computing
Code: PEC-IT701B
Contacts: 3L

Name of the Course:	Quantum Computing		
Course Code: PEC-IT701B	Semester: VII		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance : 5 marks	
Practical: NIL		End Semester Exam :70 Marks	
Credit Points:	3		
Objective:			
1	The course will provide an insight of basic of quantum physics from a computer scientist's perspective, and how it describes reality and understand the philosophical implications of quantum computing		
Pre-Requisite:			
1	Linear Algebra, Theory of Computation		

Unit	Content	Hrs/Unit	Marks/Unit
1	Qubit & Quantum States: The Qubit, Vector Spaces. Linear Combination Of Vectors, Uniqueness of a spanning set, basis & dimensions, inner Products, orthonormality, gram-schmidt orthogonalization, bra-ket formalism, the Cauchy-Schwarz and triangle Inequalities.	3	
2	Matrices & Operators: Observables, The Pauli Operators, Outer Products, The Closure Relation, Representation of operators using matrices, outer products & matrix representation, matrix representation of operators in two dimensional spaces, Pauli Matrix, Hermitian unitary and normal operator, Eigen values & Eigen Vectors, Spectral Decomposition, Trace of an operator, important properties of Trace, Expectation Value of Operator, Projection Operator, Positive Operators,	10	
3.	Commutator Algebra, Heisenberg uncertainty principle, polar decomposition & singular values, Postulates of Quantum Mechanics.	5	
4.	Tensor Products: Representing Composite States in Quantum Mechanics, Computing inner products, Tensor products of column vectors, operators and tensor products of Matrices. Density Operator: Density Operator of Pure & Mix state, Key	5	

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	Properties, Characterizing Mixed State, Practical Trace & Reduce Density Operator, Density Operator & Bloch Vector.		
5.	Quantum Measurement Theory: Distinguishing Quantum states & Measures, Projective Measurements, Measurement on Composite systems, Generalized Measurements, Positive Operator- Valued Measures.	8	
6.	Recent trends in Quantum Computing Research, Quantum Computing Applications of Genetic Programming.	6	

Text book and Reference books:

- Quantum Computing without Magic by Zdzislaw Meglicki
 2. Quantum Computing Explained By DAVID Mc MAHON
 3. Quantum Computer Science By Marco Lanzagorta, Jeffrey Uhlmann
 4. An Introduction to Quantum Computing Phillip Kaye, Raymond Laflamme, Michele Mosca.

Course Outcomes:

On completion of the course students will be able to
 knowledge of Vector spaces, Matrices, Quantum state, Density operator and Quantum

Cloud Computing

Code: PEC-IT701C

Contact: 3L

Name of the Course:	Cloud Computing		
Course Code: PEC-IT701C	Semester: VII		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical:		End Semester Exam: 70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	<u>Definition of Cloud Computing and its Basics (Lectures)</u> . Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public , Private, Hybrid and Community Clouds),	9	

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	<p>Service Platform as a Service, Software as a Service with examples of services/ service providers, models – Infrastructure as a Service, Cloud Reference model, Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing, A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients, IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos PaaS – Basic concept, tools and development environment with examples</p> <p>SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) Compliance as a Service (CaaS)</p>		
2	<p>Use of Platforms in Cloud Computing</p> <p>Concepts of Abstraction and Virtualization</p> <p>Virtualization technologies : Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D) Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Advanced load balancing (including Application Delivery Controller and Application Delivery Network), Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine Imaging (including mention of Open Virtualization Format – OVF)</p> <p>Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance, Concepts of Platform as a Service, Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development</p> <p>Use of PaaS Application frameworks, Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and</p>	12	

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	<p>disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service., Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service, Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services,</p>		
3	<p><u>Cloud Infrastructure:</u> Cloud Management: An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle). Concepts of Cloud Security: Cloud security concerns, Security boundary, Security service boundary Overview of security mapping Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management (awareness of Identity protocol standards)</p>	7	
4.	<p><u>Concepts of Services and Applications :</u></p> <p>Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs,</p> <p>Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service</p>	8	

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	attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs Cloud-based Storage: Cloud storage definition – Manned and Unmanned Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services		
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Text book and Reference books:

1. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013
2. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education (India) Private Limited, 2013
3. Cloud computing: A practical approach, Anthony T. Velte, Tata Mcgraw-Hill
4. Cloud Computing, Miller, Pearson
5. Building applications in cloud: Concept, Patterns and Projects, Moyer, Pearson
6. Cloud Computing – Second Edition by Dr. Kumar Saurabh, Wiley India

Machine Learning
Code: PEC-IT701D
Contacts: 3L

Name of the Course:	Machine Learning		
Course Code: PEC IT-701D	Semester: VII		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: Nil		End Semester Exam: 70 Marks	
Credit Points:	3		

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COURSE OBJECTIVE		
<input type="checkbox"/> To learn the concept of how to learn patterns and concepts from data without being explicitly programmed		
<input type="checkbox"/> To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.		
<input type="checkbox"/> Explore supervised and unsupervised learning paradigms of machine learning.		
<input type="checkbox"/> To explore Deep learning technique and various feature extraction strategies.		
	Hrs/unit	Marks/unit
Unit 1: Supervised Learning (Regression/Classification) <ul style="list-style-type: none"> <input type="checkbox"/> Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes <input type="checkbox"/> Linear models: Linear Regression, Logistic Regression, Generalized Linear Models <input type="checkbox"/> Support Vector Machines, Nonlinearity and Kernel Methods <input type="checkbox"/> Beyond Binary Classification: Multi-class/Structured Outputs, Ranking 	10	
Unit 2: Unsupervised Learning <ul style="list-style-type: none"> <input type="checkbox"/> Clustering: K-means/Kernel K-means <input type="checkbox"/> Dimensionality Reduction: PCA and kernel PCA <input type="checkbox"/> Matrix Factorization and Matrix Completion <input type="checkbox"/> Generative Models (mixture models and latent factor models) 	7	
Unit 3 Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)	6	
Unit 4 Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning	9	
Unit 5 Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference	9	
Unit 6: Recent trends in various learning techniques of machine learning and classification methods	5	

References:

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007
4. Rajiv Chopra, Machine Learning, Khanna Publishing House, 2018

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Multimedia Technology

Code: PEC-IT702A

Contacts: 3L

Name of the Course:	Multimedia Technology
Course Code: PEC-IT702A	Semester: VII
Duration: 6 months	Maximum Marks:100
Teaching Scheme	Examination Scheme
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance : 5 marks
Practical: Nil	End Semester Exam :70 Marks

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Multimedia today, Impact of Multimedia, Multimedia Systems, Components and Its Applications	2	
2	Text and Audio, Image and Video(14L) Text: Types of Text, Ways to Present Text, Aspects of Text Design, Character, Character Set, Codes, Unicode, Encryption; Audio: Basic Sound Concepts, Types of Sound, Digitizing Sound, Computer Representation of Sound (Sampling Rate, Sampling Size, Quantization), Audio Formats, Audio tools, MIDI Image: Formats, Image Color Scheme, Image Enhancement; Video: Analogue and Digital Video, Recording Formats and Standards (JPEG, MPEG, H.261) Transmission of Video Signals, Video Capture, and Computer based Animation.	14	
3.	Synchronization, Storage models and Access Techniques: Temporal relationships, synchronization accuracy specification factors, quality of service, Magnetic media, optical media, file systems (traditional, multimedia) Multimedia devices – Output devices, CD-ROM, DVD, Scanner, CCD	8	
4.	Image and Video Database, Document Architecture and Content Management (17L): Image representation, segmentation, similarity based retrieval,	17	

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	image retrieval by color, shape and texture; indexing- k-d trees, R-trees, quad trees; Case studies- QBIC, Virage. Video Content, querying, video segmentation, indexing, Content Design and Development, General Design Principles Hypertext: Concept, Open Document Architecture (ODA), Multimedia and Hypermedia Coding Expert Group (MHEG), Standard Generalized Markup Language (SGML), Document Type Definition (DTD), Hypertext Markup Language (HTML) in Web Publishing. Case study of Applications		
5.	Multimedia Applications(4L): Interactive television, Video-on-demand, Video Conferencing, Educational Applications, Industrial Applications, Multimedia archives and digital libraries, media editors	4	

Text book and Reference books:

1. Ralf Steinmetz and Klara Nahrstedt , Multimedia: Computing, Communications & Applications , Pearson Ed.
2. V.K. Jain, Multimedia and Animation, Khanna Publishing House, 2019.
3. Nalin K. Sharda , Multimedia Information System , PHI.
4. Fred Halsall , Multimedia Communications , Pearson Ed.
5. Koegel Buford , Multimedia Systems , Pearson Ed.
6. Fred Hoffstetter , Multimedia Literacy , McGraw Hill.
7. Ralf Steinmetz and Klara Nahrstedt , Multimedia Fundamentals: Vol. 1- Media Coding and Content Processing , PHI.
8. J. Jeffcoate , Multimedia in Practice: Technology and Application , PHI.

Neural Networks and Deep Learning

Code: PEC-IT702B

Contacts: 3L

Name of the Course:	Neural Networks and Deep Learning		
Course Code: PEC-IT702B	Semester: VII		
Duration:6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz : 10 marks	
		Attendance: 5 marks	
Practical:		End Semester Exam: 70 Marks	
Credit Points:	3		

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Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Various paradigms of learning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques.	3	
2	Feed forward neural network: Artificial Neural Network, activation function, multi-layer neural network, cardinality, operations, and properties of fuzzy relations.	6	
3	Training Neural Network: Risk minimization, loss function, backpropagation, regularization, model selection, and optimization.	6	
4.	Conditional Random Fields: Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy.	9	
5	Deep Learning: Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Recurrent Neural Network, Deep Belief Network.	6	
6	Deep Learning research: Object recognition, sparse coding, computer vision, natural language	6	

Text book and Reference books:

1. Goodfellow, I., Bengio, Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.
3. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
4. Golub, G.,H., and Van Loan, C.,F., Matrix Computations, JHU Press, 2013.
5. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.
6. Rajiv Chopra, Deep Learning, Khanna Publishing House, 2018.

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Soft Computing
Code: PEC-IT702C
Contacts: 3L

Name of the Course:	Soft Computing	
Course Code: PEC-IT702C	Semester: VII	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		Examination Scheme
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz : 10 marks
		Attendance: 5 marks
Practical:		End Semester Exam: 70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Introduction to soft computing; introduction to fuzzy sets and fuzzy logic systems; introduction to biological and artificial neural network; introduction to Genetic Algorithm	8	
2	Fuzzy sets and Fuzzy logic systems: Classical Sets and Fuzzy Sets and Fuzzy relations : Operations on Classical sets, properties of classical sets, Fuzzy set operations, properties of fuzzy sets, cardinality, operations, and properties of fuzzy relations. Membership functions : Features of membership functions, standard forms and boundaries, different fuzzification methods. Fuzzy to Crisp conversions: Lambda Cuts for fuzzy sets, fuzzy Relations, Defuzzification methods. Classical Logic and Fuzzy Logic: Classical predicate logic, Fuzzy Logic, Approximate reasoning and Fuzzy Implication Fuzzy Rule based Systems: Linguistic Hedges, Fuzzy Rule based system – Aggregation of fuzzy Rules, Fuzzy Inference System- Mamdani Fuzzy Models – Sugeno Fuzzy Models. Applications of Fuzzy Logic: How Fuzzy Logic is applied in Home Appliances, General Fuzzy Logic controllers, Basic Medical Diagnostic systems and Weather forecasting	10	

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3	<p>Neural Network</p> <p>Introduction to Neural Networks: Advent of Modern Neuroscience, Classical AI and Neural Networks, Biological Neurons and Artificial neural network; model of artificial neuron.</p> <p>Learning Methods : Hebbian, competitive, Boltzman etc., Neural Network models: Perceptron, Adaline and Madaline networks; single layer network; Back-propagation and multi layer networks.</p> <p>Competitive learning networks: Kohonen self organizing networks, Hebbian learning; Hopfield Networks. Neuro-Fuzzy modelling: Applications of Neural Networks: Pattern Recognition and classification</p>	10	
4.	<p>Genetic Algorithms: Simple GA, crossover and mutation, Multi-objective Genetic Algorithm (MOGA). Applications of Genetic Algorithm: genetic algorithms in search and optimization, GA based clustering Algorithm, Image processing and pattern Recognition</p>	10	
5	<p>PSO:Other Soft Computing techniques: Simulated Annealing, Tabu search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO).</p>	4	

Text book and Reference books:

1. Fuzzy logic with engineering applications, Timothy J. Ross, John Wiley and Sons.
2. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI
3. Principles of Soft Computing , S N Sivanandam, S. Sumathi, John Wiley & Sons
4. Genetic Algorithms in search, Optimization & Machine Learning by David E. Goldberg
5. Neuro-Fuzzy and Soft computing, Jang, Sun, Mizutani, PHI
6. Neural Networks: A Classroom Approach, 1/e by Kumar Satish, TMH,
7. Genetic Algorithms in search, Optimization & Machine Learning by David E. Goldberg, Pearson/PHI
8. A beginners approach to Soft Computing, Samir Roy & Udit Chakraborty, Pearson
9. Fuzzy Sets and Fuzzy Logic: Theory and Applications, George J. Klir and Bo Yuan, Prentice Hall
10. Neural Networks: A Comprehensive Foundation (2nd Edition), Simon Haykin, Prentice Hall.

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Adhoc –Sensor Network

Code: PEC-IT702D

Contact: 3L

Name of the Course:		Adhoc –Sensor Network	
Course Code: PEC-IT702D		Semester: VII	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: 4 hrs		End Semester Exam: 70 Marks	
Credit Points:		3	
Objective:			
1	provide an overview about sensor networks and emerging technologies		
2	To study about the node and network architecture of sensor nodes and its execution environment.		
3	To understand the concepts of communication, MAC, routing protocols and also study about the naming and addressing in WSN		
4	To learn about topology control and clustering in networks with timing synchronization for localization services with sensor tasking and control.		
5	To study about sensor node hardware and software platforms and understand the simulation and programming techniques..		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction and Overview [4L] :Overview of wireless networks, types, infrastructure-based and infrastructure-less, introduction to MANETs (Mobile Ad-hoc Networks), characteristics, reactive and proactive routing protocols with examples, introduction to sensor networks, commonalities and differences with MANETs, constraints and challenges, advantages, applications, enabling technologies for WSNs.	4	
2	Architectures Single-node architecture - hardware components, design constraints, energy consumption of sensor nodes , operating systems and execution environments, examples of sensor nodes, sensor network scenarios, types of sources	9	

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	and sinks – single hop vs. multi hop networks, multiple sources and sinks – mobility, optimization goals and figures of merit, gateway concepts, design princip		
3	Communication Protocols [9L]: Physical layer and transceiver design considerations, MAC protocols for wireless sensor networks, low duty cycle protocols and wakeup concepts - S-MAC , the mediation device protocol, wakeup radio concepts, address and name management, assignment of MAC addresses, routing protocols-classification, gossiping, flooding, energy-efficient routing, unicast protocols, multi-path routing, data-centric routing, data aggregation, SPIN, LEACH, Directed-Diffusion, geographic routing.	9	
4.	Infrastructure Establishment: Topology control, flat network topologies, hierarchical networks by clustering, time synchronization, properties, protocols based on sender-receiver and receiver-receiver synchronization, LTS, TPSN, RBS, HRTS, localization and positioning, properties and approaches, single-hop localization, positioning in multi-hop environment, range based localization algorithms – location services, sensor tasking and control		
5	Sensor Network Platforms and Tools [9L]: Sensor node hardware, Berkeley motes, programming challenges, node-level software platforms, node-level simulators, state-centric programming, Tiny OS, nesC components, NS2 simulator, TOSSIM.		

Text book and Reference books:

1. Holger Karl & Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An

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Information Processing Approach", Elsevier, 2007.

REFERENCES

1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007.
2. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.
3. Thomas Haenselmann, "Sensor Networks", available online for free, 2008.

Information Theory and Coding

Code: PEC-IT702E

Contact: 3L

Name of the Course:	Information Theory and Coding	
Course Code: PEC-IT702E	Semester: VII	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		Examination Scheme
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical:NIL		End Semester Exam: 70 Marks
Credit Points:	3	
Objective:		
1	To develop an understanding of modern network architectures from a design and performance perspective.	
2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).	
3	To provide an opportunity to do network programming	
4	To provide a WLAN measurement ideas.	
Pre-Requisite:		
1		
2		
3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Source Coding [7L] Uncertainty and information, average mutual information and entropy, information measures for continuous random variables, source coding theorem, Huffman codes	7	

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2	Channel Capacity And Coding [7L] Channel models, channel capacity, channel coding, information capacity theorem, The Shannon limit	7	
3	Linear And Block Codes For Error Correction [8L] Matrix description of linear block codes, equivalent codes, parity check matrix, decoding of a linear block code, perfect codes, Hamming codes	8	
4.	Cyclic Codes [7L] Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Golay codes..	7	
5	BCH Codes [8L] Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, examples of BCH codes.	8	
6	Convolutional Codes [8L] Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding	8	

Text book and Reference books:

1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Information and Coding - N Abramson; McGraw Hill.
3. Introduction to Information Theory - M Mansurpur; McGraw Hill.
4. Information Theory - R B Ash; Prentice Hall.
5. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.

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Cyber Security
Code: PEC-IT702F
Contact: 3L

Name of the Course:		Cyber Security	
Course Code: PEC-IT702F		Semester: VII	
Duration: 6 months		Maximum Marks: 100	
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam: 70 Marks	
Credit Points:		3	
Objective:			
1	To develop an understanding of modern network architectures from a design and performance perspective.		
2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).		
3	To provide an opportunity to do network programming		
4	To provide a WLAN measurement ideas.		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Introduction to Cyber Security, Importance and challenges in Cyber Security, Cyberspace, Cyber threats, Cyberwarfare, CIA Triad, Cyber Terrorism, Cyber Security of Critical Infrastructure, Cybersecurity - Organizational Implications.	6	
2	Hackers and Cyber Crimes: Types of Hackers, Hackers and Crackers, Cyber-Attacks and Vulnerabilities, Malware threats, Sniffing, Gaining Access, Escalating Privileges, Executing Applications, Hiding Files, Covering Tracks, Worms, Trojans, Viruses, Backdoors.	7	
3	Ethical Hacking and Social Engineering: Ethical Hacking Concepts and Scopes, Threats and Attack Vectors, Information Assurance, Threat Modelling, Enterprise Information Security Architecture, Vulnerability Assessment and Penetration Testing, Types of Social Engineering, Insider Attack, Preventing Insider Threats, Social Engineering Targets and Defence Strategies.	8	

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4.	Cyber Forensics and Auditing: Introduction to Cyber Forensics, Computer Equipment and associated storage media, Role of forensics Investigator, Forensics Investigation Process, Collecting Network based Evidence, Writing Computer Forensics Reports, Auditing, Plan an audit against a set of audit criteria, Information Security Management System Management. Introduction to ISO 27001:2013	10	
5	Cyber Ethics and Laws: Introduction to Cyber Laws, E-Commerce and E-Governance, Certifying Authority and Controller, Offences under IT Act, Computer Offences and its penalty under IT Act 2000, Intellectual Property Rights in Cyberspace. at Network Layer-IPSec.	5	

Text book and Reference books:

1. Cyber security , Nina Gobole & Sunit Belapune; Pub: Wiley India.
2. Information Security & Cyber Laws, Gupta & Gupta, Khanna Publishing House (AICTE Recommended - 2018)
3. Information Security and Cyber Laws, Pankaj Agarwal
4. Donaldson, S., Siegel, S., Williams, C.K., Aslam, A., Enterprise Cybersecurity -How to Build a Successful Cyberdefense Program Against Advanced Threats, A-press
5. Nina Godbole, SumitBelapure, Cyber Security, Willey
6. Hacking the Hacker, Roger Grimes, Wiley
7. Cyber Law By Bare Act, Govt Of india, It Act 2000.

Operation Research

Code: OEC-IT701A

Contact: 3L

Name of the Course:	Operation Research
Course Code: OEC-IT701A	Semester: VII
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme

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Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	Basic LPP and Applications; Various Components of LP Problem Formulation. Solution of Linear Programming Problems: Solution of LPP: Using Simultaneous Equations and Graphical Method; Definitions: Feasible Solution, Basic and non-basic Variables, Basic Feasible Solution, Degenerate and Non-degenerate Solution, Convex set and explanation with examples Solution of LPP by Simplex Method; Charnes' Big-M Method; Duality Theory. Transportation Problems and Assignment Problems.	17	
2	Network Analysis: Shortest Path: Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource Allocation excluded). Inventory Control: Introduction to EOQ Models of Deterministic and Probabilistic ; Safety Stock; Buffer Stock.	9	
3	Game Theory: Introduction; 2-Person Zero-sum Game; Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance	5	
4.	Queuing Theory: Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) and problems.	5	

Text book and Reference books:

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1. H. A. Taha, "Operations Research", Pearson
2. P. M. Karak – "Linear Programming and Theory of Games", ABS Publishing House
3. Ghosh and Chakraborty, "Linear Programming and Theory of Games", Central Book Agency
4. Ravindran, Philips and Solberg - "Operations Research", WILEY INDIA

Introduction to Philosophical Thoughts

Code: OEC-IT701B

Contact: 3L

Name of the Course:	Introduction to Philosophical Thoughts
Course Code: OEC-IT701B	Semester: VII
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam: 70 Marks
Credit Points:	3

Unit	Content	Hrs/Unit	Marks/Unit
1	Nature of Indian Philosophy : Plurality as well as common concerns. 2. Basic concepts of the Vedic and Upanisadic views : Atman, Jagrata, Svapna, Susupti, Turiya, Brahman, Karma, Rta, Rna,	17	
2	Carvaka school : its epistemology, metaphysics and ethics. Mukti	9	
3	Jainism : Concepts of sat, dravya, guna, paryaya, jiva, ajiva, anekantavada, syadvada, and nayavada ; pramanas, ahimsa, bondage and liberation.		
4	5. Buddhism : theory of pramanas, theory of dependent origination, the four noble truths; doctrine of momentaryness; theory of no soul. The interpretation of these theories in schools of Buddhism : Vaibhasika, Sautrantrika, Yogacara, Madhyamika.	5	
5	6. Nyaya : theory of Pramanas; the individual self and its liberation ; the idea of God and proofs for His existence.	5	

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Text book and Reference books:

1. M. Hiriyanna : Outlines of Indian Philosophy.
2. C.D.Sharma : A Critical Survey of Indian Philosophy.
3. S.N.Das Gupta : A History of Indian Philosophy Vol – I to V.
4. S.Radhakrishnan : Indian Philosophy Vol – I & II.
5. T.R.V.Murti : Central Philosophy of Buddhism.
6. J.N.Mahanty : Reason and Tradition of Indian Thought.
7. R.D.Ranade : A Constructive Survey of Upanisadic Philosophy.
8. P.T.Raju : Structural Depths of Indian Thought.
9. K.C.Bhattacharya : Studies in Philosophy Vol – 1.
10. Datta and Chatterjee : Introduction of Indian Philosophy

Soft Skills & Interpersonal Communication

Code: OEC-IT701C

Contact: 3L

Name of the Course:	Soft Skills & Interpersonal Communication
Course Code: OEC-IT701C	Semester: VII
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam: 70 Marks
Credit Points:	3

Unit	Content	Hrs/Unit	Marks/Unit
1	1. Soft Skills: An Introduction – Definition and Significance of Soft Skills; Process, Importance and Measurement of Soft Skill Development. 2. Self-Discovery: Discovering the Self; Setting Goals; Beliefs, Values, Attitude, Virtue. 3. Positivity and Motivation: Developing Positive Thinking and Attitude; Driving out Negativity; Meaning and Theories of Motivation; Enhancing Motivation Levels.	12	
2	Interpersonal Communication: Interpersonal relations; communication models, process and barriers; team communication; developing interpersonal relationships through effective	12	

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	communication; listening skills; essential formal writing skills; corporate communication styles – assertion, persuasion, negotiation. 2. Public Speaking: Skills, Methods, Strategies and Essential tips for effective public speaking. 3. Group Discussion: Importance, Planning, Elements, Skills assessed; Effectively disagreeing, Initiating, Summarizing and Attaining the Objective. 4. Non-Verbal Communication: Importance and Elements; Body Language. 5. Teamwork and Leadership Skills: Concept of Teams; Building effective teams; Concept of Leadership and honing Leadership skills.		
3	1. Interview Skills: Interviewer and Interviewee – in-depth perspectives. Before, During and After the Interview. Tips for Success. 2. Presentation Skills: Types, Content, Audience Analysis, Essential Tips – Before, During and After, Overcoming Nervousness. 3. Etiquette and Manners – Social and Business. 4. Time Management – Concept, Essentials, Tips. 5. Personality Development – Meaning, Nature, Features, Stages, Models; Learning Skills; Adaptability Skills.	12	

Text book and Reference books:

1. Managing Soft Skills for Personality Development – edited by B.N.Ghosh, McGraw Hill India, 2012.
2. English and Soft Skills – S.P.Dhanavel, Orient Blackswan India, 2010.

Project Management and Entrepreneurship

Code: HSMC 701

Contact: 2L+1T

Name of the Course:	Project Management and Entrepreneurship
Course Code: HSMC 701	Semester: VII
Duration: 6 months	Maximum Marks: 100

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Teaching Scheme		Examination Scheme
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: 1hr		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	3	

ENTREPRENEURSHIP

1. Introduction: Meaning and Concept of Entrepreneurship, Innovation and entrepreneurship, Contributions of entrepreneurs to the society, risk-opportunities perspective and mitigation of risks [2L]
2. Entrepreneurship – An Innovation: Challenges of Innovation, Steps of Innovation Management, Idea Management System, Divergent v/s Convergent Thinking, Qualities of a prospective Entrepreneur [2L]
3. Idea Incubation: Factors determining competitive advantage, Market segment, blue ocean strategy, Industry and Competitor Analysis (market structure, market size, growth potential), Demand-supply analysis [4L]
4. Entrepreneurial Motivation: Design Thinking - Driven Innovation, TRIZ (Theory of Inventive Problem Solving), Achievement motivation theory of entrepreneurship – Theory of McClelland, Harvesting Strategies [2L]
5. Information: Government incentives for entrepreneurship, Incubation, acceleration. Funding new ventures – bootstrapping, crowd sourcing, angel investors, Government of India's efforts at promoting entrepreneurship and innovation – SISI, KVIC, DGFT, SIDBI, Defense and Railways [4L]
6. Closing the Window: Sustaining Competitiveness, Maintaining Competitive Advantage, the Changing Role of the Entrepreneur. [2L]
7. Applications and Project Reports Preparation [4L]
8. PROJECT MANAGEMENT : Definitions of Project and Project Management, Issues and Problems in Project Management, Project Life Cycle - Initiation / Conceptualization Phase, Planning Phase, Implementation / Execution Phase, Closure / Termination Phase [4L]
9. Project Feasibility Studies – Pre-Feasibility and Feasibility Studies, Preparation of Detailed Project Report, Technical Appraisal, Economic/Commercial/Financial Appraisal including Capital Budgeting Process, Social Cost Benefit Analysis [2L]
10. Project Planning – Importance of Project Planning, Steps of Project Planning, Project Scope, Work Breakdown Structure (WBS) and Organization Breakdown Structure (OBS), Phased Project Planning [2L]
11. Project Scheduling and Costing – Gantt chart, CPM and PERT Analysis, Identification of the Critical Path and its Significance, Calculation of Floats and Slacks, Crashing, Time Cost Trade-off Analysis, Project Cost Reduction Methods. [6L]
12. Project Monitoring and Control – Role of Project Manager, MIS in Project Monitoring, Project Audit [2L]
13. Case Studies with Hands-on Training on MS-Project [4L]

Text Books and References

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1. Innovation and Entrepreneurship by Drucker, P.F.; Harper and Row
2. Business, Entrepreneurship and Management: Rao, V.S.P. ;Vikas
3. Entrepreneurship: Roy Rajeev; OUP.
4. Text Book of Project Management: Gopalkrishnan, P. and Ramamoorthy, V.E.; McMillan
5. Project Management for Engineering, Business and Technology: Nicholas, J.M., and Steyn, H.; PHI
6. Project Management: The Managerial Process: Gray, C.F., Larson, E.W. and Desai, G.V.; MGH

Project

Code: PROJ-IT781

Contact: 12P

Project work I

The object of Project Work I is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

Project Work II & Dissertation

The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under EC P1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned in the light of the Report prepared under EC P1;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar Presentation before a Departmental Committee.

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SEMESTER – VIII

Signal and Networks

Code: PEC-IT801A

Contact: 3L

Name of the Course:	Signal and Networks		
Course Code: PEC-IT801	Semester: VIII		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam : 70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Objective and overview, signal and system types and classifications, step response, impulse response and convolution integral;	3	
2	Periodic signal analysis: Fourier series and properties; Aperiodic signal analysis : Fourier Transform - its properties and sinusoidal steady state analysis of systems;	7	
3	Elements of electrical network : dependent and independent sources, active and passive components; classical differential equations for description of transient conditions of Network; Solutions of linear time invariant networks with initial conditions; Unilateral and Bilateral Laplace Transforms and properties; Transient solutions of networks using Laplace Transform; Network functions: poles, zeros, transfer function, Bode plot;	12	
4.	One and two port network parameters and functions : Z, Y and ABCD parameters, driving point and transfer impedances and admittances; Network Theorems and Formulation of Network equations: generalized formulation of KCL, KVL, State Variable descriptions; Thevenin, Norton, Maximum Power Transfer, Tellegen and	10	

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	Reciprocity Theorems;		
5	Graph theory: Tree, Co-tree, fundamental cut-set, fundamental loop analysis of network; Analog filter design: Butterworth, Sallen Key, frequency transformation and scaling;	6	

Text book and Reference books:

1. Signals and Systems by P. Ramesh Babu & R. Ananda Natarajan, Scitech Publications (India) .
2. Signals & Systems by A. V. Oppenheim, A. S. Willsky and S. H. Nawab, Prentice-Hall India .
3. Networks & Systems by D Roy Choudhury.
4. Networks & Systems by Ashfaq Husian.

Cryptography and Network Security

Code: PEC-IT801B

Contact: 3L

Name of the Course:	Cryptography and Network Security		
Course Code: PEC-IT801B	Semester: VIII		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam : 70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Attacks on Computers & Computer Security - Introduction, Need for Security, Security approaches, Principles of Security, Types of attack	5	
2	Cryptography: Concepts & Techniques- Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, Symmetric & Asymmetric key Cryptography, Key Range & Key Size	7	

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3	Symmetric Key Algorithm - Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES(Data Encryption Standard) algorithm, IDEA(International Data Encryption Algorithm) algorithm, RC5(Rivest Cipher 5) algorithm.	8	
4.	Asymmetric Key Algorithm, Digital Signature and RSA - Introduction, Overview of Asymmetric key Cryptography, RSA algorithm, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required).	5	
5	Internet Security Protocols, User Authentication - Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication.	6	
6	Electronic Mail Security - Basics of mail security, Pretty Good Privacy, S/MIME.	4	
7	Firewall - Introduction, Types of firewall, Firewall Configurations, DMZ Network	3	

Text book and Reference books:

1. "Cryptography and Network Security", William Stallings, 2nd Edition, Pearson Education Asia
2. "Network Security private communication in a public world", C. Kaufman, R. Perlman and M. Speciner, Pearson
3. Cryptography & Network Security: Atul Kahate, TMH.
4. "Network Security Essentials: Applications and Standards" by William Stallings, Pearson.
5. "Designing Network Security", Merike Kaeo, 2nd Edition, Pearson Books
6. "Building Internet Firewalls", Elizabeth D. Zwicky, Simon Cooper, D. Brent Chapman, 2nd Edition, Oreilly .
7. "Practical Unix & Internet Security", Simson Garfinkel, Gene Spafford, Alan Schwartz, 3rd Edition, Oreilly
8. "Cryptography and Network Security", V.K. Jain, Khanna Publishing House, 2017.

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Natural Language Processing

Code: PEC-IT801C

Contacts: 3L

Name of the Course:	Natural Language Processing
Course Code: PEC-IT801C	Semester: VIII
Duration: 6 months	Maximum Marks:100
Teaching Scheme	Examination Scheme
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance : 5 marks
Practical:NIL	End Semester Exam :70 Marks
Credit Points:	3

Unit	Content	Hrs/Unit	Marks/Unit
1	Regular Expressions and Automata(Recap) - Introduction to NLP, Regular Expression, Finite State Automata [2L] Tokenization - Word Tokenization, Normalization, Sentence Segmentation, Named Entity Recognition, Multi Word Extraction, Spell Checking – Bayesian Approach, Minimum Edit Distance [5L] Morphology - Morphology – Inflectional and Derivational Morphology, Finite State Morphological Parsing, The Lexicon and Morphotactics, Morphological Parsing with Finite State Transducers, Orthographic Rules and Finite State Transducers, Porter Stemmer [4L]	11	
2	Language Modeling Introduction to N-grams, Chain Rule, Smoothing – Add-One Smoothing, Witten-Bell Discounting; Backoff, Deleted Interpolation, N-grams for Spelling and Word Prediction, Evaluation of language models. [4L] Hidden Markov Models and POS Tagging Markov Chain, Hidden Markov Models, Forward Algorithm, Viterbi Algorithm, Part of Speech Tagging – Rule based and Machine Learning based approaches, Evaluation. [4L]	8	
3	Text Classification Text Classification, Naïve Bayes’ Text Classification, Evaluation, Sentiment Analysis – Opinion Mining and Emotion Analysis, Resources and Techniques. [4L] Context Free Grammar Context Free Grammar and Constituency, Some common CFG phenomena for	9	

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	English, Top-Down and Bottom-up parsing, Probabilistic Context Free Grammar, Dependency Parsing [4L]		
4.	Computational Lexical Semantics Introduction to Lexical Semantics – Homonymy, Polysemy, Synonymy, Thesaurus – WordNet, Computational Lexical Semantics – Thesaurus based and Distributional Word Similarity [4L] Information Retrieval Boolean Retrieval, Term-document incidence, The Inverted Index, Query Optimization, Phrase Queries, Ranked Retrieval – Term Frequency – Inverse Document Frequency based ranking, Zone Indexing, Query term proximity, Cosine ranking, Combining different features for ranking, Search Engine Evaluation, Relevance Feedback [5L]	9	

Text book and Reference books:

1. Speech and Language Processing, Jurafsky and Martin, Pearson Education
2. Foundation of Statistical Natural Language Processing, Manning and Schutze, MIT Press
3. Multilingual Natural Language Processing Applications from Theory to Practice: Bikel, Pearson.

Internet of Things
Code: PEC-IT801D
Contacts: 3L

Course Code	PEC-IT801D
Course Name	Internet of Things
Credits	3
Pre-Requisites	Wireless Networks

Total Number of Lectures: 48

COURSE OBJECTIVE
<input type="checkbox"/> Able to understand the application areas of IOT
<input type="checkbox"/> Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
<input type="checkbox"/> Able to understand building blocks of Internet of Things and characteristics

LECTURE WITH BREAKUP	NO. OF LECTURES
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Unit 1: Environmental Parameters Measurement and Monitoring: Why measurement and monitoring are important, effects of adverse parameters for the living being for IOT	7
Unit 2: Sensors: Working Principles: Different types; Selection of Sensors for Practical Applications Introduction of Different Types of Sensors such as Capacitive, Resistive, Surface Acoustic Wave for Temperature, Pressure, Humidity, Toxic Gas etc	8
Unit 3: Important Characteristics of Sensors: Determination of the Characteristics Fractional order element: Constant Phase Impedance for sensing applications such as humidity, water quality, milk quality Impedance Spectroscopy: Equivalent circuit of Sensors and Modelling of Sensors Importance and Adoption of Smart Sensors	11
Unit 4: Architecture of Smart Sensors: Important components, their features Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol-gel	10
Unit 5: Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor, Usefulness of Silicon Technology in Smart Sensor And Future scope of research in smart sensor	7
Unit 6: Recent trends in smart sensor for day to day life, evolving sensors and their architecture.	5

COURSE OUTCOMES
On completion of the course the student should be able to
<input type="checkbox"/> Understand the vision of IoT from a global context.
<input type="checkbox"/> Determine the Market perspective of IoT.
<input type="checkbox"/> Use of Devices, Gateways and Data Management in IoT.
<input type="checkbox"/> Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.
<input type="checkbox"/> Building state of the art architecture in IoT.

References:

1. Yasuura, H., Kyung, C.-M., Liu, Y., Lin, Y.-L., Smart Sensors at the IoT Frontier, Springer International Publishing
2. Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems, Springer International Publishing
3. Jeeva Jose, Internet of Things, Khanna Publishing House, 2018.
4. Internet of Things, Arsheel Bahga and Vijay Madisetti

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Remote Sensing and GIS

Code: OEC-IT801E

Contacts: 3L

Name of the Course:	Remote Sensig and GIS		
Course Code: PEC-IT801E	Semester:VIII		
Duration:6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz : 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam: 70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction and Overview of Geographic Information Systems Definition of a GIS, features and functions; why GIS is important; how GIS is applied; GIS as an Information System; GIS and cartography; contributing and allied disciplines; GIS data feeds; historical development of GIS.	3	
2	GIS and Maps, Map Projections and Coordinate Systems Maps and their characteristics (selection, abstraction, scale, etc.); automated cartography versus GIS; map projections; coordinate systems; precision and error.	4	
3	Data Sources, Data Input , Data Quality and Database Concepts Major data feeds to GIS and their characteristics: maps, GPS, images, databases, commercial data; locating and evaluating data; data formats; data quality; metadata. Database concepts and components; flat files; relational database systems; data modeling; views of the database; normalization; databases and GIS.	3	
4.	Spatial Analysis Questions a GIS can answer; GIS analytical functions; vector analysis including topological overlay; raster analysis; statistics; integrated spatial analysis.	3	
5.	Making Maps Parts of a map; map functions in GIS; map design and map elements; choosing a map type; producing a map formats, plotters and media; online and CD-ROM distribution; interactive maps and the Web.	6	
6.	Implementing a GIS Planning a GIS; requirements;	4	

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	pilot projects; case studies; data management; personnel and skill sets; costs and benefits; selecting a GIS package; professional GIS packages; desktop GIS; embedded GIS; public domain and lowcost packages.		
1.	Technology & Instruments involved in GIS & Remote Sensing GIS applications; GIS application areas and user segments; creating custom GIS software applications; user interfaces; case studies. Future data; future hardware; future software; Object-oriented concepts and GIS; future issues – data ownership, privacy, education; GIS career options and how to pursue them.	8	
2.	Remote Sensing Remote sensing of environment, E.M. Principle, Thermal infrared remote sensing, Remote sensing of Vegetation, Remote sensing of water, urban landscape	8L	

Text book and Reference books:

1. “Principles of geographical information systems”, P. A. Burrough and R. A. McDonnell, Oxford.
2. “Remote sensing of the environment” , J. R. Jensen, Pearson References:
2. “Exploring Geographic Information Systems”, Nicholas Christmas, John Wiley & Sons.
3. “Getting Started with Geographic Information Systems”, Keith Clarke, PHI.
4. “An Introduction to Geographical Information Systems”, Ian Heywood, Sarah Cornelius, and Steve Carver. Addison-Wesley Longman.

Big Data Analytics

Code: OEC-IT801A

Contacts: 3L

Name of the Course:	Big Data Analytics		
Course Code: OEC-IT801	Semester:VIII		
Duration:6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz : 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam: 70 Marks	
Credit Points:	3		

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Total Number of Lectures: 48

COURSE OBJECTIVE	
□ Understand big data for business intelligence. Learn business case studies for big data analytics. Understand nosql big data management. Perform map-reduce analytics using Hadoop and related tools	
LECTURE WITH BREAKUP	NO. OF LECTUR
Unit 1: What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.	8
Unit 2: Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.	8
Unit 3: Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures	9
Unit 4: MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats	10
Unit 5: Hbase, data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration.	7
Unit 6: Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.	6

COURSE OUTCOMES
After completion of course, students would be:

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- Describe big data and use cases from selected business domains
- Explain NoSQL big data management
- Install, configure, and run Hadoop and HDFS
- Perform map-reduce analytics using Hadoop
- Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics

References:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging
2. V.K. Jain, Big Data and Hadoop, Khanna Publishing House, New Delhi (2017).
3. V.K. Jain, Data Analysis, Khanna Publishing House, New Delhi (2019).
4. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
5. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
6. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
7. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
8. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
9. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
10. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
11. Alan Gates, "Programming Pig", O'Reilley, 2011.

Cyber Law and Ethics

Code: OEC-IT801B

Contacts: 3L

Name of the Course:	Cyber Law and Ethics		
Course Code: OEC-IT801B	Semester:VIII		
Duration:6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz : 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam: 70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction of Cybercrime: What is cybercrime?, Forgery, Hacking, Software Piracy, Computer Network intrusion[4L]. Category of Cybercrime: how criminals plan attacks, passive attack, Active attacks, cyberstalking. [4L]	8	

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2	Cybercrime Mobile & Wireless devices: Security challenges posted by mobile devices, cryptographic security for mobile devices, Attacks on mobile/cellphones, Theft, Virus, Hacking. Bluetooth; Different viruses on laptop [8L]	8	
3	Tools and Methods used in Cyber crime: Proxy servers, password checking, Random checking, Trojan Horses and Backdoors; DOS & DDOS attacks; SQL injection: buffer over flow. [8L]	8	
4.	Phishing & Identity Theft: Phishing methods, ID Theft; Online identity method. [4L] Cybercrime & Cybersecurity: Legal aspects, Indian laws, IT act, Public key certificate. [4L]	8	

Text book and Reference books:

1. Cyber security by Nina Gobole & Sunit Belapune; Pub: Wiley India.
2. Information Security & Cyber laws, Gupta & Gupta, Khanna Publishing House

Mobile Computing
Code: OEC-IT801C
Contacts: 3L

Name of the Course:	Mobile Computing		
Course Code: OEC-IT801C	Semester: VIII		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: 3L		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam: 70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction to Personal Communications Services (PCS): PCS Architecture, Mobility management, Networks signalling. Global System for Mobile Communication (GSM) system overview: GSM Architecture, Mobility management, Network signalling.	5	
2	General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes. Mobile Data Communication: WLANs (Wireless LANs) IEEE	5	

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	802.11 standard, Mobile IP.		
3	Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML). Wireless Local Loop(WLL): Introduction to WLL Architecture, wireless Local Loop Technologies.	7	
4.	Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G	7	
5	Global Mobile Satellite Systems; case studies of the IRIDIUM and GLOBALSTAR systems. Wireless Enterprise Networks: Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols.	7	
6	Server-side programming in Java, Pervasive web application architecture, Device independent example application	8	

Text book and Reference books:

1. "Pervasive Computing", Burkhardt, Pearson
2. "Mobile Communication", J. Schiller, Pearson
3. "Wireless and Mobile Networks Architectures", Yi-Bing Lin & Imrich Chlamtac, John Wiley & Sons, 2001
4. "Mobile and Personal Communication systems and services", Raj Pandya, Prentice Hall of India, 2001.
5. "Guide to Designing and Implementing wireless LANs", Mark Ciampa, Thomson learning, Vikas Publishing House, 2001.
6. "Wireless Web Development", Ray Rischpater, Springer Publishing,
7. "The Wireless Application Protocol", Sandeep Singhal, Pearson .
8. "Third Generation Mobile Telecommunication systems", by P.Stavronlakis, Springer Publishers.
9. Brijesh Gupta "Mobile Computing", Khanna Publishing House, New Delhi

Bio Informatics
Code: OEC-IT801D
Contacts: 3L

Name of the Course:	Bio Informatics
Course Code: OEC-IT801D	Semester: VIII
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme

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Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam: 70 Marks
Credit Points:	3

Unit	Content	Hrs/Unit	Marks/Unit
1	INTRODUCTION TO MOLECULAR BIOLOGY Concepts of Cell, tissue, types of cell, components of cell, organelle. Functions of different organelles. Concepts of DNA: Basic Structure of DNA; Double Helix structure; Watson and crick model. Exons and Introns and Gene Concept. Concepts of RNA : Basic structure, Difference between RNA and DNA. Types of RNA. Concept of Protein: Basic components and structure. Introduction to Central Dogma: Transcription and Tranlation Introduction to Metabolic Pathways.	5	
2	Sequence Databases Introduction to Bioinformatics. Recent challenges in Bioinformatics. Protein Sequence Databases, DNA sequence databases. sequence database search programs like BLAST and FASTA. NCBI different modules: GenBank; OMIM, Taxonomy browser, PubMed;	2	
3	DNA SEQUENCE ANALYSIS DNA Mapping and Assembly : Size of Human DNA ,Copying DNA: Polymerase Chain Reaction (PCR), Hybridization and Microarrays, Cutting DNA into Fragments, Sequencing Short DNA Molecules, Mapping Long DNA Molecules. DeBruijn Graph. Sequence Alignment: Introduction, local and global alignment, pair wise and multiple alignment, Dynamic Programming Concept. Alignment algorithms: Needleman and Wunsch algorithm, Smith-Waterman.	14	
4.	Introduction Probabilistic models used in Computational Biology Probabilistic Models; Hidden Markov Model : Concepts, Architecture, Transition matrix, estimation matrix. Application of HMM in Bioinformatics : Genefinding, profile searches, multiple sequence alignment and regulatory site identification. Bayesian networks Model :Architecture, Principle ,Application in Bioinformatics.	8	
5.	Biological Data Classification and Clustering Assigning protein function and predicting splice sites: Decision Tree	6	

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Robotics
Code: OEC-IT801E
Contacts: 3L

Name of the Course:	Robotics
Course Code: OEC-IT801E	Semester: VIII
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam: 70 Marks
Credit Points:	3

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction :Introduction -- brief history, types, classification and usage, Science and Technology of robots, Some useful websites, textbooks and research journals.	1	
2	Elements of robots – links, joints, actuators, and sensors Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link representation using D-H parameters, Examples of D-H parameters and link transforms, different kinds of actuators – stepper, DC servo and brushless motors, model of a DC servo motor, Types of transmissions, Purpose of sensors, internal and external sensors, common sensors – encoders, tachometers, strain gauge based force-torque sensors, proximity and distance measuring sensors, and vision.	5	
3	Kinematics of serial robots Introduction, Direct and inverse kinematics problems, Examples of kinematics of common serial manipulators, workspace of a serial robot, Inverse kinematics of constrained and redundant robots, Tractrix based approach for fixed and free robots and multi-body systems, simulations and experiments, Solution procedures using theory of elimination, Inverse kinematics solution for the general 6R serial manipulator.	4	
4.	Kinematics of parallel robots Degrees-of-freedom of parallel mechanisms and manipulators, Active and passive joints, Constraint and loop-closure equations,	5	

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	Direct kinematics problem, Mobility of parallel manipulators, Closed-form and numerical solution, Inverse kinematics of parallel manipulators and mechanisms, Direct kinematics of Gough-Stewart platform.		
5.	Velocity and static analysis of robot manipulators Linear and angular velocity of links, Velocity propagation, Manipulator Jacobians for serial and parallel manipulators, Velocity ellipse and ellipsoids, Singularity analysis for serial and parallel manipulators, Loss and gain of degree of freedom, Statics of serial and parallel manipulators, Statics and force transformation matrix of a Gough-Stewart platform, Singularity analysis and statics.	5	
6	Dynamics of serial and parallel manipulators Mass and inertia of links, Lagrangian formulation for equations of motion for serial and parallel manipulators, Generation of symbolic equations of motion using a computer, Simulation (direct and inverse) of dynamic equations of motion, Examples of a planar 2R and four-bar mechanism, Recursive dynamics, Commercially available multi-body simulation software (ADAMS) and Computer algebra software Maple.	4	
7	Motion planning and control Joint and Cartesian space trajectory planning and generation, Classical control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non-linear model based control schemes, Simulation and experimental case studies on serial and parallel manipulators, Control of constrained manipulators, Cartesian control, Force control and hybrid position/force control, Advanced topics in non-linear control of manipulators. 8 Module 8: Modeling and	6	
8	Modeling and control of flexible robots Models of flexible links and joints, Kinematic modeling of multi-link flexible robots, Dynamics and control of flexible link manipulators, Numerical simulations results, Experiments with a planar two-link flexible manipulator.	4	
9	Modeling and analysis of wheeled mobile robots 3Introduction and some well known wheeled mobile robots (WMR), two and three-wheeled WMR on flat surfaces, Slip and its modeling, WMR on uneven terrain, Design of slip-free motion on uneven terrain,	3	

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	Kinematics, dynamics and static stability of a three-wheeled WMR's on uneven terrain, Simulations using Matlab and ADAMS.		
10	Selected advanced topics in robotics Introduction to chaos, Non-linear dynamics and chaos in robot equations, Simulations of planar 2 DOF manipulators, Analytical criterion for unforced motion. Gough-Stewart platform and its singularities, use of near singularity for fine motion for sensing, design of Gough-Stewart platform based sensors. Over-constrained mechanisms and deployable structures, Algorithm to obtain redundant links and joints, Kinematics and statics of deployable structures with pantographs or scissor-like elements (SLE's).	3	

Text book and Reference books:

1. Robotics Process Automation, Khanna Publishing House
2. Saha, S.K., "Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014
3. Ghosal, A., "Robotics", Oxford, New Delhi, 2006.

E-Commerce & ERP:

Code: OEC-IT802A

Contacts: 3L

1. Overview, Definitions, Advantages & Disadvantages of E – Commerce, Threats of E – Commerce, Managerial Prospective, Rules & Regulations For Controlling E – Commerce, Cyber Laws. [3 L]
2. Technologies : Relationship Between E – Commerce & Networking, Different Types of Networking Commerce, Internet, Intranet & Extranet, EDI Systems Wireless Application Protocol : Definition, Hand Held Devices, Mobility & Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement For E – Commerce . [5 L]
3. Business Models of e – commerce : Model Based On Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C, E – Governance. [2 L]
4. E – strategy : Overview, Strategic Methods for developing E – commerce. [2 L]
5. Four C's : (Convergence, Collaborative Computing, Content Management & Call Center).
Convergence : Technological Advances in Convergence – Types, Convergence and its implications, Convergence & Electronic Commerce. Collaborative Computing : Collaborative product development, contract as per CAD, Simultaneous Collaboration, Security. Content Management : Definition of content, Authoring Tools & Content Management, Content – partnership, repositories, convergence, providers, Web Traffic & Traffic Management ; Content Marketing. Call Center : Definition, Need, Tasks Handled, Mode of Operation, Equipment , Strength & Weaknesses of Call Center, Customer Premises Equipment (CPE). [6 L]

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7. Supply Chain Management : E – logistics, Supply Chain Portal, Supply Chain Planning Tools (SCP Tools), Supply Chain Execution (SCE), SCE - Framework, Internet's effect on Supply Chain Power. [3 L]
8. E – Payment Mechanism : Payment through card system, E – Cheque, E – Cash, E – Payment Threats & Protections. [1 L]
9. E – Marketing :. Home –shopping, E-Marketing, Tele-marketing [1 L]
10. Electronic Data Interchange (EDI) : Meaning, Benefits, Concepts, Application, EDI Model, Protocols (UN EDI FACT / GTDI, ANSI X – 12), Data Encryption (DES / RSA). [2 L]
11. Risk of E – Commerce : Overview, Security for E – Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital certificates, Digital signatures. [4 L]
12. Enterprise Resource Planning (ERP) : Features, capabilities and Overview of Commercial Software, re-engineering work processes for IT applications, Business Process Redesign, Knowledge engineering and data warehouse . Business Modules: Finance, Manufacturing (Production), Human Resources, Plant Maintenance, Materials Management, Quality Management, Sales&Distribution ERPPackage, ERP Market: ERP Market Place, SAP AG, PeopleSoft, BAAN, JD Edwards, Oracle Corporation ERP-Present and Future: Enterprise Application Integration (EAI), ERP and E-Commerce, ERP and Internet, Future Directions in ERP [10]

Reference :

1. E-Commerce, M.M. Oka, EPH
2. Kalakotia, Winston : Frontiers of Electronic Commerce , Pearson Education.
3. Bhaskar Bharat : Electronic Commerce - Technologies & Applications. TMH
4. Loshin Pete, Murphy P.A. : Electronic Commerce , Jaico Publishing Housing.
5. Murthy : E – Commerce , Himalaya Publishing.
6. E – Commerce : Strategy Technologies & Applications, Tata McGraw Hill.
7. Global E-Commerce, J. Christopher & T.H.K. Clerk, University Press
8. Beginning E-Commerce, Reynolds, SPD
9. Krishnamurthy, E-Commerce Mgmt, Vikas

Micro-electronics and VLSI Design

Code: OEC-IT802B

Contact: 3L

Credits: 3

Allotted Hrs: 39L

Introduction to CMOS circuits: MOS Transistors, MOS transistor switches, CMOS Logic, The inverter, Combinational Logic, NAND gate, NOT Gate, Compound Gates, Multiplexers, Memory-Latches and Registers. [6L]

Processing Technology: Silicon Semiconductor Technology- An Overview, wafer processing, oxidation, epitaxy deposition, Ion-implantation and diffusion, The Silicon Gate Process- Basic CMOS Technology, basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator, CMOS process enhancement-Interconnect, circuit elements, 3-D CMOS. Layout Design Rule: Layer Representations, CMOS n-well Rules, Design Rule of background scribe line, Layer Assignment, SOI Rule [10L] .

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(Applicable from the academic session 2018-2019)

Power Dissipation: Static dissipation, Dynamic dissipation, short-circuit dissipation, total power dissipation. Programmable Logic, Programmable Logic structure, Programmable interconnect, and Reprogrammable Gate Array: Xilinx Programmable Gate Array, Design Methods: Behavioural Synthesis, RTL synthesis [8L]

Placement: placement: Mincut based placement – Iterative improvement placement simulated annealing. Routing: Segmented channel routing – maze routing – routability and routing resources – net delays. [5L]

Verification and Testing: Verification Versus Testing, Verification: logic simulation design validation – timing verification – Testing concepts: failures – mechanisms and faults – fault coverage – ATPG methods – types of tests – FPGAs – programmability failures – design for testability. [5L]

Overview of VHDL [5L]

Text Book:

1. “Digital Integrated Circuit”, J.M.Rabaey, Chandrasan, Nicolic, Pearson
2. “CMOS Digital Integrated Circuit”, S.M.Kang & Y.Leblebici, TMH
3. “Modern VLSI Design” Wayne Wolf, Pearson
4. “Algorithm for VLSI Design & Automation”, N.Sherwani, Kluwer
5. “VHDL”, Bhaskar, PHI

References:

1. “ Digital Integrated Circuits” Demassa & Ciccone, Willey Pub.
2. “Modern VLSI Design: system on silicon” Wayne Wolf; Addison Wesley Longman Publisher
3. “Basic VLSI Design” Douglas A. Pucknell & Kamran Eshranghian; PHI
4. “CMOS Circuit Design, Layout & Simulation”, R.J.Baker, H.W.Lee, D.E. Boyee, PHI

Economic Policies in India

Code: OEC-IT802C

Contacts: 3L

Economic Development and its Determinants

Approaches to economic development and its measurement – sustainable development; Role of State, market and other institutions; Indicators of development – PQLI, Human Development Index (HDI), gender development indices.

Planning in India

Objectives and strategy of planning; Failures and achievements of Plans; Developing grass-root organizations for development – Panchayats, NGOs and pressure groups.

Demographic Features, Poverty and Inequality

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(Applicable from the academic session 2018-2019)

Broad demographic features of Indian population; rural-urban migration; Urbanization and civic amenities; Poverty and Inequality.

Resource Base and Infrastructure

Energy; social infrastructure – education and health; Environment; Regional imbalance; Issues and policies in financing infrastructure development.

The Agricultural Sector

Institutional Structure – land reforms in India; Technological change in agriculture – pricing of agricultural inputs and output; industry; Agricultural finance policy; Agricultural Marketing and Warehousing; Issues Terms of trade between agriculture and in food security – policies for sustainable agriculture.

Section – II

Industrial policy; Public Sector enterprises and their performance; Problem of sick units in India; Privatization and disinvestment debate; Growth and pattern of industrialization; Small-scale sector; Productivity in industrial sector; Exit policy – issues in labour market reforms; approaches for employment generation.

Public Finances

Fiscal federalism – Centre-State financial relations; Finances of central government; Finances of state governments; Parallel economy; Problems relating to fiscal policy; Fiscal sector reforms in India.

Money, Banking and Prices

Analysis of price behaviour in India; Financial sector reforms; Interest rate policy; Review of monetary policy of RBI; Money and capital markets; Working of SEBI in India.

External Sector

Structure and direction of foreign trade; Balance of payments; Issues in export-import policy and FEMA; Exchange rate policy; Foreign capital and MNCs in India; The progress of trade reforms in India.

Economic Reforms

Rationale of internal and external reforms; Globalization of Indian economy; WTO and its impact on the different sectors of the economy; Need for and issues in good governance; Issues in competition and safety nets in Indian economy.

BASIC READING LIST

1. Ahluwalia, I. J. and I. M. D Little (Eds.) (1999), India's Economic Reforms and Development (Essays in honour of Manmohan Singh), Oxford University Press, New Delhi.
2. Bardhan, P. K. (9th Edition) (1999), The Political Economy of Development in India, Oxford University Press, New Delhi.
3. Bawa, R. s. and P. S. Raikhy (Ed.) (1997), Structural Changes in Indian Economy, Guru Nanak Dev University Press, Amritsar.

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(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

4. Brahmananda, P. R. and V. R. Panchmukhi (Eds.) (2001), Development Experience in the Indian Economy: Inter-State Perspectives, Book well, Delhi.
5. Chakravarty, S. (1987), Development Planning : The Indian Experience, Oxford University Press, New Delhi.
6. Dantwala, M. L. (1996), Dilemmas of Growth : The Indian Experience, Sage Publications, New Delhi.
7. Datt, R. (Ed.) (2001), Second Generation Economic Reforms in India, Deep & Deep Publications, New Delhi.
8. Government of India, Economic Survey (Annual), Ministry of Finance, New Delhi.
9. Jain, a. K. (1986), Economic Planning in India, Ashish Publishing House, New Delhi.
10. Jalan, B. (1992), The Indian Economy – Problems and Prospects, Viking, New Delhi.

General Guidelines

- ❖ This MBA curriculum will be applicable from the academic year 2018 – 19.
- ❖ All rules and regulations regarding admission, examination, registration, migration and others shall be according to MAKAUT norms.

CURRICULUM

Core Courses (Six/ Semester)

Semester – I

MB – 101	Managerial Economics (Micro)
MB – 102	Organizational Behaviour
MB – 103	Business Communication
MB – 104	Legal and Business Environment(Micro and Macro)
MB – 105	Indian Ethos and Business Ethics
MB – 106	Quantitative Techniques

Semester – II

MB – 201	Indian Economy and Policy
MB – 202	Financial Reporting,Statements and Analysis
MB – 203	Marketing Management
MB – 204	Operations Management
MB – 205	Management Information System
MB – 206	Human Resource Management

Semester – III

Core Papers:

MB – 301	Entrepreneurship and Project Management
MB – 302	Corporate Strategy

Elective Papers: Two from any one Functional Area (Major) and two from a different Functional Area (Minor)

FM/ MM/HR/OM/BA/ MIS/ HCM- 301
FM/ MM/HR/OM/BA/ MIS/ HCM – 302
FM/ MM/HR/OM/BA/ MIS/ HCM – 303
FM/ MM/HR/OM/BA/ MIS/ HCM – 304

MB – 303 Internship Project and Viva Voce

Semester – IV

Elective Papers (Four from Major Functional Area and Two from Minor Functional area) **

FM/ MM/HR/OM/BA/ MIS/ HCM – 401

FM/ MM/HR/OM/BA/ MIS/ HCM – 402
 FM/ MM/HR/OM/BA/ MIS/ HCM – 403
 FM/ MM/HR/OM/BA/ MIS/ HCM – 404
 FM/ MM/HR/OM/BA/ MIS/ HCM – 405
 FM/ MM/HR/OM/BA/ MIS/ HCM – 406

****The Major and Minor Functional areas will be same as chosen in the 3rd Semester.**

Elective Papers for Third Semester

Functional Specialization (3rd Semester)

MARKETING		OPERATIONS	
CODE	COURSE NAME	CODE	COURSE NAME
MM 301	B2B MARKETING	OM 301	SUPPLY CHAIN & LOGISTICS MANAGEMENT
MM 302	DIGITAL & SOCIAL MEDIA MARKETING	OM 302	OPERATIONS STRATEGY
MM 303	IMC/ PROMOTION STRATEGY	OM 303	QUALITY TOOLKIT FOR MANAGERS
MM 304	MARKETING RESEARCH	OM 304	PRICING & REVENUE MANAGEMENT

FINANCE		HUMAN RESOURCE	
CODE	COURSE NAME	CODE	COURSE NAME
FM 301	TAXATION	HR 301	TEAM DYNAMICS AT WORK
FM 302	PROJECT APPRAISAL & FINANCE	HR 302	HR METRICS AND ANALYTICS
FM 303	BEHAVIORAL FINANCE	HR 303	CROSS CULTURAL MANAGEMENT
FM 304	CORPORATE FINANCE	HR 304	ORGANIZATIONAL DESIGN

MIS		BUSINESS ANALYTICS	
CODE	COURSE NAME	CODE	COURSE NAME
MIS 301	DATA MINING FOR BUSINESS DECISIONS	BA 301	DATA MINING
MIS 302	E-COMMERCE & DIGITAL MARKETS	BA 302	MARKETING ANALYTICS
MIS 303	MANAGING SOFTWARE PROJECTS	BA 303	BUSINESS FORECASTING
MIS 304	DATA SCIENCE USING R	BA 304	DATA SCIENCE USING R

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

MBA PROGRAMME

(Revised Curriculum - 2018)

Objective

To conduct business and industry - oriented MBA Programme following AICTE Model Curriculum for Management (MBA & PGDM), 2018.

Course

- Two - Year full-time MBA course (Four - Semester).
- Minimum number of class room contact teaching for MBA/PGDM programme should be 96 credits (one credit equals 10 hours) and Internship / Project should be 06 credits i.e., Total $96 + 06 = 102$ credits.
- Specialization: Students can opt for any two functional specializations (One Major Area and one Minor Area) from Marketing, Finance, HRM, Operations Management, Healthcare Management, MIS and Business Analytics
- Each Paper = 4 credits (40 contact hours), 6 Papers / Semester
- Marks per paper: 100 (70 - University, 30 - College)

Course Structure

➤ **Regular Course**

Semester	Paper	Credit (1=4 credit)	Contact Hrs. (1 = 10 hrs.)
I (C*)	6	24	240
II (C*)	6	24	240
III (2 C*+4 E**)	6	24	240
Internship/Project #	2	6	60
IV (6 E**)	6	24	240
Course Total	26	102	1020

(# Project: Project Paper + Presentation + Viva)

(C*: CORE PAPERS/E**: ELECTIVE PAPERS)

- **On – Line Courses** (Non-credit, Paper & Marks to be mentioned in the Mark sheet)
 - Total : 4(1/Semester)
 - Weightage : 4 Credits / Paper = 04 X 4 = 16 credits
 - Courses (any 4): Environment Sciences, Indian Society & Culture, Indian Constitution, Entrepreneurship, English Communication, Data Mining, E-Commerce, Agri-Business, Hospitality Management, Small Business Management, Corporate Social Responsibility.
- **Total Credits:**

Regular	:	102
On-Line (Non-Credit)	:	16

Session

- July – December (Odd Semesters / 1st& 3rd)
- January – June (Even semesters / 2nd& 4th)
- Class / Day : 5 hrs / Day (5 days week)
- Project Work : after 2ndSem Examination, June & July (8 Weeks)

Examination System (Semester – Wise)

- Total Marks = 100 (University – 70, College – 30)
- Internal (College level) : Weightage : 30 (20-Class Test, 10-Presentation & Viva)
- Paperwise Class Test = 2 Tests / every Six weeks
- Average of 2 internal tests (2 components – Test, Presentation& Viva)
- External (University Level) : 70 (20 = MCQ, 20 = Short Q, 30 = Analytical Q and Cases)
- Semester Grade Point Average : SGPA
- Yearly Grade Point Average: YGPA
- Degree Grade Point Average : DGPA
- Odd Semester (1st& 3rd) Examination : 1st Week of December
- Even Semester (2nd& 4th) Examination : 1st Week of May
- Project Marks (100) : Project Report (50), Presentation (30), Viva (20)
- Passmarks : 40 per paper, 50% aggregate

Teaching Methodology

Lecture, Discussion, Presentation, Case Studies, Group Task, Assignments, Projects, Special Lectures by industry professionals.

Internship / Project

Six to Eight weeks Internship Project in industry. Students will be required to submit a Project Report on any area of Elective courses (**Finance, Marketing, HRM, Operations Management, Business Analytics, MIS, Healthcare Management**) under the Faculty guidance. The Project will be examined on Project Report, Presentation and Viva.

General Guidelines

- ❖ This MBA curriculum will be applicable from the academic year 2018 – 19.
- ❖ All rules and regulations regarding admission, examination, registration, migration and others shall be according to MAKAUT norms.

CURRICULUM

Core Courses (Six/ Semester)

Semester – I

MB – 101	Managerial Economics (Micro)
MB – 102	Organizational Behaviour
MB – 103	Business Communication
MB – 104	Legal and Business Environment(Micro and Macro)
MB – 105	Indian Ethos and Business Ethics
MB – 106	Quantitative Techniques

Semester – II

MB – 201	Indian Economy and Policy
MB – 202	Financial Reporting,Statements and Analysis
MB – 203	Marketing Management
MB – 204	Operations Management
MB – 205	Management Information System
MB – 206	Human Resource Management

Semester – III

Core Papers:

MB – 301	Entrepreneurship and Project Management
MB – 302	Corporate Strategy

Elective Papers: Two from any one Functional Area (Major) and two from a different Functional Area (Minor)

FM/ MM/HR/OM/BA/ MIS/ HCM- 301
FM/ MM/HR/OM/BA/ MIS/ HCM – 302
FM/ MM/HR/OM/BA/ MIS/ HCM – 303
FM/ MM/HR/OM/BA/ MIS/ HCM – 304

MB – 303 Internship Project and Viva Voce

Semester – IV

Elective Papers (Four from Major Functional Area and Two from Minor Functional area) **

FM/ MM/HR/OM/BA/ MIS/ HCM – 401

FM/ MM/HR/OM/BA/ MIS/ HCM – 402
 FM/ MM/HR/OM/BA/ MIS/ HCM – 403
 FM/ MM/HR/OM/BA/ MIS/ HCM – 404
 FM/ MM/HR/OM/BA/ MIS/ HCM – 405
 FM/ MM/HR/OM/BA/ MIS/ HCM – 406

****The Major and Minor Functional areas will be same as chosen in the 3rd Semester.**

Elective Papers for Third Semester

Functional Specialization (3rd Semester)

MARKETING		OPERATIONS	
CODE	COURSE NAME	CODE	COURSE NAME
MM 301	B2B MARKETING	OM 301	SUPPLY CHAIN & LOGISTICS MANAGEMENT
MM 302	DIGITAL & SOCIAL MEDIA MARKETING	OM 302	OPERATIONS STRATEGY
MM 303	IMC/ PROMOTION STRATEGY	OM 303	QUALITY TOOLKIT FOR MANAGERS
MM 304	MARKETING RESEARCH	OM 304	PRICING & REVENUE MANAGEMENT

FINANCE		HUMAN RESOURCE	
CODE	COURSE NAME	CODE	COURSE NAME
FM 301	TAXATION	HR 301	TEAM DYNAMICS AT WORK
FM 302	PROJECT APPRAISAL & FINANCE	HR 302	HR METRICS AND ANALYTICS
FM 303	BEHAVIORAL FINANCE	HR 303	CROSS CULTURAL MANAGEMENT
FM 304	CORPORATE FINANCE	HR 304	ORGANIZATIONAL DESIGN

MIS		BUSINESS ANALYTICS	
CODE	COURSE NAME	CODE	COURSE NAME
MIS 301	DATA MINING FOR BUSINESS DECISIONS	BA 301	DATA MINING
MIS 302	E-COMMERCE & DIGITAL MARKETS	BA 302	MARKETING ANALYTICS
MIS 303	MANAGING SOFTWARE PROJECTS	BA 303	BUSINESS FORECASTING
MIS 304	DATA SCIENCE USING R	BA 304	DATA SCIENCE USING R

Elective Papers for Fourth Semester

Functional Specialization (4th Semester)

MARKETING		OPERATIONS	
CODE	COURSE NAME	CODE	COURSE NAME
MM 401	CONSUMER BEHAVIOUR	OM 401	SALES & OPERATIONS PLANNING
MM 402	RETAIL MANAGEMENT	OM 402	BEHAVIORAL OPERATIONS MANAGEMENT
MM 403	SALES & DISTRIBUTION MANAGEMENT	OM 403	OPERATIONS RESEARCH APPLICATIONS
MM 404	SERVICE MARKETING	OM 404	SUPPLY CHAIN ANALYTICS
MM 405	PRODUCT & BRAND MANAGEMENT	OM 405	MANAGEMENT OF MANUFACTURING SYSTEM
MM 406	INTERNATIONAL MARKETING	OM 406	SOURCING MANAGEMENT
FINANCE		HUMAN RESOURCE	
CODE	COURSE NAME	CODE	COURSE NAME
FM 401	INVESTMENT ANALYSIS & PORTFOLIO MANAGEMENT	HR 401	MANPOWER PLANNING RECRUITMENT & SELECTION
FM 402	MANAGING BANKS & FINANCIAL INSTITUTIONS	HR 402	EMPLOYEE RELATIONS&LABOUR LAWS
FM 403	MERGERS, ACQUISITION & CORPORATE RESTRUCTURING	HR 403	COMPENSATION & BENEFITS MANAGEMENT
FM 404	FINANCIAL DERIVATIVES	HR 404	PERFORMANCE MANAGEMENT SYSTEMS
FM 405	INTERNATIONAL FINANCE	HR 405	STRATEGIC HRM
FM 406	FINANCIAL MARKETS & SERVICES	HR 406	INTERNATIONAL HRM
MIS		BUSINESS ANALYTICS	
MIS 401	IT CONSULTING	BA 401	DATA VISUALIZATION FOR MANAGERS
MIS 402	MANAGING DIGITAL PLATFORMS	BA 402	BIG DATA TECHNOLOGY
MIS 403	STRATEGIC MANAGEMENT FOR IT	BA 403	STATISTICS FOR BUSINESS ANALYTICS
MIS 404	RELATIONAL DATABASE MANAGEMENT SYSTEM	BA 404	DATABASE MANAGEMENT SYSTEM
MIS 405	MANAGEMENT OF INFORMATION TECHNOLOGY	BA 405	DATA ANALYTICS USING PYTHON
MIS 406	MANAGING DIGITAL INNOVATION & TRANSFORMATION	BA 406	HR METRICS AND ANALYTICS

FIRST SEMESTER

MB 101: MANAGERIAL ECONOMICS (MICRO)

MODULE I

1. Introduction to Managerial Economics [2L]

- (a) Basic problems of an economic system
- (b) Goals of managerial decision making
- (c) Resource allocation using PPC

2. Demand Analysis [10 L]

- A. Demand Functions - Law of Demand, Explaining the law of demand, Violations of the Law of Demand, Shifts in Demand; Elasticity of Demand: Price Elasticity (at a point and over and interval), Factors affecting price elasticity, Price elasticity and Change in Total Revenue, AR, MR and Price elasticity, Range of Values of Price Elasticity; Income Elasticity, Inferior, Superior and Normal goods, Income Elasticity and Share in Total Expenditure; Cross-Price Elasticity, Substitutes and Complements
- B. Indifference curves, budget line and consumer equilibrium
- C. Introduction to methods of demand estimation (concepts only)

3. Production and Cost Analysis [14L]

- A. Production Function, Short Run and Long Run, Production with One Variable Input, Total Product, Average and Marginal Products, Law of Variable proportions, Relationship between TP, AP and MP.
- B. Short Run Costs of Production, Fixed and Variable Costs, Short Run Total, Average and Marginal Cost and Relationship between them, Short Run Cost Curves, Relationship between AVC, MC, AP and MP; Long run cost curves, Relationship between LAC and SAC, Economies of Scale and Scope.
- C. Production with Two Variable Inputs, Isoquants - Characteristics, Marginal Rate of Technical Substitution, Laws of Returns to Scale, Isocost Curves, * # Finding the Optimal Combination of Inputs, Production of a given output at Minimum Cost, Production of Maximum Output with a given level of Cost, Expansion Path, Finding the Long Run Cost Schedules from the Production Function,
- D. Law of supply, elasticity of supply, market equilibrium, changes in equilibrium.

MODULE II

4. Alternate Goals of Managerial Firms

[2 L]

- (A) Profit maximization
- (B) Revenue maximization
- (C) Managerial utility maximization

5. Managerial Decision Making under Alternative Market Structures

[6 L]

- A. Characteristics of Perfect Competition, Profit Maximization in Competitive Markets, Output Decision in the Short Run, Shut Down Point, Short Run Supply for the Firm and Industry; Output Decision in the Long Run, Break Even Point, Long Run Supply for the Perfectly Competitive Industry
- B. Price and output decision under different market structure – Monopoly, Monopolistic Competition, Oligopoly – cartel, price leadership.

6. Pricing Decisions

[6 L]

- A. Price Discrimination under Monopoly, Transfer Pricing.
- B. Market Failure
- C. Game theory & Asymmetric information

Suggested Readings:

1. Damodaran, Suma – Managerial Economics – Oxford University Press
2. Lipsey & Chrystal – Economics – Oxford University Press
3. Peterson & Lewis – Managerial Economics – Pearson Education.
4. Pindyck and Rubinfeld - Micro Economics – Pearson Education
5. H.L. Ahuja- Managerial Economics, S. Chand
6. D.N. Dwivedi- Managerial Economics, Prentice Hall.

MB 102: ORGANIZATIONAL BEHAVIOUR

MODULE I

- A. **OB – Overview** – Meaning of OB, Importance of OB, Field of OB, Contributing Disciplines, Applications in Industry. **[2L]**

- B. **Personality**– Meaning of Personality, Determinants of Personality, Theories of Personality, Measurement of Personality, Development of Personality [6L]
- C. **Perception** – Process and Principles, Nature and Importance, Factors Influencing, Perception, Perceptual Selectivity, Social Perception, Fundamentals of Decision making. [4 L]
- D. **Work Motivation** – Approaches to Work Motivation, Theories of Motivation – Maslow’s Hierarchy of Need Theory, Alderfer’s ERG Theory, Herzberg’s Motivation-Hygiene Theory, McClelland’s Achievement – Motivation Theory, McGregor’s Theory X & Y, Vroom’s Expectancy Theory, Porter Lawler Expectancy Model [6L]
- E. **Attitudes and Job Satisfaction** – Sources of Attitudes, Types of Attitudes, Attitudes and Consistency, Cognitive Dissonance Theory, Attitude Surveys. [2L]

MODULE –II

- F. **Organization** - Mission, Goals, Characteristics, Types, Organizational Theory- Classical Theories: Scientific Management, Administrative Principles, Bureaucracy, Human Relation Approach, Modern Theories: System Approach, Contingency Approach, Quantitative Approach, Behavioral Approach, Managing Organizational Culture. [6L]
- G. **Group Behavior** - Characteristics of Group, Types of Groups, Stages of Development, Group Decision-making, difference work group and work team, Why work Teams, Work team in Organization, Team Building, Organizational Politics. [4L]
- H. **Leadership** - Leadership Theories, Leadership Styles, Skills and influence process, Leadership and power, Examples of Effective Organizational Leadership in India, Cases on Leadership, Success stories of today’s Global and Indian leaders. [4L]
- I. **Conflict in Organization** - Sources of Conflict, Types of Conflict, Conflict Process, Johari Window, Conflict Resolution, Cases on Conflict Resolution. [2L]
- J. **Organizational Change** - Meaning and Nature of Organizational Change, Types of Organizational Change, Forces that acts as stimulant to change. Resistance to change, How to overcome resistance to change, Approaches to managing Organizational Change, Kurt Lewin’s three Step model, Action research model, Kotter’s eight step model. [4L]

Suggested Readings:

1. Robbins, S.P. Judge, T.A. & Sanghi, S.: Organizational Behaviour, Pearson
2. Luthans, Fred: Organizational Behaviour, McGraw Hill
3. Newstrom J.W. & Devis K.: Organizational Behaviour, McGraw Hill
4. Aswathappa, K : Organisational Behaviour ,Himalaya Publishing House
5. Shukla, Madhukar : Understanding Organizations – Organizational Theory & Practice in India, Prentice Hall
6. Sekharan, Uma: Organisational Behaviour , The Mc Graw –Hill Companies

MB 103: BUSINESS COMMUNICATION

Module I:

1. **Principles of Communication** – Definition, Purposes, Types, Process, Models and Barriers [2L]
2. **Verbal and Non Verbal Communication** – Presentation Skills (Planning and Preparation/ Using Visual Aids/ Delivery), Individual and Team Presentations, Public Speaking, Listening and Feedback, Body Language [4L+6 P]
3. **Written Communication** – Stages of Writing, Composing Business Messages, Preparing Notes, Style, Punctuation, Using simple words, Proof Reading. [4L]
4. **Report Writing** – Report Planning, Types of Reports, Developing an outline, Nature of Headings, Ordering of Points, Logical Sequencing, Graphs, Charts, Executive Summary, List of Illustration, Report Writing. [4L]

Module II:

5. **Internal Communication** – Circulars, Notices, Memos, Agenda and Minutes [4L + 2P]
6. **External Communication** – Resume/CV, Using Facsimiles (Fax), Electronic Mail, Handling Mail [4 L]
7. **Writing Business Letters** – Formats, Styles Types – Request, Enquiry, Placing Order, Instruction, Action, Complaint, Adjustment, Sales, Reference, Good News & Bad News, Acknowledgement [2L + 4P]
8. **Handling Business Information** – Annual Report, House Magazine, Press Release, Press Report [2 L + 2P]

Suggested Readings:

1. Monipally: Business Communication, Tata McGraw Hill
2. Business Communication Essentials (6th Edition) by Courtland L. Bovee & John V. Thill, Pearson
3. Business English: A Complete Guide for All Business and Professional Communications by Prem P. Bhalla; UBS Publishers
4. The Effective Presentation: Talk your way to success by Asha Kaul; SAGE
5. Madhukar: Business Communications; Vikas Publishing House
6. Senguin J: Business Communication; Allied Publishers

MB 104: LEGAL AND BUSINESS ENVIRONMENT
(MICRO & MACRO)

Module I: Legal Environment

1. **Legal Aspects of Business** - Society, State and Law, Enforceability of Law, Mercantile Law. [2L]
2. **Indian Contract Act, 1872** - Contract defined, Elements of valid contract, Classification of contracts, Offer and acceptance, Consideration, Capacity to contracts, Free consent, Legality of object and consideration, Illegal agreements, Termination of contracts, Breach of contract, Indemnity and guarantee, Laws of agency [6L]
3. **Sale of Goods Act, 1930** - Classification of goods, Conditions & Warranties, Passing of ownership rights, Rights of an unpaid seller, Remedies for breach of Contract of Sale of Goods. [4L]
4. **Negotiable Instruments Act, 1881** - Definition and characteristics of different types of negotiable instruments, Parties to a negotiable instrument and their capacity, Dishonour of cheques, Discharge from Liability, Crossing of cheques, Bank drafts and Banker's cheques. [4L]
5. **Companies Act, 1956** - Nature and kinds of companies, Formation, Memorandum, Articles, Prospectus, Capital - shares, debentures, borrowing powers, minimum subscription, Appointment of Directors; Winding up of companies (Including Amendments) [6L]

6. **Consumer Protection Act, 1986** – Salient features and objectives of the Consumer Protection Act, 1986, Different Consumer redressal Forums, Composition and jurisdiction of district, state and National forum, Mode of complaints, Procedures for disposal of complaints, Penalty. [4L]
7. **Intellectual Property Right-** Laws relating to Patents (Patent Act, 1970), Trademarks (Trademark Act, 1999), Copyright (Copyright Act, 1957), Geographical Indications (Registration & Protection) Act, 1999 [4L]

Module II: Business Environment

8. **Economic Indicators** – Consumer Price Index, Interest Rate, Inflation Rate and its impact on Business, Business Risk [4L]
9. **Intellectual Property Regime** (WTO Guidelines) [2L]
10. **Legislation for Anti competitive and Unfair Trade Practice** – Objectives of MRTP Act, 1969, Objectives of Competition Act, 2002, Monopolistic Trade Practice, Anti competitive Agreement, MRTP vs Competition Act [4L]

Suggested Readings:

1. Sen & Mitra: Commercial law; World Press
2. Pathak: Legal Aspect of Business, TMH
3. Das & Ghosh: Business Regulatory Framework: Ocean Publication, Delhi
4. Pillai & Bagavathi: Business law, S. Chand
5. Dutt & Sundaram: Economic Environment of Business, S. Chand
6. Misra, S. K & Puri, D. K.: Economic Environment of Business, Himalaya Publishing

MB 105: INDIAN ETHOS AND BUSINESS ETHICS

Module – I: Indian Ethos

1. **History & Relevance;** Principles, practiced by Indian Companies; Role of Indian Ethos (Management lessons from Vedas, Mahabharata, Bible, Quran, Arthashastra,) Indian Heritage in Business. Ethics Vs Ethos, Indian Vs Western Management; Work ethos and values for Indian Managers [6L]
2. **Relevance of Value-based Management in Global change-** - impact of Values on stake holders; Trans-cultural human values ; Secular - Vs Spiritual values; value system in work culture [4 L]

3. **Stress Management**, - meditation for mental health, yoga [2 L]
4. **Contemporary Approaches to Leadership** – Joint Hindu Family business; Leadership qualities of Karta [2 L]
5. **Indian systems of learning**- Gurukul system of learning, advantages – disadvantages of Karma, Importance of Karma to managers , Nishkama Karma- laws of Karma ; Law of creation- Law of humility- Law of growth – Law of Responsibility- Law of connection – Corporate Karma Leadership [6 L]

Module - II: Business Ethics

6. **Understanding Business Ethics** – Ethical Values, Myths and Ambiguity, Ethical Codes, Ethical Principles in Business; Theories of Ethics, Absolutism vs. Relativism [6 L]
7. **Approaches to Business Ethics**: Teleological Approach, The Deontological Approach , Kohlberg's Six Stages Of Moral Development (CMD) [4 L]
8. **Managing Ethical Dilemma**: Characteristics, Ethical Decision Making, Ethical Reasoning, The Dilemma Resolution Process; Ethical Dilemmas In Different Business Areas Of Finance, Marketing, HRM and International Business [4 L]
9. **Ethical Culture in Organizations** – Developing Code of Culture in Organization, Ethical and Value-Based Leadership. Role of Scriptures in Understanding Ethics, Ethics in Business, Strategies of Organizational Culture Building, Ethical Indian Wisdom and Indian Approaches towards Business Ethics. [6 L]

Suggested Readings

1. Beteille, Andre - Society and Politics in India, OUP
2. Chakraborty, S. K. - Values and Ethics for Organisations, OUP
3. Fernando, A.C. - Business Ethics - An Indian Perspective, Pearson
4. Gupta, Dipankar - Social Stratification, OUP.
5. Srinivas, M. N.- Social Structure and Caste and Other Essays, OUP.
6. Sandhya, N- Indian Society, Vrindya Publication

MB 106: QUANTITATIVE TECHNIQUES

Module I:

1. **Linear Programming**: Formulating maximization/minimization problems, Graphical solution, Simplex method, Artificial Variables – Big M – Method, Special cases of LP, Duality of LP and its interpretation, Post Optimality/Sensitivity Analysis, Applications of LP. [6L]

2. **Transportation Problems:** Introduction - Mathematical formulation of transportation problem - the Transportation method for finding initial solutions-North West Corner Method - Least Cost Method - Vogel's Approximation method - test for optimality - steps of MODI method-loops in transportation table - Degeneracy. [6L]
3. **Assignment Problems:** Introduction - Mathematical statement of the problem-Hungarian method of solution - Maximization case in assignment problem—unbalanced assignment problem - restrictions on assignment - Travelling salesman problem. [4L]
4. **Theory of Games:** Introduction - Two person zero sum games - Pure strategies - games with saddle points - rules to determine saddle points - mixed strategies - Game without saddle points - the rules of dominance - Methods of solution for games without saddle points—algebraic methods, graphical methods. [4L]

Module II:

5. **Basic Statistics:** Basic Concept (Variables, Population v/s Sample, Central tendency, Dispersion, data Visualization, Simple Correlation and Regression. [4L]
6. **Probability & Distribution:** Probability - Introduction, Rules of Probability, Conditional Probability (Baye's Theorem), Random Variables, Discrete and Continuous Distributions (Binomial, Poisson and Normal), Sampling - Types and Distribution. [6L]
7. **Theory of Estimation:** Estimation - estimation problems, standard error, margin of error, confidence error, confidence interval, characteristics of estimators, consistency unbiasedness, sufficiency and efficiency, most sufficient estimators. Point Estimation and Interval Estimation. [4L]
8. **Statistical Inference:** Hypothesis Testing, Parametric Test - Z, F, t test, ANOVA, Non Parametric Test - Chi square test (goodness of fit, independence of attributes) Spearman's Rank Correlation Coefficient. [6L]

Software Packages to be used in illustrating the above methods

Suggested Readings

1. Statistics by Wayne L. Winston
2. Business Statistics by GC Berry
3. Business Statistics, Problems & Solutions by JK Sharma
4. Operations Research by A Ravindran, Don T Philips and James J Solberg..
5. Operations Research by V K Kapoor
6. Operations Research by S K Kalavathy

SECOND SEMESTER

MB 201: INDIAN ECONOMY AND POLICY

MODULE I

1. Circular Flow of Income

National Income Accounting –terms and concepts, three methods of measuring GDP/GNP (3L)

2. Theory of Income Determination

Simple Keynesian model: Aggregate demand – Aggregate supply method, Savings-investment method

Concepts of multiplier: Autonomous expenditure multiplier, introducing the Government, Government expenditure multiplier, Tax Rate Multiplier, Balanced Budget Multiplier, Open economy – Export and import multipliers.

Paradox of Thrift, Crowding out effect, Business cycle – phases and stabilization (6L)

3. Introduction of Money and Asset Market

IS-LM model, Fiscal policy and monetary policy using IS-LM (4L)

4. Inflation and Unemployment

Concepts of inflation – demand pull and cost push, Stabilization policies

Introduction to Philips curve as relation between inflation and unemployment. (3L)

5. Introduction to Foreign Trade & International Linkages

Concepts of Balance of Payments

Alternative exchange rate systems – fixed, flexible and managed float

Comparative Advantage as basis for trade;

Tariff and non-tariff barriers (4L)

MODULE II

6. Indian Economy - An Overview

Evolution of Indian economy since independence

Liberalization of Indian economy since 1991 (4L)

7. New Industrial Policy

LPG model, New Industrial Policy (1991) (4L)

8. Banking and Capital Market Reforms

Banking structure in India,
Composition of Indian Capital market,
SEBI and Capital Market Reforms (4L)

9. Monetary and Fiscal Policy Reforms

Composition of Indian money market
Components and Instruments of Monetary policy
Concepts and Management of Deficits (4L)

10. Trade Policy Reforms

Major components of trade policy reforms
Idea of FEMA, NITI AYOOG role and function
Current and capital account convertibility. (4L)

Suggested Readings:

1. Principles of Macroeconomics - SoumyenSikdar, (OUP)
2. Managerial Economics - Suma Damodaran, (OUP)
3. Macroeconomics – Dornbusch , Fischer &Startz (PHI)
4. Economic Environment of Business: S.K. Mishra and V.K. Puri,
5. Indian Economy: Datt & Sundharam,
6. Indian Economy since Independence, Uma Kapilaed.

MB 202: FINANCIAL REPORTING, STATEMENT AND ANALYSIS

MODULE I

1. **Basic Financial Accounting Concept:** Meaning and Scope of Accounting -Definition of accounting-classification of accounting- GAAP- Accounting Concepts and Conventions -Accounting Equation (2L)
2. **Preparation Of Books Of Accounts:** Event-Transaction- Accounting Cycle - Golden Rule- Journal-Ledger-Trial Balance-Final Account (10L)
3. **Basic Cost Accounting Concept-** Cost Concept-Cost Unit- Technique of Costing- Method of Costing- Cost center- Cost Unit- Cost Sheet preparation and Interpretation. (4L)
4. **Introduction to Accounting Standard:** Introduction to Indian GAAP and IndAS- Introduction to IFRS and IAS- Comparative Analysis of Indian GAAP and IndAS. (4L)

MODULE II

5. **Preparation Of Financial Statement:** Trading Account-Profit & Loss Account - Balance Sheet (As per Schedule VI, old & new) with Adjustment Entries - Preparation and Interpretation of Annual Report -Corporate Social Responsibility - Human Resource Accounting-Value Added Statement (10L)
6. **Financial Statement Analysis:** Comparative Statement- Common Size Statement- Trend Analysis- Ratio Analysis-Fund Flow Statement - Cash Flow Statement. (10L)

Suggested Readings:

1. M. Hanif & A. Mukherjee : Financial Accounting. McGraw Hill
2. S. K. Paul: Financial Accounting, New Central book Agency
3. S. P. Jain & K. L. Narang: Cost and Management Accounting. Kalyani Publication
4. P. M. Rao: Financial Statement Analysis and Reporting. PHI
5. T. P. Ghosh, N. Ankarnath, K. J. Mehta & Y. A. Alkafazi: Understanding IFRS Fundamentals, Wiley
6. Tulsian & Tulsian: Corporate Financial Reporting, S. Chand

MB 203: MARKETING MANAGEMENT

MODULE I

1. **Introduction:** Definitions of marketing; Core Concept of Marketing – need, want, demand, offering and branding, value and satisfaction, Evolution of marketing concepts (orientations); Marketing Mix – 4Ps and 4Cs. [2 L]
2. **Marketing Environment:** Major components of Internal Environment, the micro-environment and macro-environment; SWOT Analysis, PEST Analysis [2 L]
3. **Strategy and Planning:** Concept of SBU, Choice of Corporate level Strategy; BCG matrix, Product-Market Grid, Porter's Five Force Model for Industry Analysis. [4 L]
4. **Market Segmentation, Targeting and Positioning (STP):** Concepts of market segmentation: Various bases for segmentation: Geographic, Demographic, Psychographic (VALS-II) and Behavioural; Targeting: Mass marketing, Segment Marketing, Niche Marketing, Micro Marketing and Customization; Concept of Differentiation and Positioning. [4 L]
5. **Consumer Behaviour and Marketing Research:** A framework of consumer decision making process, overview of major factors influencing consumer behavior; marketing research: Role in decision making, Steps and process of Marketing Research, B2B Marketing. [4 L]

MODULE II

6. **Product:** Product Classification, Service – characteristics and expanded service mix elements; Product Levels, Product Mix, Product Line Management, Product Life Cycle: concept and types, New Product Development. [6 L]
7. **Branding and Packaging:** Purpose of branding; Brand equity; Branding strategies; Purpose of Packaging; Types of Packaging – primary, secondary, shipping packages. [3 L]
8. **Pricing:** Procedure for price setting; Pricing objectives; Cost and Demand consideration; Pricing Methods, Pricing Strategies [3 L]

9. **Marketing Channels:** Channel flows and functions; Channel design decisions; Wholesaling and Retailing, Concept of Supply Chain Management and Logistics Management, Channel Conflict Management [5 L]
10. **Promotion:** Elements of Promotion Mix (Advertising, Sales Promotion, Personal Selling, Direct Marketing, Publicity & PR), 5M model of Advertising, Concept of Digital Marketing; Overview of Selling Process [5 L]
11. **Basic concepts of market potential:** Sales potential/ Market Share and Sales forecast; Methods of Sales forecasting. [2 L]

Suggested Reading:

1. Kotler, P., Keller, K., Koshy, A. & Jha, M. - Marketing Management; Pearson
2. Ramaswamy & Namakumari - Marketing Management; McMillan
3. Saxena, R. - Marketing Management; TMH
4. Kurtz, David L, Boone , Louis E - Principles of Marketing; Thomson
5. Keith Blois – Text Book of Marketing; Oxford University Press
6. Etzel, M.J., Walker, B.W. & W.J. Stanton - Marketing; TMH

MB 204: OPERATIONS MANAGEMENT

MODULE I

1. **Introduction to Production and Operations Management:** Difference between Manufacturing and Service Operations; Product Process Matrix capacity planning- Responsibilities of Production Manager; Production as a Coordination Function; Production Cycle, Production Planning & Control Concept. (4L)
2. **Characteristics of Manufacturing Systems:** Classification of Manufacturing Systems with Examples; Differences between Intermittent and Continuous Production (2L)
3. **Plant Location:** Need for a Good Plant Location; Factors influencing Plant Location – Tangible and Intangible Factors; Economic Survey of Site Selection (2L)
4. **Plant Layout:** Need for a Good Plant Layout; Characteristics of a Good Layout; Costs associated with Plant Layout; Process Layout vs. Product Layout; Optimization in a Process Layout and Product Layout; Designing Product and Process Layout; Assembly Line Balancing – Concept and Problems; Cellular Manufacturing Concept (6L)
5. **Maintenance Management:** Types of Maintenance – Breakdown and Preventive Maintenance; Total Productive Maintenance (TPM) (3L)

MODULE II

6. **Purchase Management:** Purchasing Procedure; Value Analysis; Vendor Selection; Negotiation; Make or Buy decision (2L)
7. **Inventory Management:** Classification of inventory items – ABC, FSN, VED classification; Introduction to EOQ and EBQ; MRP – Concept, inputs and outputs, benefits, examples; Deterministic demand model-EOQ- Continuous and Periodic review Inventory models; Master Production Schedule and MRP; Concepts of MRP II, JIT and ERP (6L)
8. **Inspection & Quality Control:** Types of Inspection; Statistical Quality Control – Acceptance Sampling and Control Charts (5L)

9. **Scheduling:** Sequencing – Definition and Assumptions; Sequencing of n jobs on a single machine – Shortest Processing Time, Longest Processing Time, Earliest Due Date and First Come First Serve basis; Sequencing of 2 jobs on 2 machines – Gantt Charts, Limitations of Gantt Charts; Sequencing of n jobs on 2 and 3 machines – Johnson's Rule; Introduction to Project Management – CPM and PERT, Identification and Importance of the Critical Path (6L)
10. **Work Study:** Definition and its Importance; Basic Procedure in Performing a Work Study; Method Study –Objectives and Procedure; Work Measurement–Objectives and Procedure; Concepts of Performance Rating, Basic Time, Allowances and Standard Time (4L)

Suggested Readings:

1. Chary, S.N. – Production and Operations Management; TMH
2. Panneerselvam, R. – Production and Operations Management, PHI
3. Bedi, K. – Production and Operations Management; Oxford University Press
4. Chase, Jacobs, Aquilano and Agarwal – Operations Management for Competitive Advantage; TMH
5. Buffa, E. S. and Sarin, R.K. – Modern Production / Operations Management; John Wiley
6. Collier, Evans and Ganguly – Operations Management; Cengage Learning

MB 205: MANAGEMENT INFORMATION SYSTEM

MODULE I

1. E-commerce / E-business [3L]

Overview, Definitions, Advantages & Disadvantages of E-commerce

Business models of e-commerce: models based on transaction party (B2B, B2C, B2G, C2B, C2C, E-Governance), models based on revenue models

Implementation ecommerce business, online and offline marketing

2. ERP, CRM, SCM [10L]

ERP (Enterprise Resource Planning):

Concepts of ERP, architecture of ERP, Generic modules of ERP, Applications of ERP, concept of XRP (extended ERP)

Features of commercial software like SAP, Oracle Apps, MS Dynamics NAV

CRM (Customer Relationship Management):

Concepts of CRM, Features, application of CRM

Sales force automation

SCM (Supply Chain Management):

Concepts of SCM, drivers of SCM, inbound & outbound

Definition, brief description and applicability of: eProcurement, eTailing, eLogistics, eCollaboration, eIntegration.

Case studies for ERP, CRM, and SCM

3. Data Communication & Networking [4L]

Need for computer networking, components of a data communication system,

Network topology

Types of networks: LAN, MAN, WAN; concepts of Internet, Intranet, Extranet, and WWW.

Network protocols, Network Architecture

MODULE II

4. Threats to Computer Systems and Control Measures [2L]

Concepts of threats: Virus, hacking, phishing, spyware, spam, physical threats (fire, flood, earthquake, vandalism)

Concepts of security measures: firewall, encryption

5. Database Management Systems (DBMS) [e.g. MS-Access/ Oracle/ MS SQL Server / MySQL etc.] [4L+2P]

What is a DBMS; Need for using DBMS. Concepts of tables, records, attributes, keys, integrity constraints

SQL: DDL & DML, DCL concepts, SQL commands [ANSI standard].

6. Data Warehousing and Data Mining [3L]

Concepts of Data warehousing, data mart, meta data, multidimensional modeling, Online Analytical Processing (OLAP), Online Transaction Processing (OLTP), Data mining concepts, knowledge discovery v. data mining, data mining applications.

7. MS Office Applications [12 P]

MS Excel: Graphs and Charts–Calculation of various financial functions Performing Mathematical Calculations (using Formula and Functions), Searching, Sorting and Filtering, Min Media Mode, Reference Operators, Functions: Typing a Function, Creating a Column Chart: Changing the Size and Position of a Chart Saving

MS Access: Tables and Queries, Forms, Relationship

MS Power Point: Introduction–Toolbar, their Icons and Commands– Navigating in Power point–Creation of slides, animation, and templates–Designing Presentations–Slide show controls–Making notes on Pages and Handouts–Printing Presentations–Customizing Presentations–Auto content Wizard.

Suggested Readings:

1. Waman S Jawadekar: Management Information Systems – Text and Cases 3ed. McGraw Hill
2. Mahadeo Jaiswal & Monica Mittal: Management Information Systems, OUP
3. Forouzan: Data Communication & Networking, TMH.
4. Tanenbaum: Computer Networks, Pearson Education
5. Ivan Bayross: SQL & PL/SQL, BPB ISRD, Introduction to Database Management Systems, Tata McGraw Hill
6. Sadagopan: ERP: A Managerial Perspective, Tata McGraw Hill.

MB - 206: HUMAN RESOURCE MANAGEMENT

MODULE I

- 1. Human Resource Management:** Meaning, Scope, objectives, and functions of HRM , HR as a Factor of Competitive Advantage, Structure of HR Department, , Line and staff responsibility of HR Managers, Environmental factors influencing HRM (2L)
- 2. Human Resource Planning:** definition, objective, process of HRP. Supply and Demand Forecasting techniques, Manpower Inventory, Career Planning& Development, Succession Planning, Rightsizing, Restructuring. Human Resource Information System (HRIS) (6L)
- 3. Recruitment and Selection :** Process, Sources, Methods of selection, Interviewing Methods, Skills and Errors. (4L)
- 4. Human Resource Development:** Definition, objective, process of HRD, Assessment of HRD Needs, HRD Methods: Training and Non-Training, Training Process; Designing, Implementation and Evaluation of Training Programmes, Induction Training. Developing Managerial Skills for: team management, collaboration, interaction across business functions, presentation , Negotiation, and Networking (6L)
- 5. Performance Appraisal Systems :** Purpose, Methods, Appraisal instruments, 360 degree Appraisal,HR Score Card, Errors in appraisal, Potential Appraisal, Appraisal Interview. (4L)

MODULE -II

- 6. Compensation Management :** Concepts, Components; System of Wage Payment, job evaluation, wage/ salary fixation, incentives, bonus, ESOPs, Fringe Benefits, Retirement Benefits. Compensation Plans (4L)
- 7. Industrial Relations in India:** Parties; Management and Trade Unions, Industrial Disputes: Trends, Collective Bargaining, Settlement Machineries, Role of Government, Labour Policy in India. (4L)

8. **Workers' Participation in Management:** Concept, Practices and Prospects in India, Quality Circles and other Small Group Activities. (2L)
9. **Discipline Management** : Misconduct, Disciplinary action, Domestic Enquiry, Grievance Handling (4L)
10. **Strategic HRM:** Meaning, Strategic HRM vs Traditional HRM, SHRM Process, barriers to SHRM. Nature of e-HRM, eRecruitment & Selection, e-Performance Management, e-Learning (4L)

Suggested Readings:

1. Agarwala T. - Strategic Human Resource Management, OUP
2. Aswathappa, K. - Human Resource Management, Tata McGraw Hill
3. Jyothi P. & Venkatesh, D.N. - Human Resource Management, OUP
4. Ramaswamy, E.A. - Managing Human Resources, OUP
5. Saiyadain, M.S - Human Resource Management : Tata McGraw Hill
6. Mondal Sabari & Goswami Amal - Human Resource Management: Vrinda Publications

THIRD SEMESTER

MB 301: ENTREPRENEURSHIP & PROJECT MANAGEMENT

MODULE I: ENTREPRENEURSHIP

1. Introduction: Meaning and Concept of Entrepreneurship, Innovation and entrepreneurship, Contributions of entrepreneurs to the society, risk-opportunities perspective and mitigation of risks [2L]
2. Entrepreneurship - An Innovation: Challenges of Innovation, Steps of Innovation Management, Idea Management System, Divergent v/s Convergent Thinking, Qualities of a prospective Entrepreneur [2L]
3. Idea Incubation: Factors determining competitive advantage, Market segment, blue ocean strategy, Industry and Competitor Analysis (market structure, market size, growth potential), Demand-supply analysis [4L]
4. Entrepreneurial Motivation: Design Thinking - Driven Innovation, TRIZ (Theory of Inventive Problem Solving), Achievement motivation theory of entrepreneurship - Theory of McClelland, Harvesting Strategies [2L]
5. Information: Government incentives for entrepreneurship, Incubation, acceleration. Funding new ventures - bootstrapping, crowd sourcing, angel investors, Government of India's efforts at promoting entrepreneurship and innovation - SISII, KVIC, DGFT, SIDBI, Defense and Railways [4L]
6. Closing the Window: Sustaining Competitiveness, Maintaining Competitive Advantage, the Changing Role of the Entrepreneur. [2L]
7. Applications and Project Reports Preparation [4L]

MODULE II: PROJECT MANAGEMENT

8. Definitions of Project and Project Management, Issues and Problems in Project Management, Project Life Cycle - Initiation / Conceptualization Phase, Planning Phase, Implementation / Execution Phase, Closure / Termination Phase [4L]

9. Project Feasibility Studies – Pre-Feasibility and Feasibility Studies, Preparation of Detailed Project Report, Technical Appraisal, Economic/Commercial/Financial Appraisal including Capital Budgeting Process, Social Cost Benefit Analysis [2L]
10. Project Planning – Importance of Project Planning, Steps of Project Planning, Project Scope, Work Breakdown Structure (WBS) and Organization Breakdown Structure (OBS), Phased Project Planning [2L]
11. Project Scheduling and Costing – Gantt chart, CPM and PERT Analysis, Identification of the Critical Path and its Significance, Calculation of Floats and Slacks, Crashing, Time Cost Trade-off Analysis, Project Cost Reduction Methods. [6L]
12. Project Monitoring and Control – Role of Project Manager, MIS in Project Monitoring, Project Audit [2L]
13. Case Studies with Hands-on Training on MS-Project [4L]

Suggested Readings:

1. Innovation and Entrepreneurship by Drucker, P.F.; Harper and Row
2. Business, Entrepreneurship and Management: Rao, V.S.P. ;Vikas
3. Entrepreneurship: Roy Rajeev; OUP.
4. Text Book of Project Management: Gopalkrishnan, P. and Ramamoorthy, V.E.; McMillan
5. Project Management for Engineering, Business and Technology: Nicholas, J.M., and Steyn, H.; PHI
6. Project Management: The Managerial Process: Gray, C.F., Larson, E.W. and Desai, G.V.; MGH

MB 302: CORPORATE STRATEGY

MODULE I:

1. Strategic Management: Objectives, policies, Tools – Balanced Score Card, Strategic Management process. [4L]
2. Environmental Scanning: SWOT Analysis, External Environment Analysis (Economic, Legal, Political, Social, Geographic, Technical); Internal Environment Analysis - Strategic Advantage Factors (Finance, Marketing, Production, HR, R & D, etc.) [4L]

3. Strategic Planning: Corporate; Functional and Managerial Goal Setting; Positioning Organization, Models for Resource Allocation, Environmental Turbulence Strategic Investment, Strategic Entry [6L]
4. Formulating Strategies: Corporate, Administrative/Executive and Operating Levels, Developing Functional Strategies – Production/Operations, Finance, Marketing, HR, Materials, R & D; BCG Matrix, Portfolio analysis. [6L]

MODULE II:

5. Implementation of Strategies: Role of Managers, Leadership, Strategic Control System and Measurement, Structural Implementation, Functional Implementation. [6L]
6. Strategic Actions: Mergers, Acquisitions, Diversification, Joint Ventures, De-Merger, etc. [4L]
7. Evaluation of Strategy: Need, Problems, Criteria for Evaluation (Qualitative/Quantitative), Process of Evaluation [4L]
8. Case studies – Strategic Planning and Management [6L]

Suggested Readings:

1. Corporate Strategies: Banerjee, Bani P.; OUP
2. Crafting the Strategy: Das, Ranjan ;, Tata McGraw Hill
3. Business Policy and Strategic Management: Kazmi, A., Tata McGraw Hill
4. Global Strategic Management: Mellahi, K.,Frynas, J.G.and Finlay, P., OUP
5. Competitive Strategy: Porter, Michael E., The Free Press
6. Discourses on Strategic Management: Roy, Dilip; Asian Books

ELECTIVE PAPERS

SPECIALIZATION: MARKETING

MM 301: B2B MARKETING

MODULE I:

1. Nature of Business Marketing: Business Marketing Concept, Business vs. Consumer Marketing, Economics of Industrial demand, Types of Industrial Markets, Types of Business Customers, Classifying Industrial Products and Services, Business customers' purchase orientations, Organizational Procurement Characteristics, Environment Analysis in Business Marketing. [6L]
2. Organizational Buying Behavior: Organizational Buying Process, Types of purchases/buying situations, Buying Centre Concept, Inter Personal Dynamics of Business Buying Behaviour, Roles of Buying centre, Conflict Resolution in Decision, The Webster and Wind model of Organizational Buying Behaviour, Ethics in Purchasing. [6L]
3. Business Marketing Research: Differences between B2C and B2B Marketing Research, Sales Forecasting Approaches, Top-Down, Bottom-up approaches. [2L]
4. Market Segmentation: Segmenting, Targeting and Positioning of Business Market, Value based segmentation, Model for segmenting the organizational Market. [4L]

MODULE II:

5. Product Policy of established products: Classification of the product types; the life cycle of the product; Management products; Strategies for established products. Product policy of new product development: Strategies for the development of new products; Marketing systems; Marketing of engineering services. [4L]
6. Formulating Channel Strategy: Nature of Business Marketing channels, Intermediaries, Direct and Indirect Channels, Channel Objectives, Channel Design, Managing Channel Members, Selection and Motivation of Channel Members, Channel conflicts [4L]
7. Pricing Strategy: Price Determinants, Factors that Influence the Pricing Strategies, Pricing Methods, concept of learning curves, Pricing Strategies, Pricing Policies, Terms of Payment, Competitive Bidding, Leasing [2L]

8. The Promotional Strategies: Communication Objectives, Role of personal relation, Advertising, Sales Promotion in Industrial Markets, Trade shows and Exhibitions. [2L]
9. Management of Sales Force: Personal Selling, steps involved in B2B personal selling, process of tendering, Key Account Management, Managing the Industrial Sales Force, Organizing and controlling the industrial sales force activity, planning for sales force deployment. [4L]
10. B2B through E-Commerce: Business-to-Business forms of E-Commerce, Models for B2B ecommerce, marketing strategy for the electronic market place. [4L]
11. Case Studies in Indian context only [2L]

Suggested Readings:

1. Industrial Marketing by P. K. Ghosh; Oxford University Press
2. Indian Cases in B2B Marketing by Dilip Sarwate
3. Fundamentals of Business to Business by Coe John; McGraw-Hill Education
4. Business Market Management by Jr. Anderson James C; Pearson
5. Driving Demand: Transforming B2B Marketing to Meet the Needs of the Modern Buyer by Carlos Hidalgo; Palgrave Macmillan
6. The Challenger Sale by Matthew Dixon, Brent Adamson; Penguin

MM 302: DIGITAL & SOCIAL MEDIA MARKETING

MODULE I:

1. Fundamentals of Digital Marketing: concept, history, types, implementation and benefits of digital marketing [2L]
2. Search Engine optimization: concept of Search Engines optimization, how SEO operates, website domain, file name, design layouts, optimized keywords, keyword frequency weightage, prominence, placement of keywords, finding keyword, word stemming, metatag optimization, title optimization, anchor optimization, mobile SEO techniques. [8L]
3. Social Media Marketing: concept, as a marketing tool, importance of social media marketing, Social marketing strategy (SMO) for business, SMO key concepts, business profile creation, brand awareness, social engagement; Viral marketing, tools of measurement of popularity, traffic, analytics and statistics. [8L]

MODULE II:

4. Facebook marketing: overview-types of facebook pages, growth of business through facebook; profile page setup, page navigation, influencer, ad options, page promotion, identity target ,likes philosophy, create and engaging fans, call to action, video promotion, marketing tricks, FB analytics. [8L]
5. Twitter Marketing: Concept, advantages, implementation of twitter; create of twitter account, follower growth, hash tags, sponsor of twitter/hash tags, twitter analytics. [4L]
6. Google+: Concepts, advantages, creating page on Google+, customization, integration with website/blog, increase in followers, promotion and tools. [4L]
7. Linkedin: concept, benefits, promotion and growth of business using linkedin. [4L]
8. Case Study [2L]

Suggested Readings:

1. Understanding Digital Marketing by Damian Ryan , Pearson
2. Fundamentals of Digital Marketing by Puneet Singh Bhatia
3. Digital Marketing cases from India by Rajendra Nargudkar and Romi Sainy
4. Marketing 4.0: Moving from Traditional to Digital by Kotler, Kartajaya, Setiawan
5. Social Media Marketing by Tracy L Tuten and Michel R Solomon by SAGE
6. Social Media: 2017 Marketing Tools for Facebook, Twitter, Linkedin, Youtube, Instagram and Beyond by Mcdonald Jason.

MM 303: IMC/ PROMOTION STRATEGY

MODULE I:

1. Introduction to Integrated Marketing Communication: Definition, features and role of IMC and its relation with marketing program Concept, Evolution of IMC, Reasons for Growth and Features. Promotional Tools for IMC, IMC Planning Process, Communication Process, AIDA and Hierarchy of Effect Model, Establishing Objectives and Budgeting: Determining Promotional Objectives, Sales vs. Communication Objectives, DAGMAR, Problems in Setting Objectives, and Setting Objectives for the IMC Program. [4L]

2. Elements of IMC: Sales Promotion – Different Types of Sales Promotion, Advantages and Disadvantages. Public Relation and Publicity – Types of PR, Process, Advantages and Disadvantages, Types of Publicity, Direct Marketing – Features, Advantages and Disadvantages, Personal Selling – Features, Advantages and Disadvantages, Advertising – Features, Advantages and Disadvantages,, New Trends in IMC, International Media. [6L]
3. Sales Promotion: Definition, Reasons for rapid growth of sales promotion, Objectives of sales promotion, Types of sales promotion, Tools and techniques of consumer and trade promotion with merits and demerits, Role of sales promotion in IMC programme [4L]
4. Public Relations and Corporate Advertising: Definition, New role of PR, Objectives, tools and techniques of public relations with merits and demerits, Corporate advertising- scope and types, role of PR in IMC programme [2L]
5. Evaluation of Promotional Effectiveness: Reasons to measure effectiveness, What, when, where, how to test, Testing methods - pre-testing and post testing techniques, Essentials of effective measures, Problems with current methods, Measuring effectiveness of other promotion [2L]

MODULE II:

6. Advertisement: Introduction to Advertising: History of advertising, Definition, features and role of advertising, Relationship of advertising with other promotional mixes and marketing mix elements, Various forms of Advertising: (national, retail, cooperative, trade, industrial financial, corporate, public services, political) [2L]
7. Advertising Industry: Advertisers, Advertising agencies and support organizations, Types of agencies, Structure, role and functions of ad agencies, Agency compensation and evaluation. [2L]
8. Advertising Planning and Budgeting: Planning process, steps, situation analysis, objective setting, budgeting, developing promotional strategies, implementation and control, Budgeting approaches – different methods, allocation of budget [2L]
9. Designing an Advertisement: Different dimensions, Importance of creativity to advertising, Creative process, developing a creative brief, Message Strategies: Message structure, Message appeals- rational, emotional, Message source-credibility, attractiveness, power. [4L]

10. Execution frameworks: for print and electronic media - copywriting, body copy, headlines, layout, visuals, slogans, logos, signatures, storyboards [2L]
11. Media Strategies: Media planning process, Media mix, Coverage, Reach, Frequency, Impact, Scheduling, Different types of media – television, radio, print, outdoor, characteristic features, advantages and limitations, Factors influencing choice of media flows and functions, Channel design decisions.. [4L]
12. Social Media marketing: Concept, role and features of SMO, SEO, Facebook, Twitter, LinkedIn, youtube as means of marketing communication. [2L]
13. Advertising and Society: Social – social and cultural, Ethical – deceptive, offensive, economical- effect on consumer choice, competition, cost and prices, and Regulatory aspects of advertising – ASCI [2L]
14. Case Study on aspects of Advertising [2L]

Suggested Readings:

1. Contemporary Advertising: Arens W.F.; TMH
2. Advertising and Promotion: Belch G.E. and Belch M.A; TMH
3. Integrated Advertising, Promotion and Marketing Communications: Clow K.E., Baack D.; Pearson
4. Advertising and Integrated Brand Promotion: O'Guinn T. C., Allen C.T.; South Western
5. Ogilvy on Advertising: Ogilvy David; Pan Books
6. Understanding Digital Marketing: Damian Ryan, Pearson

MM 304: MARKETING RESEARCH

MODULE I:

1. Marketing Research: Introduction, Application of research in managerial decision making, Aims, roles, functions and sources of research, Client-user interface – role conflict and resolution [2L]
2. Research Process: Steps in planning – research purpose and objectives, Converting a manager's problem to a researcher's problem, Problem formulation, research design, data collection, analysis, report presentation, Preparation of the research proposal. [4L]

3. Research Design: Types of research - exploratory studies, descriptive studies, causal studies, Types of information needed - behavioural and non-behavioural correlates [4L]
4. Sources of Data: Primary and secondary source (govt., non-govt. and syndicated research), Errors in data collection [4L]
5. Primary Source – Methods of Data Collection: Focus groups, Observations, Case histories; Surveys – survey methods - structured and unstructured, direct and indirect methods, in-depth interviews, panels, interview media: personal, telephone, internet and mail, questionnaire construction and pre-testing, qualitative and quantitative research. [4L]

MODULE II:

6. Measurement and Scaling: Types of scales (data/levels of measurements), nominal, ordinal, interval, ratio scales, Attitude measurement methods - variability methods (paired comparison, ranking, rating, ordered category sorting), Quantitative judgment methods [6L]
7. Sampling: Census vs. sample, Steps in sampling process, Definition of population, frame, unit and element, Types of sampling: Probabilistic and non-probabilistic sampling techniques Determination of sample size [4L]
8. Analysis of Data: Classification of data, Analytical techniques – univariate analysis, hypothesis testing- parametric and non-parametric tests, bivariate analysis. Some multivariate analysis techniques like multiple regression, discriminant analysis, factor analysis, cluster analysis, multi - dimensional scaling and conjoint analysis, forecasting methods (application and interpretation only) [10L]
9. Application Areas: Advertising Sales analysis and forecasting, Case Studies [2L]

Suggested Readings:

1. Research for Marketing Decisions: P. Green and D. Tull and G. Albaum; PHI
2. Marketing Research: Text and Cases; Boyd and Westfall; AIT Bookseller
3. Marketing Research: Luck and Rubin; PHI
4. Marketing Research: D.R. Cooper and P.S. Schindler; TMH
5. Marketing Research: Naresh K Malhotra; Pearson
6. Marketing Research: G C Beri; Tata McGraw Hill

SPECIALIZATION: MANAGEMENT INFORMATION SYSTEM

MIS 301: DATA MINING FOR BUSINESS DECISION

MODULE I:

1. Introduction to Data Mining: Data Mining Concept, Goals, Stages of Mining Process, Applications, Techniques, Knowledge representation methods, Challenges. [4L]
2. Data Preprocessing: Data types, Quality, Descriptive data summarization – central tendency and dispersion measure, Data cleaning, Outlier detection, Data integration and transform, Data reduction. [6L]
3. Association Rule Mining: Market-basket analysis basics, Naïve algorithm, Apriori algorithm, Software for Association Rule Mining. [4L]
4. Classification and Prediction: Decision Tree, Bayesian classification, Rule-based classification, Prediction – Linear Regression [4L]

MODULE II:

5. Data Warehouse and OLAP: Data Warehouse and DBMS, Multidimensional data model, OLAP operations. [6L]
6. Clustering: Basic issues in clustering, Partitioning methods: k-means, Hierarchical methods: distance-based agglomerative and divisible clustering, Cluster Analysis Software. [8L]
7. Data Mining Software and Applications: Text mining: extracting attributes (keywords), structural approaches (parsing, soft parsing), Bayesian approach to classifying text, Web mining: classifying web pages, extracting knowledge from the web, Social impacts of data mining, information privacy and data security, IT Act overview. [6L]
8. Case Study [2L]

Suggested Readings:

1. Tan, Steinbach and Kumar, Introduction to Data Mining, Pearson
2. Han and Camber, Data Mining: Concepts and Techniques, Morgan Kaufmann
3. Foreman, Data Smart: Using Data Science to Transform Information into Insight, John Wiley
4. Dunham, Data Mining : Introductory and Advanced Topics, Pearson

5. Vipin Kumar: Introduction to Data Mining, Pearson
6. Ian, H. Witten, Frank: Data Mining: Practical Machine Learning Tools and Techniques, Elsevier.

MIS 302: E-COMMERCE and DIGITAL MARKETS

MODULE I:

1. E-Commerce /E-Business: Introduction, Advantages and Disadvantages, Benefits, Features, Business models of E-Commerce, Model based on revenue models, Implementation E-Commerce business, Infrastructure Requirement for E-Commerce, Different types of Networking for E-Commerce ,Internet, Extranet and Intranet, Intelligent System, Risk of E-commerce –Overview, Security for E-Commerce, Security Standards, Farewell, Cryptography [8L]
2. M-Commerce: Definition, Classification, Advantages and Disadvantages, Benefits, Pitfalls of M-Commerce, Hand Held Devices, Mobility and Commerce, Mobile Computing, Wireless Web, Payment Mode. [6L]
3. E-Strategy: Overview, Strategic Methods for developing E-Commerce, E-Advertisement, Payment Mode, E-Cheque, E-cash, E-Threats and Protection [8L]

MODULE II:

4. ERP and SCM: Definitions-ERP,CRM,SCM, Concept of ERP, Evolution of ERP, Scope and Problem of ERP selection and Implementation ,Selection of ERP process, Feature of Commercial Software, Concept of CRM, Features ,Applications, SRM portal, SCP tools, SCE, Framework, Internet's Effect on Supply Chain Power, Case Study [8L]
5. E- Marketing/ Digital Marketing: E-shopping, Role, Policies ,Online Marketing and Offline marketing, SEO,SMM,SEM, Meta Tags, Content Marketing, Marketing in Digital Age, Telemarketing, Commercial packages for E-shopping Portal, Case Study [6L]
6. EDI: Introduction, Definition, Features, Benefits, Application, Model, Protocol [4L]
7. Case Study [2L]

Suggested Readings:

1. Dropshipping E-commerce Business Model 2019: Steven Sparrow
2. Electronic Commerce: Gray P. Schneider
3. E-Commerce Website Optimization: Dan Croxen-John, Johann van Tonder
4. Electronics Commerce –Technologies and Applications: Bhaskar Bharat, TMH
5. Frontiers of Electronic Commerce: Kalakota ,Whinston, Pearson Education
6. E-Commerce : Strategy Technologies and Applications: Whiteley, David, TMH

MIS 303: MANAGING SOFTWARE PROJECTS

MODULE I:

1. Project Evaluation and Project Planning: Importance of Software Project Management – Activities Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning [8L]
2. Project Life Cycle: Software process and Process Models – Choice of Process models – mental delivery – Rapid Application development – Agile methods – Extreme Programming – SCRUM – Managing interactive processes [4L]
3. Effort Estimation: Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II. Parametric Productivity Model – Staffing Pattern [4L]
4. Activity Planning And Risk Management: Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Forward Pass and Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Monitoring – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical patterns – Cost schedules. [6L]

MODULE II:

5. Project Management and Control: Framework for Management and control – Collection of data Project termination – Visualizing progress – Cost monitoring – Earned Value Analysis-

Project tracking – Change control- Software Configuration Management – Managing contracts – Contract Management. [8L]

6. Staffing in Software Projects: Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham-Hackman job characteristic model – Ethical and Programmed concerns – Working in teams – Decision making – Team structures – Virtual teams – Communications genres – Communication plans. [8L]

7. Case Study [2L]

Suggested Readings:

1. Project Management: K. Nagarajan – New Age International Publishers
2. Applied Softer Project Management: Andrew Stellman, Jenifer Greene – O' Reilly Media
3. Software Project Management: Bob Hughes, Mike Cotterell and Rajib Mall:- Tata McGraw Hill, New Delhi.
4. Effective Software Project Management: Robert K. Wysocki – Wiley Publication.
5. Software Project Management: Walker Royce - Addison-Wesley.
6. Managing Global Software Projects: Gopalaswamy Ramesh - McGraw Hill Education (India).

MIS 304: DATA SCIENCE USING R

MODULE I:

1. Programming in R: Basics of R, Conditional and loops, R packages/libraries, Data mining GUI in R, Data structures in R, Exceptions/ debugging in R [4L]
2. Data Wrangling: Reading CSV, JSON, XML, .XLSX and HTML files using R,ETL operations in R, Sorting/ merging data in R, Cleaning data, Data management using dplyr in R [4L]
3. Modeling in R:Linear regression model in R, Multiple linear regressions model, Representation of regression results, Non Linear Regression [10L]

MODULE II:

4. Mining Algorithms using R: Association analysis, Market-based analysis/ rules, Apriori algorithm, Segmentation analysis- types of segmentation, k-means clustering, Bayesian clustering, Principal Component Analysis (PCA) [12L]
5. Time Series Forecasting in R and model deployment: Basics of time series, Components of time series, Time series forecasting, Deploying predictive models [8L]
6. Case Study [2L]

Suggested Readings:

1. R for Data Science – Hadley Wickham and Garrett Grolemund
2. R in Action – Robert Kabacoff
3. R for Everyone: Advanced Analytics and Graphics – Jared P. Lander
4. The R Book – Michael J. Crawley
5. R and Data Mining: Examples and Case Studies – Yanchang Zhao
6. Data Analytics using R - Seema Acharya, Mc. Graw Hill Publication

SPECIALIZATION: FINANCE

FM 301: TAXATION

MODULE I: DIRECT TAX

1. Concepts: Cannons of Taxation, Person, Assessee, Income, Previous Year, Assessment Year, Gross Avoidance, Planning, Exemption, Planning, Exemption, Deduction, Rebate, Relief. [2L]
2. Residential Status and Tax Incidence: Individual and Corporate. [4L]
3. Income Exempted from Tax: Individual and Corporate. [2L]
4. Computation of Taxable Income of Individual, HUF, Firm and Corporate: Heads of Income – Salaries, Income from House Property, Profits and Gains from Business or Profession, Capital Gains, Income from Other sources. Deduction from Gross Total Income – 80CCC, 80D, 80DDB, 80E, 80G, 80GG, 80GGA, 80C, 80U; Set Off and Carry

Forward of Losses – Principles, Meaning, Inter – sources and Inter – head Set Off, Carry Forward and Set Off of Losses under sections 71, 72 and 73. [8L]

5. Computation of Tax for Individual, H.U.F, Firm and Corporate: Rate of Tax and Surcharge Tax, Rebate Tax Management – Submission of Return and Procedure of Assessment, Pan, Tan, Preliminary ideas of Deduction and Collection of Tax at Source, Advance Payment of Tax, Refund of Tax, Minimum Alternate Tax. [6L]

MODULE II: INDIRECT TAX

1. Customs Act and Valuation: Basic Concepts only [2L]
2. Goods and Service Tax: GST in India. Features and Advantages, Structure of GST in India: CGST, SGST, UTGST, IGST, Taxes subsumed by GST, Commodities kept outside the scope of GST. Procedure for Registration; Deemed Registration, Cancellation of Registration, Revocation of Cancellation of Registration. Levy and Collection of Tax under GST: 16 Rates structure of GST, Scope of supply, Composition Scheme under GST [8L]
3. Tax Planning: Scheme of Tax Planning, Tax Planning for Salaries, Tax Planning for Profits and gains of Business or Profession, Tax Planning for Capital Gains. [6L]
4. Case Study [2L]

Suggested Readings:

1. Lal and Vasisht, Direct Taxes, Pearson Education
2. Singahnia, Direct Taxes, Taxman
3. Singhania, Indirect Taxes, Taxman
4. Bhagawati Prasad, Direct tax law and Practice.
5. Gaur and Narang, Income Tax law and Practices, Kalyani Publisher
6. T. B. Chatterjee and V. Jalan, How to handle - GST-TDS and GST-TCS, GST audit, GST Annual Return, Book Corporation

FM 302: PROJECT APPRAISAL and FINANCE

MODULE I:

1. Introduction to Project Finance, Overview and Fundamentals- Concepts, Functions, Types, Advantages and Disadvantages, Parties, Perquisites of Project Finance. [4L]
2. Project Finance Risks and Risk Mitigation- Project Conceptualization Risk, Financial Closure Risk , Project Construction Risk , Political Risk , Market Risk ,Supply Chain Risk, Policy Risk, Exchange Risk, Environmental Risk , Force Majeure. [6L]
3. Sources of Capital- Various sources of debt and equity , Prudence in Mix of Long Term and Short Term Finance ,Forms of Long Term Project Finance ,Forms of Short Term Project Finance , Lease , Role of Non-Banking Finance Companies (NBFC) [6L]
4. Project Selection- Projects Procurement Process, Life – Cycle Costing, Market Analysis , Competencies and Promoter Analysis, Loan Documentation - Infrastructure and Public Private Partnership [6L]

MODULE II:

5. Cost of Project -Project specifications , Estimating Fixed Capital Investment in Project , Estimating Working Capital investment in the project, Means of Financing , Concepts of Depreciation and Amortization [4L]
6. Project Feasibility Analysis - Background , Net Present Value (NPV) , Profit v/s Cash Flow, Discount Rate , Tax-Shield on Interest , Tax-Shield on depreciation ,Internal Rate of Return (IRR) , XIRR , MIRR , Project IRR and Equity IRR , Payback Period , Discounted Payback Period , Economic IRR [6L]
7. Financial Projections-Projected Profit and Loss Account, Projected Balance Sheet, Projected Funds Flow, Project IRR , Equity IRR , Loan Servicing Capability: (a) Interest Coverage Ratio (ICR) (b) Debt Service Coverage Ratio (DSCR) (c) Long Term Debt Service Coverage Ratio (LDR) d) Sensitivity Analysis [6L]
8. Case Study [2L]

Suggested Readings:

1. Project Financing: Asset-Based Financial Engineering-John D. Finnerty, Wiley and Sons
2. Project Finance in Theory and Practice: Designing, Structuring, and Financing Private and Public Projects, Stefano Gatti- Academic Press
3. Principles of Project Finance- E. R. Yescombe, Academic Press
4. Corporate and Project Finance Modeling: Theory and Practice- Edward Bodmer, Wiley and Sons
5. Introduction to Project Finance-Andrew Fight, Elsevier
6. PPP And Project Finance -Das, Prabuddha, McGraw-Hill Education

FM 303: BEHAVIORAL FINANCE

MODULE I:

1. Introduction to the Practical Application of Behavioral Finance: Concept of Behavioral Finance, History, Incorporating Investment Behavior into the Asset Allocation Process. [4L]
2. Investment Decision Cycle: Judgment under Uncertainty [2L]
3. Intro to Neoclassical Economics and Expected Utility Theory-Utility/ Preference Functions: Expected Utility Theory [EUT] [4L]
4. Brief History of Rational Thought: Pascal-Fermat to Friedman-Savage Paradoxes[4L]
5. Prospect Theory :Capital Asset Pricing Model, Misconceptions about Market Efficiency, and Agency Theory Prospect Theory, Framing, and Mental Accounting [4L]
6. Information Screening Biases : Anomalies, Noise Trading, and Limits to Arbitrage [2L]

MODULE II:

7. Information Processing: Bayesian Decision Making, Heuristics and cognitive biases Overconfidence, Emotional Foundations, Implication of Heuristics and Biases for Financial Decision-Making, Implications for Overconfidence for Financial Decision-Making, Individual Investors and the Force of Emotion [6L]

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| 8. Forecasting Biases | [2L] |
| 9. Emotion and Neuroscience | [4L] |
| 10. Group Behavior: Conformism, Herding, Fatal Attractions | [4L] |
| 11. Investing Styles and Behavioral Finance | [4L] |
| 12. Case Study | [2L] |

Suggested Readings:

1. Behavioural Finance Chandra. Prasanna.Mcgraw Hill
2. Behavioural Finance M. M. Sulphey. PHI
3. Understanding Behavioral Finance Lucy AckertCengage Learning India
4. Behavioural Finance ,William Forbes, Wiley
5. Behavioral Finance: Psychology, Decision-Making, and Markets ,Richard Deaves , South-Western College Publishing
6. Behavioural Finance, Shuchita Singh Vikas Publishing House

FM 304: CORPORATE FINANCE

MODULE I:

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|---|------|
| 1. Introduction to Financial Management: Scope, Objectives, Functions | [2L] |
| 2. Capital Structure: Concepts, Component of Capital, Leverage, Models of Capital Structure | [6L] |
| 3. Introduction to Corporate Finance: Meaning of Corporation, Role of Financial Manager, Agency Problem. | [2L] |
| 4. NPV as Investment Decision Criteria: Comparing NPV with other methods of Investment Decisions, The problems of multiple rates of Return, Mutually Exclusive Projects, Capital Rationing. | [4L] |

5. The Investment Decision: The Cash Flow, Equivalent annual Costs, Project Interactions [4L]

MODULE II:

6. Capital Budgeting and Risk: Company and Project Costs of Capital, Measuring Cost of Equity, Cost of Capital, and Risk Adjusted Discount Rate, Sensitivity Analysis, Monte Carlo Simulation, Real Options and Decision Trees [4L]
7. Alignment of Managers and Owners Goal: Practical aspects of Capital Investment Process, Information and Capital Investment, Incentives and their role in agency Problem, Measuring and Rewarding Performance: EVA, Pros and Cons of EVA [4L]
8. Market efficiency and Corporate Financing Basics of EMH, The Anomalies, The lessons for the Corporate Manager [4L]
9. The Financing Decision: The Financing Process, The Financing Mix: Tradeoffs and Theory, The Optimal Financing Mix, The Financing Mix and Choices [4L]
10. The Dividend Decision: Dividend Policy, analyzing Cash Returned to Stockholders, Buybacks, Spinoffs, and Divestitures [4L]
11. Case Study [2L]

Suggested Readings:

1. Brearly, Myers, Mohanty: Corporate Finance, Tata McGraw-Hill
2. Copeland Weston Shastri: Financial theory and Corporate Policies, Pearson Education
3. Damodaran: Corporate Finance, Wiley
4. Ehrhardt and Brigham: Corporate Finance- a Focused approach, Thomson Learning
5. Megginson, Smart and Gitman: Principles of Corporate Finance, Thomson Learning
6. Ross, Westerfield and Jaffe: Corporate Finance, Tata McGraw-Hill

SPECIALIZATION: OPERATIONS MANAGEMENT

OM 301: SUPPLY CHAIN AND LOGISTICS MANAGEMENT

MODULE I:

1. Introduction – Value Chain, Value System and Supply Chain, Supply Chain Drivers and Obstacles, Concept of Supply Chain Management (SCM) [4L]
2. Supply Chain Structure – Push-based Supply Chain vs. Pull-based Supply Chain, Trade-off between Push and Pull Strategies, Agile Supply Chain [4L]
3. Supply Chain Strategy – Strategic Decisions in SCM, Relating Supply Chain Strategies with Corporate Strategies, SBU Strategies and Functional Strategies [4L]
4. Role of Sales and Marketing in SCM – Personal Selling in SCM, New Roles for Sales Management, Relationship Marketing in SCM [2L]
5. Operational Aspects in SCM – JIT and Kanban in SCM, Green Logistics, Reverse Logistics, Ethical SCM [4L]
6. Role of Transportation in SCM – Key Role Players in Transportation, Transportation Modes, Performance Characteristics and Selection, Vehicle Scheduling and Routing, Distribution Management [4L]

MODULE II:

7. Sourcing in SCM – Importance of Sourcing in SCM, Buying Decision, Procurement Process, Strategic Sourcing [4L]
8. Supply Chain Planning – Demand Planning, Collaborative Planning, Scope of Planning Initiatives in SCM [2L]

9. Role of Inventory Management in SCM – Need for Inventory Management, Control of Inventory in Retail and Services, Costs in Inventory Management [2L]
10. Information Systems in SCM – Supply Chain Information Systems, Requirements Analysis of IT for SCM, E-Business and SCM, Challenges in Implementing Supply Chain Information Systems [4L]
11. SCM in the Global Environment – Global Business Environment, Approaches to Globalization, an Overview of Global SCM, Challenges in establishing a Global Supply Chain [4L]
12. Case Study [2L]

Suggested Readings:

1. Chandrasekaran, N. – Supply Chain Management – Process, System and Practice; OUP
2. Altekar, R.V. – Supply Chain Management; PHI
3. Chase, R.B., Shankar, R. and Jacobs, F.R. – Operations and Supply Chain Management; MGH
4. Agarwal, D.K. – Supply Chain Management: Strategy Cases and Best Practices; Cengage Learning
5. Chopra S., Meindl, P. and Kalra, D.V. – Supply Chain Management: Strategy, Planning and Operation; Pearson
6. Shah, J. – Supply Chain Management: Text and Cases; Pearson

OM 302: OPERATIONS STRATEGY

MODULE I:

1. Introduction – Innovation and operations discipline; Frameworks for strategy and the decision category approach; Developing an operations strategy; Content of Operations Strategy; The Operations Strategy Matrix; Value chain dynamics and operations decisions; Enterprise architecture and operations strategy. [4L]

2. **Key Elements and Decision Categories** – Vertical integration and outsourcing; Business processes; Process technology decisions and multiple plants; Capacity strategy: How to make decisions on capacity and capacity expansion; Facilities strategies and globalization; Comparisons of plant productivity; facilities strategy and globalization; Sourcing and supplier management; Information systems and the impacts of the electronic economy. [6L]
3. **Capabilities and Different Approaches** – Competing on quality: Sources of quality and different measures of quality; Competing on cost versus competing on availability; Competing on cost versus competing on features and innovativeness; Competition in the various industries: Improving cost and quality. [6L]
4. **Strategic Operations Planning** – Environmental assessment including assessment of technology and competition, organization position assessment, mission, financial and non-financial goals, operational forecasts. [4L]

MODULE II:

5. **Modern Approach to Operations Strategy** – Integrating Operations strategy with Marketing, Finance and HR Strategies. International Operations Management: Key differences between Asia, Europe and USA, Productivity enhancement practices in Asia, Europe and USA, Role of competitive pricing. [6L]
6. **Globalization, Outsourcing and other Critical Issues** – Models for gaining advantage in a global environment; How to position within a value chain; Globalization, joint ventures, sourcing overseas, and macroeconomic effects of off-shoring; Supplier power and overseas sourcing: Moving up the value chain in outsourcing; basic concept of International trade and competitiveness. [6L]
7. **Strategy Implementation** – Tracking goal fulfillment, Quality and productivity, Technology Plans, Mechanization and Automation. Simulation: Techniques of simulation, simulating operational scenarios, integrating operations with other functional areas, simulating service operations based on known distributions. [6L]
8. Case Study [2L]

Suggested Readings:

1. Slack, N., Leewis, M. and Sharma, M.G. – Operations Strategy; Pearson India.
2. Krajewski, L.J. and Ritzman, L.P. – Operations Management – Strategy and Analysis; Addison-Wesley Publishers.
3. Garvin, D.A. – Operations Strategy: Text and Cases; Pearson.
4. Tan, K. H. and Matthews, R. – Operations strategy in action: A guide to the theory and practice of implementation; Edward Elgar Publishing.
5. Hayes, R., Pisano, G. and Upton, D. – Strategic operations: Competing through capabilities; Free Press.
6. Hayes, R. – Operations, Strategy and Technology: Pursuing the Competitive Edge; Wiley India.

OM 303: QUALITY TOOLKIT FOR MANAGERS

MODULE I:

1. Quality Philosophies – Defining Quality, Introduction to TQM, Benefits of TQM, Obstacles in Implementing TQM [2L]
2. Customer Satisfaction – Defining Customer, Customer Perception of Quality, Feedback, Customer Complaints Analysis, Customer Retention [4L]
3. Quality Leadership – Characteristics and Role of Quality Leaders/Gurus, Strategic Planning and Decision Making, Deming Philosophy [4L]
4. Quality Awards – Quality Audits, Documentation, ISO 9000 [2L]
5. Quality Function Deployment – Introduction, Benefits of QFD, Voice of Customer, House of Quality, QFD Process [4L]
6. Failure Mode and Effects Analysis – Reliability and Reliability Requirements, Failure Rate, Stages of FMEA [2L]

MODULE II:

7. Statistical Process Control – 7 QC Tools, Acceptance Sampling Plan, Control Charts – Mean and Range Charts, p-Chart, np-Chart, c-Chart [6L]
8. Continuous Process Improvement - PDCA / PDSA Cycle, Poka yoke, Kaizen, Theory of Constraints, Kaizen, Benchmarking, Business Process Reengineering, Kaikaku [6L]
9. Cost of Quality – Cost of Achieving Good Quality, Cost of Poor Quality, Optimum Quality Level [2L]
10. Six Sigma Implementation – Introduction to Six Sigma, Process Capability Indices, Six Sigma in Manufacturing, DMAIC and DMADV, Technology Development using Design for Six Sigma, Product Design using Design for Six Sigma, Six Sigma in Service Industries [4L]
11. Lean Manufacturing – Concept of Value and Waste, VA, NVA and NNVA activities, Value Stream Mapping, Concept and Features of Lean Manufacturing [2L]
12. Case Study [2L]

Suggested Readings:

1. Besterfield, D.H., Besterfield-Michna, C., Besterfield-Sacre, M. Besterfield, G.H. Urdhwareshe, H. and Urdhwareshe, R. – Total Quality Management; Pearson.
2. Feigenbaum, A.V. – Total Quality Control; MGH
3. Urdhwareshe, H. – Six Sigma for Business Excellence; Pearson
4. Charantimath, P.M. – Total Quality Management; Pearson
5. Omachonu, V.K. and Ross, J.E. – Principles of Total Quality; CRC Press
6. Wilson, L. – How to Implement Lean Manufacturing, Indian Edition; MGH

OM 304: PRICING & REVENUE MANAGEMENT

MODULE I:

1. Introduction – Historical background and context. Financial impact and Implications of Pricing and Revenue Management. [2L]
2. Revenue Management – Introduction, Revenue Management Process, Measuring Revenue Management Effectiveness, Revenue Management in Action. [6L]
3. Pricing Theory and Optimization – Traditional approaches to pricing, Basic pricing optimization, Price response function, Price response with competition, Price differentiation, Economies of price differentiation, Price differentiation and consumer welfare, Variable pricing. [8L]
4. Markdown Management – Markdown Pricing and Optimization; Estimating Markdown sensitivity; Markdown Management in Action. [6L]

MODULE II:

5. Customized Pricing – Introduction and Customized Pricing in Action, Bid Price Approach. [4L]
6. Forecasting – Demand Forecasting – Need, Types, Objectives and Steps. Overview of Qualitative methods, Quantitative methods – Naive, Moving Average (Simple and Weighted), Exponential Smoothing, Linear Regression, Implication of Forecasting in Revenue Management. [6L]
7. Capacity Allocation – Capacity Planning – Long range, Types, Developing capacity alternatives, Capacity Allocation with dependent demands, Forecasting and capacity planning. [4L]
8. Industry Applications – Industry Implementations and Practices, Case Studies. [4L]

Suggested Readings:

1. Philips R.L. – Pricing and Revenue Optimization, Stanford Business Book
2. The Oxford Handbook of Pricing Management Edited by Ozalp Ozer and Robert Philips, Oxford University Press
3. Talluri, K. and Van Ryzin, G. – The Theory and Practice of Revenue Management, Springer.
4. Bodea, T. and Ferguson, M. – Segmentation, Revenue Management and Pricing Analytics, Routledge.
5. Makridakis, S., Wheelright, S.C. and Hyndman, R.J. – Forecasting Methods and Application, Wiley.
6. John Hogan, Joseph Zale and Thomas T Nagle: The Strategy and Tactics of Pricing, published 2016 Routledge.

SPECIALIZATION: HUMAN RESOURCE MANAGEMENT

HR 301: TEAM DYNAMICS AT WORK

MODULE I:

1. Meaning of a Group and Group Dynamics, Classification of Groups – Formal and Informal groups, Command, Task, Interest and Friendship groups. Why people join groups. The dynamics of group formation. Theories of group formation: Classic theory of George Homans, Theodore Newcomb's Balance theory, Exchange theory. Five stage group development model, Punctuated Equilibrium model of development of temporary groups with deadlines. Managerial Implications. [4L]
2. Group Properties: Roles, Norms, Status, Size, Cohesiveness - factors that increase, Decrease group cohesiveness, relationship between group cohesiveness, Performance norms and productivity. Deviant workplace behaviour, Typology of Deviant workplace behaviour, groups and deviant behaviour. Managerial Implications. [4L]
3. The Schachter Study - Implication of the Schachter study, Sociogram, Sociometry. The dynamics of Informal Groups - Norms and Roles in informal groups, informal Roles and the informal organization. The dynamics of formal Groups - Positive and negative attributes of committees. The dysfunctions of group norms violation and

role ambiguity conflict. Groups' contribution to employee satisfaction and performance. Managerial Implications. [4L]

4. Group decision making: Group versus the Individual, strength and weakness of group decision making, Effectiveness and efficiency. Group Think - conformity problem, symptoms of groupthink. Group Shift - risky shift phenomenon. Dysfunctions perspective, social loafing. Group decision making techniques - Interacting groups, Brainstorming, Nominal Group Technique, Electronic meeting, Dialectic Decision Method (DDM), Delphi Technique. Managerial Implications. [4L]

Case Studies, Presentations, quizzes, experiential exercises, Team exercises, Group Discussions, Role Playing. [4L]

MODULE II:

5. Teams in the modern workplace, why teams have become so popular, difference between group and team, types of teams - problem-solving teams, self-managed work teams, cross-functional teams, virtual teams. Managerial Implications. [4L]
6. Creating effective teams, the Team Effectiveness Model - context, composition, work design, process. Ingredients of effective teams - supportive environment, skills and role clarity, super ordinate goals, team rewards. Potential team problems - changing composition, social loafing. Guidelines for developing effective self-managed teams. Turning individuals into team players, shaping team players - selection, training, rewards. Managerial Implications. [6L]
7. Team building: meaning of team building, need of team building, the process, specific building issues, team leadership, skills useful in team building - process consultation, T- group sensitivity training, communication skills, Negotiation skills, conflict resolution in teams, competitive vs collaborative behavior, developing collaboration facilitating behaviours, feedback. Managerial Implications. [4L]
8. Contemporary issues in managing teams: teams and quality management, teams and workforce diversity. Cultural/global issues. Characteristics of mature teams - individual territories versus team spaces. Managerial Implications. [2L]

Case Studies, Presentations, quizzes, experiential exercises, Team exercises, Group Discussions, Role Playing. [4L]

Suggested Readings:

1. Robbins, S.P. Judge, T.A. and Sanghi, S.: Organizational Behaviour, Pearson
2. Luthans, Fred: Organizational Behaviour, McGraw Hill
3. Newstrom J.W. and Devis K.: Organizational Behaviour, McGraw Hill
4. Aswathappa, K: Organisational Behaviour, Himalaya Publishing House
5. Shukla, Madhukar: Understanding Organizations – Organizational Theory and Practice in India, Prentice Hall
6. Sekharan, Uma: Organisational Behaviour, The Mc Graw –Hill Companies

HR 302: HUMAN RESOURCE METRICS AND ANALYTICS

MODULE I:

1. Introduction: HR metrics - meaning, importance, what metrics should HR measure? Examples of HR metrics. HR Analytics - What is Analytics? Big data and Analytics, Stages in Data Analytics, Types of Analytics, Causal Modeling, What is HR Analytics? Objectives of HR Analytics. Its importance and benefits. [6L]
2. Realigning HR to business priorities, Stages of HR Analytics and the role of technology. Leveraging HR Analytics for organizational success. Mapping Business Analytics and HR Analytics. IMPACT Cycle. Pillars of HR Analytics success. Linking HR metrics to business outcomes. HR measurement tools and techniques: Identifying HR metrics, sources of data, tools and techniques of measurement. Excel, SPSS, SAP and Other software packages. [8L]
3. Human Capital Management (HCM) - Concepts, Phases-Scanning, Planning, Producing, Predicting. The Model for Predictive Management. Value Chain for HCM Model. Predictive Human Capital measurements. Guiding principles of Human Capital Analytics. [4L]

MODULE II:

4. HR Analytics and the HR delivery model. Requisites of effective HR Analytics. HR analytics modules: HR Planning, Hiring, HR Operations, Learning and Development, Performance Management, Compensation and Rewards, Succession Planning, Employee Engagement. [10L]

5. Human Resource Information System (HRIS): Understanding HRIS, Framework of HRIS. Benefits of HRIS. HRIS Trends: Talent Management Analysis, Data Analytics, Social media, cloud mobile enabled, Employee Engagement Analysis. Integrated HRIS. [6L]
6. Data and Information needs for HR Manager - Role of IT in HRM - IT for HR Managers - Concept, Structure, and Mechanisms of HRIS, survey of Software Packages for Human Resource Information System including ERP Software such as SAP, Oracle. EHRM-objectives, advantages and disadvantages. [4L]
7. Case Study [2L]

Suggested Readings:

1. Michael Armstrong, A Handbook Of Human Resource Management Practice, Kogan Page
2. Gueutal and Stone, The Brave New World Of e-HR
3. Monk and Wagner, Concepts In Enterprise Resource Planning, Thomson
4. Steve VanWieren, Quantifiably Better: Delivering Human Resource Analytics from start to finish.
5. Bernard Marr, Data-driven HR: How to use Analytics and Metrics to drive performance.
6. Ramesh Soundararajan, Kuldeep Singh, Winning on HR Analytics: Leveraging data for competitive advantage.

HR 303: CROSS CULTURAL MANAGEMENT

MODULE I:

1. Introduction - Concept of Culture For A Business Context; Organizational Culture and Its Dimensions; Cultural Background of Business Stake-Holders [Managers, Employees, Share -Holders, Suppliers, Customers and Others] - An Analytical Framework [10L]
2. Culture and Global Management - Global Business Scenario and Role of Culture; A Frame Work for Analysis; Elements and Processes of Communication Across Cultures; Communication Strategy for/ of An Indian MNC and Foreign MNC and

High Performance Winning Teams and Cultures; Culture Implications for Team Building [10L]

MODULE II:

3. Cross Culture - Negotiation and Decision Making - Process of Negotiation and Needed Skills and Knowledge Base - Over view with two illustrations from multi cultural contexts [India - Europe/ India - US settings, for instance]; International and Global Business Operations- Strategy Formulation and Implementation; Aligning Strategy, Structure and Culture in an organizational Context. [8L]
4. Global Human Resources Management - Staffing and Training for Global Operations - Expatriate - Developing a Global Management Cadre.. Motivating and Leading; Developing the values and behaviors necessary to build high-performance organization personnel [individuals and teams included] - Retention strategies.[4L]
5. Corporate Culture - The Nature of Organizational Cultures Diagnosing the As-Is Condition; Designing the Strategy for a Culture Change Building; Successful Implementation of Culture Change Phase; Measurement of ongoing Improvement. [6L]
6. Case Study [2L]

Suggested Readings:

1. Cashby Franklin, Revitalize Your Corporate Culture: PHI, Delhi
2. Deresky Helen, International Management: Managing Across Borders And Cultures, PHI, Delhi
3. Esenn Drlarry, Rchildress John, The Secret Of A Winning Culture: PHI, Delhi
4. Deepak Kr. Bhattacharya, Cross Cultural Management, PHI
5. Jessica. L. Whiteman, Richard, L. Griffith, Critical Issues in Cross Cultural Management, Springer
6. Broweays, Understanding Cross Cultural Management; Pearson

HR 304: ORGANIZATIONAL DESIGN

MODULE I:

1. Organization Theory – Classical Theories: Scientific Management, Administrative Principles, Theory of Bureaucracy, Human Relations Approach; Modern Theories: Systems Approach, Information processing Approach, Contingency Approach. Managerial Implications. [4L]
2. The Bureaucratic model, dysfunctions of Specialization, Hierarchy, Rules, Impersonal characteristics. Modern view of Bureaucracies, Modifications of Bureaucratic structuring, types of centralization and decentralization, optimum degree of decentralization, Flat and tall structures, Behavioral implications of Flat versus Tall Structure. Managerial Implications. [4L]
3. Organizational Structure and Design – Understanding organizational structure, Elements of Designs of organization's structure: Work Specialization, Departmentalization, Chain of command, Span of control, Centralization and Decentralization, Formalization Understanding Departmentalization by Function, Product, Location, process, customer. Types of structures: Line, Line and Staff, Functional, Project, Matrix structures. Managerial Implications [6L]
4. Case Studies, Presentations, quizzes, experiential exercises, Team exercises, Group Discussions. [6L]

MODULE II:

5. Mechanistic and Organic Models: Determinants of an Organization's Structure – Strategy, the strategy and structure relationship, Organization Size, Technology and Environment, Three Dimensional Model of the Environment. Organizational Designs and Employee Behaviour. Managerial Implications. [4L]
6. Emerging Organizational Designs: Horizontal design, Network design, Virtual Organization, Boundary less Organization, Learning Organisation, Empowered Organizations, e-Organization: implications for Individual Behaviour, Group behaviour, effects on interpersonal relationships. Restructuring Indian Organisations, Regrouping business activities, strategic business units. Managerial Implications. [6L]

7. Forces reshaping Organizations: Organizational Life Cycles, Impact of Culture on organization Structure, Types and forces of organizational change: Globalization, Changes in Information processing technologies, Automation, Demands on organizational processes. Roles and responsibilities in the changed process. Managerial Implications. [6L]
8. Case Studies, Presentations, quizzes, experiential exercises, Team exercises, Group Discussions. [4L]

Suggested Readings:

1. Robbins, S.P. Judge, T.A. and Sanghi, S.: Organizational Behaviour, Pearson
2. Luthans, Fred: Organizational Behaviour, McGraw Hill
3. Newstrom J.W. and Devis K.: Organizational Behaviour, McGraw Hill
4. Aswathappa, K: Organisational Behaviour, Himalaya Publishing House
5. Shukla, Madhukar: Understanding Organizations – Organizational Theory and Practice in India, Prentice Hall
6. Sekharan, Uma: Organisational Behaviour, The Mc Graw –Hill Companies

SPECIALIZATION: BUSINESS ANALYTICS

BA 301: DATA MINING

MODULE I:

1. Introduction to Data Mining: Data Mining Concept, Goals, Stages of Mining Process, Applications, Techniques, Knowledge representation methods, Challenges. [4L]
2. Data Preprocessing: Data types, Quality, Descriptive data summarization – central tendency and dispersion measure, Data cleaning, Outlier detection, Data integration and transform, Data reduction. [6L]
3. Association Rule Mining: Market-basket analysis basics, Naïve algorithm, Apriori algorithm, Software for Association Rule Mining. [4L]
4. Classification and Prediction: Decision Tree, Bayesian classification, Rule-based classification, Prediction – Linear Regression [4L]

MODULE II:

5. Data Warehouse and OLAP: Data Warehouse and DBMS, Multidimensional data model, OLAP operations. [6L]
6. Clustering: Basic issues in clustering, Partitioning methods: k-means, Hierarchical methods: distance-based agglomerative and divisible clustering, Cluster Analysis Software. [8L]
7. Data Mining Software and Applications: Text mining: extracting attributes (keywords), structural approaches (parsing, soft parsing), Bayesian approach to classifying text, Web mining: classifying web pages, extracting knowledge from the web, Social impacts of data mining, information privacy and data security, IT Act overview. [6L]
8. Case Study [2L]

Suggested Readings:

1. Tan, Steinbach and Kumar, Introduction to Data Mining, Pearson
2. Han and Camber, Data Mining: Concepts and Techniques, Morgan Kaufmann
3. Foreman, Data Smart: Using Data Science to Transform Information into Insight, John Wiley
4. Dunham, Data Mining : Introductory and Advanced Topics, Pearson
5. Vipin Kumar: Introduction to Data Mining, Pearson
6. Ian, H. Witten, Frank: Data Mining: Practical Machine Learning Tools and Techniques, Elsevier.

BA 302: MARKETING ANALYTICS

MODULE I:

1. Introduction to Marketing Analytics: Need for Data Driven Marketing Approach, Marketing Engineering, Model Building in Marketing Engineering, Basic Principles of Marketing Analytics to Business Problems, Slicing and Dicing Marketing data with Pivot Tables, Excel Charts to summarize data [6L]

2. Pricing Analytics: Basic Concept of Pricing, Estimating Demand Curves and Optimize Price, Price Bundling, Non Linear Pricing and Price Skimming [6L]
3. Marketing Forecasting: Simple Regression and Correlation, Multiple Regression to forecast sales, Modeling trend and Seasonality, Ratio to Moving Average Method, Winter's Method [4L]
4. Strategic Marketing Analytics: The STP framework, Value generation through STP framework, Managing the segmentation process, Segmentation in Real world: Cluster Analysis, Hierarchical and Non-Hierarchical - K Means Clustering, Prediction of Customer's segment membership: Discriminant Analysis (DA), two Group DA [4L]

MODULE II:

5. Positioning Strategies: Concept of Product positioning, Conduct a Positioning Study, Perceptual Mapping using Principal Component Analysis (PCA), Multidimensional Scaling (MDS), Incorporating preferences into Perceptual Maps [8L]
6. Customer Lifetime Value (CLV): Concept of CLV, Comparison of CLV with related metrics, Analyzing CLV, Extensions of CLV Analysis, Drivers of CLV, Uses of CLV metrics [8L]
7. Product Designing: Concept of Product Designing, Conjoint Analysis as a decompositional preference model, Steps in Conjoint Analysis, Uses of Conjoint Analysis, Drivers of CLV, Uses of CLV metrics [4L]
8. Case Study [2L]

Suggested Readings:

1. Marketing Analytics - Data-driven Techniques with Microsoft Excel by Wayne L. Winston
2. Marketing and Sales Analytics: Proven Techniques and Powerful Applications from Industry Leaders by Cesar A. Brea
3. Marketing Analytics by Winston
4. Data Analytics using R - Seema Acharya, Mc. Graw Hill Publication
5. Advanced Customer Analytics: Targeting, Valuing, Segmenting and Loyalty Techniques' Mike Grigsby

6. Digital Marketing Analytics: Making sense of Consumer Data in digital world, Chuck Hemann, Ken Burbary; Que Publishing

BA 303: BUSINESS FORECASTING

MODULE I:

1. Historical perspective of Business Forecasting: Concept of Business forecasting, Difference among Econometrics, Mathematics and Statistics, Importance of Econometrics, Linkage of Econometrics with Business Forecasting-Types of Data [6L]
2. Regression Model: Steps, Linear, Non linear. [4L]
3. Univariate time series: Linear model, Stationarity, Autocorrelation, Partial Auto correlation, Multicollinearity, ARIMA, ARMA process. [10L]

MODULE II:

4. Stationarity and Unit Roots Tests: Introduction, Unit Roots tests, Stationarity tests [4L]
5. Univariate Time Series: Volatility Models-Introduction, The ARCH Model, The GARCH Model [6L]
6. Multivariate Time Series Analysis: Vector Autoregression Model-Cointegration [4L]
7. Introduction to E Views: E views Functions, Programming in E views [2L]
8. Introduction to R studios: Programming in R for time series forecasting [2L]
9. Case Study [2L]

Suggested Readings:

1. Damodar N. Gujarati, Basic Econometrics ,McGraw-Hill Publication,2003
2. Chris Chatfield, The Analysis of Time Series: An Introduction , Chapman and Hall
3. N. H. Chan, Time Series: Applications to Finance, John Wiley and Sons,

4. James D. Hamilton, Time Series Analysis, Princeton University Press,
5. Terence C. Mills, The Econometrics of Financial Time Series Cambridge University Press.
6. Box, Jenkins, Reinsel, Ljung, Time Series Analysis: Forecasting and Control; Wiley Publications

BA 304: DATA SCIENCE USING R

MODULE I:

1. Programming in R: Basics of R, Conditional and loops, R packages/libraries, Data mining GUI in R, Data structures in R, Exceptions/ debugging in R [4L]
2. Data Wrangling: Reading CSV, JSON, XML, .XLSX and HTML files using R,ETL operations in R, Sorting/ merging data in R, Cleaning data, Data management using dplyr in R [4L]
3. Modeling in R:Linear regression model in R, Multiple linear regressions model, Representation of regression results, Non Linear Regression [10L]

MODULE II:

4. Mining Algorithms using R: Association analysis, Market-based analysis/ rules, Apriori algorithm, Segmentation analysis- types of segmentation, k-means clustering, Bayesian clustering, Principal Component Analysis (PCA) [10L]
5. Time Series Forecasting in R and model deployment: Basics of time series, Components of time series, Time series forecasting, Deploying predictive models [10L]
6. Case Study [2L]

Suggested Readings:

1. R for Data Science – Hadley Wickham and Garrett Grolemund
2. R in Action – Robert Kabacoff
3. R for Everyone: Advanced Analytics and Graphics – Jared P. Lander
4. The R Book – Michael J. Crawley
5. R and Data Mining: Examples and Case Studies – Yanchang Zhao
6. Data Analytics using R - Seema Acharya, Mc. Graw Hill Publication

Maulana Abul Kalam Azad University of Technology, West Bengal
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Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2018-2019)

Curriculum Structure
Semester III (Second year)

Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
Theory							
1	Basic Science courses	CE(BS)301	Biology for Engineers	2	1	0	3
2	Engineering Science Courses	CE(ES)301	Engineering Mechanics	3	1	0	4
3	Engineering Science Courses	CE(ES)302	Energy Science & Engineering	1	1	0	2
4	Basic Science courses	CE(BS)301	Mathematics-III (Transform & Discrete Mathematics)	2	0	0	2
5	Humanities and Social Sciences including Management courses	CE(HS)301	Humanities-I (Effective Technical Communication)	3	0	0	3
6	Humanities and Social Sciences including Management courses	CE(HS)302	Introduction to Civil Engineering	1	1	0	2
Theory credits							16
Practical/ Sessional							
1	Engineering Science Courses	CE(ES)391	Basic Electronics	1	0	2	2
2	Engineering Science Courses	CE(ES)392	Computer-aided Civil Engineering Drawing	1	0	2	2
3	Engineering Science Courses	CE(ES)393	Life Science	1	0	2	2
Practical credits							6
Total credits							22

Maulana Abul Kalam Azad University of Technology, West Bengal
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 (Applicable from the academic session 2018-2019)

Semester IV (Second year)

Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
Theory							
1	Engineering Science Courses	CE(ES)401	Introduction to Fluid Mechanics	2	0	0	2
2	Engineering Science Courses	CE(ES)402	Introduction to Solid Mechanics	2	0	0	2
3	Professional Core courses	CE(PC)401	Soil Mechanics – I	2	1	0	3
4	Professional Core courses	CE(PC)402	Environmental Engineering -I	2	1	0	3
5	Professional Core courses	CE(PC)403	Surveying & Geomatics	2	1	0	3
6	Professional Core courses	CE(PC)404	Concrete Technology	2	1	0	3
7	Humanities and Social Sciences including Management courses	CE(HS)401	Civil Engineering - Societal & Global Impact	2	0	0	2
8	Mandatory Courses (non-credit)	CE(MC)401	Management I (Organizational Behavior)	2	0	0	0
Theory credits							18
Practical/ Sessional							
1	Professional Core courses	CE(ES)491	Fluid Mechanics Laboratory	0	0	2	1
2	Professional Core courses	CE(ES)492	Solid Mechanics Laboratory	0	0	2	1
3	Professional Core courses	CE(ES)493	Engineering Geology Laboratory	0	0	2	1
4	Professional Core courses	CE(PC)493	Surveying & Geomatics	0	0	2	1
5	Professional Core courses	CE(PC)494	Concrete Technology Laboratory	0	0	2	1
Practical credits							5
Total credits							23

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Semester V (Third year]

Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
Theory							
1	Professional Core courses	CE(PC)501	Design of RC Structures	2	1	0	3
2	Professional Core courses	CE(PC)502	Engineering Hydrology	2	1	0	3
3	Professional Core courses	CE(PC)503	Structural Analysis – I	2	1	0	3
4	Professional Core courses	CE(PC)504	Soil Mechanics – II	2	1	0	3
5	Professional Core courses	CE(PC)505	Environmental Engineering – II	2	1	0	3
6	Professional Core courses	CE(PC)506	Transportation Engineering	2	1	0	3
7	Mandatory courses (non-credit)	CE(MC)501	Constitution of India/ Essence of Indian Knowledge Tradition	-	-	-	0
Theory credits							18
Practical/ Sessional							
1	Professional core courses	CE(PC)591	RC Design Sessional	0	0	2	1
2	Professional core courses	CE(PC)594	Soil Mechanics Laboratory	0	0	2	1
3	Professional core courses	CE(PC)595	Environmental Engineering Laboratory	0	0	2	1
4	Professional core courses	CE(PC)596	Transportation Engineering Laboratory	0	0	2	1
5	Professional core courses	CE(PC)597	Computer Application in CE	0	0	2	1
Practical credits							5
Total credits							23

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Semester VI (Third year]

Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
Theory							
1	Professional Core courses	CE(PC)601	Construction Engineering & Management	2	0	0	2
2	Professional Core courses	CE(PC)602	Engineering Economics, Estimation & Costing	2	0	0	2
3	Professional Core courses	CE(PC)603	Water Resources Engineering	2	0	0	2
4	Professional Core courses	CE(PC)604	Design of Steel Structures	2	0	0	2
5	Professional Elective courses	CE(PE)601	Elective-I	2	0	0	2
6	Professional Elective courses	CE(PE)602	Elective-II	2	0	0	2
7	Open Elective courses	CE(OE)601	Open Elective-I (Humanities)	2	0	0	2
Theory credits							14
Practical/ Sessional							
1	Professional Core courses	CE(PC)693	Water Resource Engineering Laboratory	0	0	2	1
2	Professional Core courses	CE(PC)694	Steel Structure Design Sessional	0	0	2	1
3	Professional Core courses	CE(PC)695	Quantity Survey Estimation and Valuation Sessional	0	1	2	2
Practical credits							4
Total credits							18

CE(PE)601 (Elective-I)	CE(PE)602 (Elective-II)
601A: Stability of Slopes 601B: Foundation Engineering 601C: Ground Improvement Technique	602A : Building Construction Practice 602B : Structural Analysis-II 602C : Industrial Structures
CE(OE)601 (Open Elective-I)	
601A: Soft Skills and Interpersonal Communication – I 601B: Introduction to Philosophical Thoughts	

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Semester VII (Fourth year]

Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
Theory							
1	Open Elective courses	CE(OE)701	Open Elective-II	2	0	0	2
2	Professional Elective courses	CE(PE)701	Elective III	2	1	0	3
3	Professional Elective courses	CE(PE)702	Elective IV	2	1	0	3
4	Professional Elective courses	CE(PE)703	Elective V	2	1	0	3
5	Professional Elective courses	CE(PE)704	Elective-VI	2	1	0	3
6	Professional Elective courses	CE(PE)705	Elective-VII	2	0	0	2
Theory credits							16
Practical/ Sessional							
1	Internship	CE(IN)791	Industrial Internship (after sixth semester)				1
2	Project	CE(PROJ)792	Project-1 (Project work)	0	0	10	5
Practical credits							6
Total credits							22

CE(OE)701 (Open Elective-II)	CE(PE)701 (Elective-III)
A: Metro Systems & Engineering	701A: Computational Hydraulics
B: ICT for Development	701B: Disaster Preparedness and Planning
C: Cyber Law & Ethics	701C: Hydraulic Structure
CE(PE)702 (Elective-IV)	CE(PE)703 (Elective-V)
702A: Prestressed Concrete	703A: Air and Noise Pollution and Control
702B: Repairs & Rehabilitation of Structures	703B: Physico-Chemical Processes for Water and Wastewater Treatment
702C: Finite Element Method	703C: Water and Air Quality Modelling
CE(PE)704 (Elective-VI)	CE(PE)705 (Elective-VII)
704A: Structural Dynamics	705A: Railway and Airport Engineering
704B: Advanced Structural Analysis	705B: Pavement Design
704C: Coastal Hydraulics and Sediment Transport	705C: Transport System Planning

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Syllabus for B. Tech in Civil Engineering
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Semester VIII (Fourth year]

Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
Theory							
1	Humanities and Social Sciences including Management courses	CE(HS)801	Professional Practice, law & Ethics	2	0	0	2
2	Professional Elective Courses	CE(PE)801	Elective VIII	2	0	0	2
3	Open Elective courses	CE(OE)801	Open Elective-III	2	0	0	2
4	Open Elective courses	CE(OE)802	Open Elective-IV	2	0	2	2
Theory credits							8
Practical/ Sessional							
1	Comprehensive Viva Voce	CE(CV)891	Comprehensive Viva Voce				1
2	Project	CE(PROJ)892	Project-2 (Continued from VII)	0	0	10	5
Practical credits							6
Total credits							14
CE(PE)801 (Elective-VIII)							
801A: GIS & Remote Sensing 801B: Rock Mechanics 801C: Environmental laws and Policy 801D: Pavement Materials and Design							
CE(OE)801 (Open Elective-III)			CE(OE)802 (Open Elective-IV)				
A: Human Resource Development and Organizational Behavior B: Bridge Engineering C: Deep Foundations D: Groundwater Contamination			A: Soft Skills and Personality Development B: Earthquake Engineering C: Urban Transport Planning D: Environmental Impact Assessment and Life cycle Analysis				

TOTAL CREDITS – [38 +(22+23)+(23+18)+(21+15)]=160

SEM 1 & SEM 2	SEM3	SEM4	SEM5	SEM6	SEM7	SEM8	Total
38	22	23	23	18	21	15	160

1st Year Curriculum for B.Tech courses in Engineering & Technology

(Applicable from the academic session 2018-2019)



Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits

B. Range of credits :

A range of credits from 150 to 160 for a student to be eligible to get B.Tech Degree in Engineering. A student will be eligible to get B.Tech Degree *with Honours*, if he/she completes an additional 20 credits. These could be acquired through Massive Open Online Courses (MOOCs).

C. MOOCs for B. Tech Honours

The additional 20 credits (for obtaining B. Tech with Honours) are to be gained through MOOCs. The complete description of the MOOCs relevant for the first year course are given in *Annexure-I*. The courses for subsequent years of study will be posted subsequently.

D. Guidelines regarding Mandatory Induction Program for the new students

All concerned are requested to follow the guidelines given in *Annexure-II* (Notice dt.06/12/2017) concerning Mandatory Induction Program. The colleges/ Institute may also refer to the AICTE Model Curriculum for Undergraduate Degree Courses in Engineering & Technology (January 2018) -Volume I (Page No.31-38), if necessary.

E. Mandatory Additional Requirement for earning B. Tech Degree

All concerned are requested to follow the guidelines in *Annexure-III* concerning Mandatory Additional Requirements.

F. Group division:

Group-A:

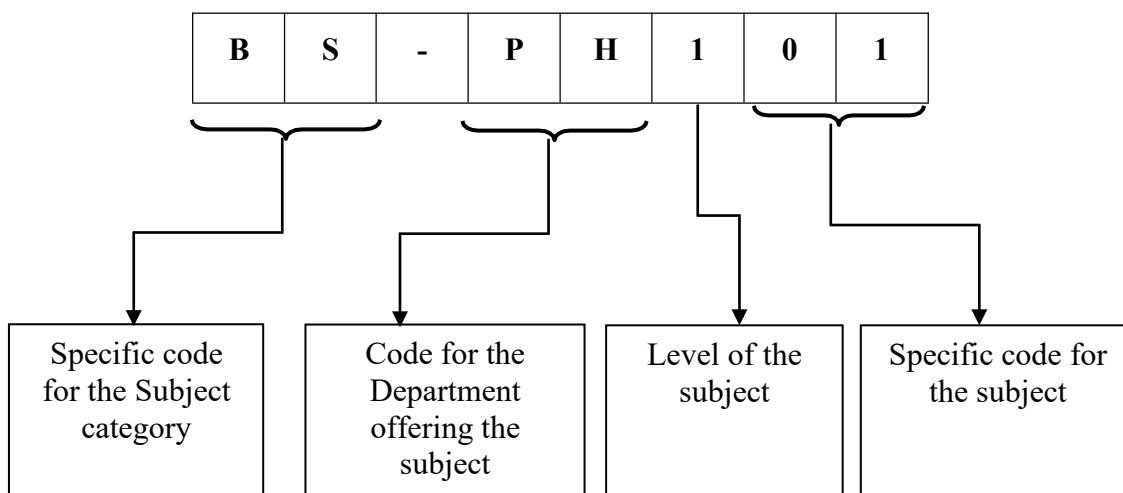
Chemistry based subjects: [Bio-Technology, Food Technology, Leather Technology, Textile Technology, Ceramic Technology, Chemical Engineering and any other Engineering that chooses to be Chemistry based] + Physics based subjects: [Mechanical Engineering, Production Engineering, Civil Engineering, Automobile Engineering, Marine Engineering, Apparel Production Engineering, Computer Science & Engineering, Information Technology.]

Group-B:

All Physics based subjects which are also Electrical & Electronics based [Electrical Engineering, Electronics & Communication Engineering, Applied Electronics & Instrumentation Engineering, Power Engineering, Electrical & Electronics Engineering, Bio-Medical Engineering, Instrumentation & Control Engineering]

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G. Subject Numbering Scheme:



List of Codes for Subject Category	
Code	Category Name
BS	Basic Science Courses
ES	Engineering Science Courses
HM	Humanities and Social Sciences including Management courses
PC	Professional core courses
PE	Professional Elective courses
OE	Open Elective courses
MC	Mandatory courses
PW	Project

List of Codes for Departments			
Code	Name of the Department	Code	Name of the Department
APM	Apparel Production Engineering	ECE	Electronics & Communication Engineering
AEIE	Applied Electronics & Instrumentation Engineering	FT	Food Technology
AUE	Automobile Engineering	IT	Information Technology
BME	Bio-Medical Engineering	ICE	Instrumentation & Control Engineering
BT	Bio-Technology	LT	Leather Technology
CT	Ceramic Technology	MRE	Marine Engineering
CHE	Chemical Engineering	ME	Mechanical Engineering
CE	Civil Engineering	PWE	Power Engineering
CSE	Computer Science & Engineering	PE	Production Engineering
EEE	Electrical & Electronics Engineering	TT	Textile Technology
EE	Electrical Engineering		

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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

First Year First Semester							
Mandatory Induction Program- 3 weeks duration							
Sl No.	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science course	BS-PH101/ BS-CH101	Physics-I (Gr-A)/ Chemistry-I(Gr-B)	3	1	0	4
2	Basic Science course	BS-M101/ BS-M102	Mathematics –IA*/ Mathematics –IB *	3	1	0	4
3	Engineering Science Courses	ES-EE101	Basic Electrical Engineering	3	1	0	4
	Total Theory			9	3	0	12
Practical							
1	Basic Science course	BS-PH191/ BS-CH191	Physics-I Laboratory (Gr-A)/ Chemistry-I Laboratory (Gr-B)	0	0	3	1.5
2	Engineering Science Courses	ES-EE191	Basic Electrical Engineering Laboratory	0	0	2	1
3	Engineering Science Courses	ES-ME191/ ES-ME192	Engineering Graphics & Design(Gr-B)/ Workshop/Manufacturing Practices(Gr-A)	1	0	4	3
	Total Practical			1		9	5.5
	Total of First Semester			10	3	9	17.5

* Mathematics –IA (BS-M101) - CSE & IT
 Mathematics –IB (BS-M102) - All stream except CSE & IT

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First Year Second Semester							
Sl No.	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science courses	BS-PH201/ BS-CH201	Physics-I (Gr-B)/ Chemistry-I (Gr-A)	3	1	0	4
2	Basic Science courses	BS-M201/ BS-M202	Mathematics –IIA [#] / Mathematics –IIB [#]	3	1	0	4
3	Engineering Science Courses	ES-CS201	Programming for Problem Solving	3	0	0	3
4	Humanities and Social Sciences including Management courses	HM-HU201	English	2	0	0	2
	Total Theory			11	2	0	13
Practical							
1	Basic Science courses	BS-PH291/ BS-CH291	Physics-I Laboratory (Gr-B)/ Chemistry-I Laboratory (Gr-A)	0	0	3	1.5
2	Engineering Science Courses	ES-CS291	Programming for Problem Solving	0	0	4	2
3	Engineering Science Courses	ES-ME291/ ES-ME292	Engineering Graphics & Design(Gr-A)/ Workshop/Manufacturing Practices(Gr-B)	1	0	4	3
4	Humanities and Social Sciences including Management courses	HM-HU291	Language Laboratory	0	0	2	1
	Total Practical			1	0	13	7.5
	Total of Second Semester			12	2	13	20.5

Mathematics –II (BS-M201) - CSE & IT
 Mathematics –II (BS-M202) - All stream except CSE & IT

	Group-A	Group-B
1 st Year 1 st Semester	Physics-I (BS-PH101); Workshop/Manufacturing Practices (ES-ME192)	Chemistry-I (BS-CH101); Engineering Graphics & Design (ES-ME191)
1 st Year 2 nd Semester	Chemistry-I (BS-CH201); Engineering Graphics & Design (ES-ME291)	Physics-I (BS-PH201); Workshop/Manufacturing Practices (ES-ME292)

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Course Code : BS-PH101/ BS-PH201	Category : Basic Science Courses
Course Title : Physics-I	Semester : First/ Second
L-T-P : 3-1-0	Credit:4
Pre-Requisites:	

Course objectives :

Basic concepts of mechanics, optics and its applications, electricity, magnetism and qualitative understanding of concepts of quantum physics and statistical mechanics.

1. Mechanics (7L)

Problems including constraints & friction. Basic ideas of vector calculus and partial differential equations. Potential energy function $F = -\text{grad } V$, equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy & momentum. Non-inertial frames of reference. Harmonic oscillator; Damped harmonic motion forced oscillations and resonance. Motion of a rigid body in a plane and in 3D. Angular velocity vector. Moment of inertia.

2. Optics (5L)

- Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits (only the expressions for max;min, & intensity and qualitative discussion of fringes); diffraction grating(resolution formulac only), characteristics of diffraction grating and its applications.
- Polarisation : Introduction, polarisation by reflection, polarisation by double reflection, scattering of light, circular and elliptical polarisation, optical activity.
- Lasers : Principles and working of laser : population inversion, pumping, various modes, threshold population inversion with examples .

3. Electromagnetism and Dielectric Magnetic Properties of Materials (8L)

- Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielecrrics, internal fields in a solid, Clausius- Mossotti equation(expression only), applications of dielectrics.
- Magnetisation , permeability and susceptibility, classificationof magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.

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4. Quantum Mechanics (16L)

- Introduction to quantum physics, black body radiation, explanation using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.

5. Statistical Mechanics (8L)

- Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics.

Course outcomes:

Students will be familiar with

- Basic concepts of mechanics
- Bragg's Law and introduction to the principles of lasers, types of lasers and applications.
- Various terms related to properties of materials such as, permeability, polarization, etc.
- Some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials.
- Simple quantum mechanics calculations.
-

Learning Resources:

1. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited
2. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker, Wiley
3. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press
4. Engineering Mechanics (In SI Units) (SIE), S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati, McGraw Hill Education
5. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education
6. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education
7. Engineering Mechanics, M.K. Harbola, Cengage India
8. An Introduction to Mechanics (SIE), David Kleppner, Robert Kolenkow, McGraw Hill Education
9. Principles of mechanics, John L. Synge and Byron A. Griffith, New York, McGraw-Hill
10. Mechanics (Dover Books on Physics), J. P. Den Hartog, Dover Publications Inc.
11. Engineering Mechanics: Dynamics, L.G. Kraige J.L. Meriam, Wiley
12. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, Robert Eisberg, Robert Resnick, Wiley
13. Introduction to Quantum Mechanics, J. Griffiths David, Pearson Education
14. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press
15. Optics, Hecht, Pearson Education
16. Optics, Ghatak, McGraw Hill Education India Private Limited
17. Fundamentals of Statistical and Thermal Physics, Reif, Sarat Book Distributors
18. Statistical Mechanics, Pathria, Elsevier
19. Statistical Physics, L.D. Landau, E.M. Lifshitz, Butterworth-Heinemann

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Course Code : BS-CH101/ BS-CH201	Category : Basic Science Courses
Course Title : Chemistry-I	Semester : First/ Second
L-T-P : 3-1-0	Credit:4
Pre-Requisites:	

Detailed contents

i) Atomic and molecular structure (10 lectures)

Schrodinger equation. Particle in a box solutions and their applications for simple sample. Molecular orbitals of diatomic molecules (e.g.H₂). Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

ii) Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

iii) Intermolecular forces and potential energy surfaces (4 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena.

iv) Use of free energy in chemical equilibria (8 lectures)

First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

v) Periodic properties (4 Lectures)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

vi) Stereochemistry (4 lectures)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

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vii) Organic reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

Learning Resources:

1. Engineering Chemistry, Satyaprakash, Khanna Book Publishing, Delhi
2. University chemistry, by B. H. Mahan
3. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
4. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
5. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
6. Physical Chemistry, by P. W. Atkins
7. Spectroscopy of Organic Compounds, by P.S.Kalsi, New Age International Pvt Ltd Publishers
8. Physical Chemistry, P. C. Rakshit, Sarat Book House
9. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition
<http://bcs.whfreeman.com/vollhardtschore5e/default.asp>

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Course Code : BS-M101	Category : Basic Science Course
Course Title : Mathematics – I A	Semester : First (CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic	Lectures Hours
1	<i>Calculus (Integration):</i> Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	<i>Calculus (Differentiation):</i> Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	<i>Matrices:</i> Matrices, Vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.	7
4	<i>Vector Spaces:</i> Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem, composition of linear maps, Matrix associated with a linear map.	9
5	<i>Vector Spaces (Continued):</i> Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.	10

Course Outcomes:

The students will be able to:

Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

Understand the domain of applications of mean value theorems to engineering problems.

Learn different types of matrices, concept of rank, methods of matrix inversion and their applications.

Understand linear spaces, its basis and dimension with corresponding applications in the field of computer science.

Learn and apply the concept of eigen values, eigen vectors, diagonalisation of matrices and orthogonalization in inner product spaces for understanding physical and engineering problems

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Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. S.K. Mapa, Higher Algebra: Abstract and Linear, Sarat Book House Pvt.Ltd.
8. Hoffman and Kunze: Linear algebra, PHI.

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Course Code : BS-M102	Category : Basic Science Course
Course Title : Mathematics –I B	Semester : First (All stream except CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic	Lectures Hours
1	<i>Calculus (Integration):</i> Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	<i>Calculus (Differentiation):</i> Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	<i>Sequence and Series:</i> Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.	11
4	<i>Multivariate Calculus:</i> Limit, continuity and partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, Curl and Divergence.	9
5	<i>Matrices:</i> Inverse and rank of a matrix, Rank-nullity theorem; System of linear equations; Symmetric, Skew-symmetric and Orthogonal matrices; Determinants; Eigenvalues and Eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.	8

Course Outcomes:

After completing the course the student will be able to

Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

Understand the domain of applications of mean value theorems to engineering problems.

Learn the tools of power series and Fourier series to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.

Apply the knowledge for addressing the real life problems which comprises of several variables or attributes and identify extremum points of different surfaces of higher dimensions.

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Understand different types of matrices, their eigen values, eigen vectors, rank and also their orthogonal transformations which are essential for understanding physical and engineering problems.

Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.

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Course Code : ES-EE101	Category : Engineering Science Courses
Course Title : Basic Electrical Engineering	Semester : First
L-T-P : 3-1-0	Credit: 4
Pre-Requisites:	

Detailed contents:

Module 1: DC Circuits (8 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers (6 hours)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 hours)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters (6 hours)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

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Course Outcomes

To understand and analyze basic electric and magnetic circuits

To study the working principles of electrical machines and power converters.

To introduce the components of low voltage electrical installations

Learning Recourses:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Book Publishing Co. (P) Ltd., Delhi.
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
4. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
5. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
6. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

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Course Code : BS-PH191/ BS-PH291	Category : Basic Science course
Course Title : Physics-I Laboratory	Semester : First/ Second
L-T-P : 0-0-3	Credit:1.5
Pre-Requisites:	

Choose 10 experiments including at least one from Optics, Electricity and Magnetism and Quantum Mechanics and at least a total of six from these three groups.

Experiments in Optics

1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of a monochromatic light by Newton's ring
3. Determination of wavelength of a monochromatic light by Fresnel's bi-prism
4. Determination of wavelength of the given laser source by diffraction method

Electricity & Magnetism experiments

1. Determination of thermo electric power of a given thermocouple.
2. Determination of specific charge (e/m) of electron by J.J. Thompson's method.
3. Determination of dielectric constant of a given dielectric material.
4. Determination of Hall coefficient of a semiconductor by four probe method.
5. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.
6. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
7. Determination of unknown resistance using Carey Foster's bridge
8. Study of Transient Response in LR, RC and LCR circuits using expeyes
9. Generating sound from electrical energy using expeyes

Experiments in Quantum Physics

1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Lande-g factor using Electron spin resonance spectrometer.
4. Determination of Rydberg constant by studying Hydrogen spectrum.
5. Determination of Band gap of semiconductor.
6. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

Miscellaneous experiments

1. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure
2. Determination of bending moment and shear force of a rectangular beam of uniform cross-section
3. Determination of modulus of rigidity of the material of a rod by static method
4. Determination of rigidity modulus of the material of a wire by dynamic method
5. To determine the moment of inertia of a body about an axis passing through its centre of gravity and to determine the modulus of rigidity of the material of the suspended wire
6. Determination of coefficient of viscosity by Poiseuille's capillary flow method

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Course Code : BS-CH191/ BS-CH291	Category : Basic Science Courses
Course Title : Chemistry-I Laboratory	Semester : First/ Second
L-T-P : 0-0-3	Credit:1.5
Pre-Requisites:	

Choose 10 experiments from the following:

1. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
2. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
3. Determination of dissolved oxygen present in a given water sample.
4. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution)
5. Determination of surface tension and viscosity
6. Thin layer chromatography
7. Ion exchange column for removal of hardness of water
8. Determination of the rate constant of a reaction
9. Determination of cell constant and conductance of solutions
10. Potentiometry - determination of redox potentials and emfs
11. Saponification/acid value of an oil
12. Chemical analysis of a salt
13. Determination of the partition coefficient of a substance between two immiscible liquids
14. Adsorption of acetic acid by charcoal
15. Use of the capillary viscosimeters to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

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Course Code : ES-EE191	Category : Engineering Science Courses
Course Title : Basic Electrical Engineering Laboratory	Semester : First
L-T-P : 0-0-2	Credit: 1
Pre-Requisites:	

Choose 10 experiments from the following:

1. First activity: Introduction to basic safety precautions and mentioning of the do's and Don'ts. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about the modalities of evaluation.
2. Introduction and uses of following instruments :
 - (a) Voltmeter
 - (b) Ammeter
 - (c) Multimeter
 - (d) Oscilloscope

Demonstration of real life resistors, capacitors with color code , inductors and autotransformer.

3. Demonstration of cut-out sections of machines: DC machine, Induction machine, Synchronous machine and single phase induction machine.
4. Calibration of ammeter and Wattmeter.
5. Determination of steady state and transient response of R-L, R-C and R-L-C circuit to a step change in voltage.
6. Determination of steady state response of R-L and R-C and R-L-C circuit and calculation of impedance and power factor.
7. Determination of resonance frequency and quality factor of series and parallel R-L-C circuit.
8. (a) Open circuit and short circuit test of a single-phase transformer
(b) Load test of the transformer and determination of efficiency and regulation
9. Demonstration of three phase transformer connections. Voltage and current relationship, phase shifts between the primary and secondary side.
10. Measurement of power in a three phase unbalanced circuit by two wattmeter method.
11. Determination of Torque –Speed characteristics of separately excited DC motor.
12. Determination of Torque speed characteristics and observation of direction reversal by change of phase sequence of connection of Induction motor.
13. Determination of operating characteristics of Synchronous generator.
14. Demonstration of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter for speed control of an Induction motor
15. Demonstration of components of LT switchgear.

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Course Code : ES-ME191/ ES-ME 291	Category : Engineering Science Courses
Course Title : Engineering Graphics & Design	Semester : First/ Second
L-T-P : 1-0-4	Credit: 3
Pre-Requisites:	

Sl. No.	Content	Lecture (L)	Practical (P)
1	INTRODUCTION TO ENGINEERING DRAWING Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes.	1	4
2	LETTERING, DIMENSIONING, SCALES Plain scale, Diagonal scale and Vernier Scales.	1	4
3	GEOMETRICAL CONSTRUCTION AND CURVES Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Archimedian Spiral.	1	4
4	PROJECTION OF POINTS, LINES, SURFACES Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle, pentagon, Hexagon etc.) inclined Planes - Auxiliary Planes.	1	4
5	PROJECTION OF REGULAR SOLIDS Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).	1	4
6	COMBINATION OF REGULAR SOLIDS, FLOOR PLANS Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.	1	4
7	ISOMETRIC PROJECTIONS Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;	1	4

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8	SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)	1	4
9	OVERVIEW OF COMPUTER GRAPHICS, CUSTOMISATION & CAD DRAWING listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;	1	4
	ANNOTATIONS, LAYERING & OTHER FUNCTIONS applying dimensions to objects, applying annotations to drawings;		
10	Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;	2	8

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11	DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).	2	8
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Course Outcomes

The student will learn:

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling

General Instructions

1. In every topic some problems are to be done in the class and some are to be given to students as home assignment.
2. The problems for class work are to be prepared on drawing sheet of A1 size in the class/ using AutoCAD software.
3. The problems for home assignments are to be prepared on drawing copy/ using AutoCAD software.
4. Print out of every assignment is to be taken for CAD Drawings on Drawing sheets (A4 Sheets).
5. A title block must be prepared in each sheet/ assignment.

Following is the list of drawing instruments that required for making engineering drawings on paper with perfection.

1. Drawing Board
2. Mini drafter/ Set-squares (45°–45° & 60°–90°), T-square
3. Protractor (180°, 360°)
4. Scales (Plain, Diagonal)
5. Compass (Small and Large)
6. Divider (Small and Large)

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7. French Curves
8. Drawing paper (A1 Size)
9. Drawing pencil (H, HB, B)
10. Sharpener
11. Eraser
12. Drawing pins & clips
13. Duster or handkerchief etc.

Learning Resources:

1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House
2. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
5. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
6. Corresponding set of CAD Software Theory and User Manuals

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Course Code : ES-ME192/ ES-ME 292	Category : Engineering Science Courses
Course Title : Workshop/ Manufacturing Practices	Semester : First/ Second
L-T-P : 1-0-4	Credit:3
Pre-Requisites:	

(i) Lectures & videos:

Detailed contents:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Electrical & Electronics
5. Carpentry
6. Plastic moulding, glass cutting
7. Metal casting
8. Welding (arc welding & gas welding), brazing

(ii) Workshop Practice:

Machine shop (8 hours)

Typical jobs that may be made in this practice module:

To make a pin from a mild steel rod in a lathe.

To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Fitting shop (8 hours)

Typical jobs that may be made in this practice module:

To make a Gauge from MS plate.

Carpentry (8 hours)

Typical jobs that may be made in this practice module:

To make wooden joints and/or a pattern or like.

Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs))

Typical jobs that may be made in this practice module:

ARC WELDING (4 hours): To join two thick (approx 6mm) MS plates by manual metal arc welding.

GAS WELDING (4 hours): To join two thin mild steel plates or sheets by gas welding.

Casting (8 hours)

Typical jobs that may be made in this practice module:

One/ two green sand moulds to prepare, and a casting be demonstrated.

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Smithy (4 hours) ~ 4 hours

Typical jobs that may be made in this practice module:

A simple job of making a square rod from a round bar or like.

Plastic moulding & Glass cutting (4 hours)

Typical jobs that may be made in this practice module:

For plastic moulding, making at least one simple plastic component should be made.

For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made.

Electrical & Electronics (8 hours)

Familiarization with LT switchgear elements, making its sketches and noting down its specification. Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable.

Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point.

Simple wiring exercise to be executed to understand the basic electrical circuit.

Simple soldering exercises to be executed to understand the basic process of soldering.

Fabrication of a single-phase full wave rectifier with a step down transformer using four diodes and electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes

Upon completion of this laboratory course, students will be able to fabricate components with their own hands.

They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

By assembling different components, they will be able to produce small devices of their interest.

Learning Resources:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. and Steven S. Schmid, “Manufacturing Engineering and Technology”, 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu, “Manufacturing Technology – I” Pearson Education, 2008.
4. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4th edition, Prentice Hall India, 1998.
5. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGrawHill House, 2017.

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Course Code : BS-M201	Category : Basic Science Course
Course Title : Mathematics – II A	Semester : Second (CSE &IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics and BS-M101	

Module No.	Description of Topic	Lectures Hours
1	Basic Probability: Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the Multinomial distribution, Poisson approximation to the Binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.	11
2	Continuous Probability Distributions: Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities.	4
3	Bivariate Distributions: Bivariate distributions and their properties, distribution of sums and quotients, Conditional densities, Bayes' rule.	5
4	Basic Statistics: Measures of Central tendency, Moments, Skewness and Kurtosis, Probability distributions: Binomial, Poisson and Normal and evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.	8
5	Applied Statistics: Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	8
6	Small samples: Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	4

Course Outcomes:

The students will be able to:

Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.

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Understand the basic ideas of statistics with different characterisation of a univariate and bivariate data set.

Apply statistical tools for analysing data samples and drawing inference on a given data set.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
3. S. Ross, A First Course in Probability, Pearson Education India
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.
5. John E. Freund, Ronald E. Walpole, Mathematical Statistics, Prentice Hall.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
7. N.G. Das, Statistical Methods (Combined Volume), Tata-McGraw Hill.

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Course Code : BS-M202	Category : Basic Science Course
Course Title : Mathematics – II B	Semester : Second (All stream except CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics and BS-M102	

Module No.	Description of Topic	Lectures Hours
1	<i>Multivariate Calculus (Integration):</i> Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, change of variables (Cartesian to Polar), Applications: Areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.	11
2	<i>First order ordinary differential equations:</i> Exact, linear and Bernoulli's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.	5
3	<i>Ordinary differential equations of higher orders:</i> Second order linear differential equations with constant coefficients, Use of D-operators, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.	9
4	<i>Complex Variable – Differentiation</i> Differentiation of complex functions, Cauchy-Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithmic) and their properties; Conformal mappings, Mobius transformations and their properties.	6
5	<i>Complex Variable – Integration</i> Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, Zeros of analytic functions, Singularities, Laurent's series; Residues, Cauchy residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.	9

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Course Outcomes:

The students will be able to:

Learn the methods for evaluating multiple integrals and their applications to different physical problems.

Understand different techniques to solve first and second order ordinary differential equations with its formulation to address the modelling of systems and problems of engineering sciences.

Learn different tools of differentiation and integration of functions of a complex variable that are used with various other techniques for solving engineering problems.

Apply different types of transformations between two 2- dimensional planes for analysis of physical or engineering problems.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. E. L. Ince, Ordinary Differential Equations, Dover Publications.
8. J. W. Brown and R. V. Churchill, Complex Variables and Applications, Mc-Graw Hill.

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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
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Course Code : ES-CS201	Category : Engineering Science Courses
Course Title : Programming for Problem Solving	Semester : Second
L-T-P : 3-0-0	Credit :3
Pre-Requisites:	

Detailed contents

Unit 1: Introduction to Programming (4 lectures)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - **(1 lecture)**.

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. **(1 lecture)**

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- **(2 lectures)**

Unit 2: Arithmetic expressions and precedence (2 lectures)

Unit 3: Conditional Branching and Loops (6 lectures)

Writing and evaluation of conditionals and consequent branching **(3 lectures)**

Iteration and loops **(3 lectures)**

Unit 4: Arrays (6 lectures)

Arrays (1-D, 2-D), Character arrays and Strings

Unit 5: Basic Algorithms (6 lectures)

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 6: Function (5 lectures)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Unit 7: Recursion (4 -5 lectures)

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 8: Structure (4 lectures)

Structures, Defining structures and Array of Structures

Unit 9: Pointers (2 lectures)

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Unit 10: File handling (only if time is available, otherwise should be done as part of the lab)

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Course Outcomes

The student will learn

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical errors.
- To implement conditional branching, iteration and recursion.
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- To apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.

Learning Resources:

1. R. S. Salaria, Computer Concepts and Programming in C, Khanna Publishers
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

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Course Code : ES-CS291	Category : Engineering Science Courses
Course Title : Programming for Problem Solving	Semester : Second
L-T-P : 0-0-4	Credit:2
Pre-Requisites:	

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

Tutorial 12: File handling:

Lab 12: File operations

Laboratory Outcomes

To formulate the algorithms for simple problems

To translate given algorithms to a working and correct program

To be able to correct syntax errors as reported by the compilers

To be able to identify and correct logical errors encountered at run time

To be able to write iterative as well as recursive programs

To be able to represent data in arrays, strings and structures and manipulate them through a program

To be able to declare pointers of different types and use them in defining self-referential structures.

To be able to create, read and write to and from simple text files.

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Course Code : HM-HU201	Category : Humanities and Social Sciences including Management courses
Course Title : English	Semester : Second
L-T-P : 2-0-0	Credit:2
Pre-Requisites:	

Detailed contents

1. Vocabulary Building

- 1.1 The concept of Word Formation: Compounding, Backformation, Clipping, Blending.
- 1.2 Root words from foreign languages and their use in English
- 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
- 1.4 Synonyms, antonyms, and standard abbreviations: Acronyms

2. Basic Writing Skills

- 2.1 Sentence Structures & Types: Simple, Compound, Complex
- 2.2 Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration
- 2.3 Importance of proper punctuation
- 2.4 Creating coherence: Arranging paragraphs & Sentences in logical order
- 2.5 Creating Cohesion: Organizing principles of paragraphs in documents
- 2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

- 3.1 Subject-verb agreement
- 3.2 Noun-pronoun agreement
- 3.3 Misplaced modifiers
- 3.4 Articles
- 3.5 Prepositions
- 3.6 Redundancies
- 3.7 Clichés

4. Nature and Style of sensible Writing

- 4.1 Describing
- 4.2 Defining
- 4.3 Classifying
- 4.4 Providing examples or evidence
- 4.5 Writing introduction and conclusion

5. Writing Practices

- 5.1 Comprehension
- 5.2 Précis Writing
- 5.3 Essay Writing
- 5.4 Business Letter, Cover Letter & CV; E-mail

Addendum

Some examples of English words with foreign roots

Greek Root/Affix	Examples
Anti	Antisocial, antiseptic

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Auto	Automatic, autograph
Anthropos	Anthropology, philanthropy
Bio	Biography
Chronos	Time
Di	Dilemma
Bio	Biology
Biblio	Bibliography
Chron	Chronology
Cracy	Contradiction
Geo	Geology
Hyper	Hyperactive
Mania	Kleptomania
Mega	Megaserial
Eu	Eulogy, euphoria
Geo	Geology
Graph	autograph, photograph
Hetero	Heterogeneous
Hyper	Hyperactive
Hypo	hypodermic, hypoglycemia
Macro	Macrocosm
Mega	megalomania
Micro	microcosm

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Mono	Monarch
Pan	Panorama
Pathos	Pathetic
Phobia	Hydrophobia
Pod (Gk), ped (Latin)	Pseudopodia
Poly	polyglot
Tele	Telephone
Theo	Theology, theist
Latin Root	Examples
Aud	Audible
Bene	Beneficial
Brev	abbreviate, brief
circum	Circulate
Contra	Contradict
Cred	Credible
Dict	Diction
Femina	Feminine
Inter	Internet, interval
Magna	Magnificent
Mal	Malnutrition
Multi	multinational
Nova	Novel
Multi	Multiple, multiplex
Non	Nonstop

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Pre	Previous, predicate
Re	Redo, rewind
Scrib	Scripture
Spect	Spectator
Trans	Transport
Uni	Unity
Omni	Omnipotent
Semi	Semicircle
Sub	Subway
somnus	Insomnia,
Super	Superman
Sym	Sympathy
scribe	Describe, scribble(write illegibly), inscribe
Trans	Transform
Un	Unnecessary
Uni	Universal

Learning Resources:

- (i) Kulbushan Kumar, R S Salaria, Effective Communication Skills, Khanna Publishing House, Delhi.
- (ii) Practical English Usage. Michael Swan. OUP. 1995.
- (iii) Remedial English Grammar. F.T. Wood. Macmillan. 2007
- (iv) On Writing Well. William Zinsser. Harper Resource Book. 2001
- (v) Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- (vi) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
- (vii) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
- (viii) Universal English Prof. Prasad Kataria Publications, 2019.
- (ix) "Communication Skills for Professionals"-Nira Konar, Prentice Hall of India 2nd edition, New Delhi, 2011
- (x) Gajendra Singh Chauhan, Smita Kashiramka and L. Thimmesha. Functional English. Cengage, 2019.

Course Outcomes

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

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Course Code : HM-HU291	Category : Humanities and Social Sciences including Management courses
Course Title : Language Laboratory	Semester : Second
L-T-P : 0-0-2	Credit:1
Pre-Requisites:	

- | | |
|---|----|
| 1) Honing ‘Listening Skill’ and its sub skills through Language Lab Audio device; | 3P |
| 2) Honing ‘Speaking Skill’ and its sub skills | 2P |
| 3) Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/
Voice modulation/ Stress/ Intonation/ Pitch & Accent) of connected speech | 2P |
| 4) Honing ‘Conversation Skill’ using Language Lab Audio –Visual input;
Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone &
Role Play Mode) | 2P |
| 5) Introducing ‘Group Discussion’ through audio –Visual input and acquainting them
with key strategies for success | 2P |
| 6) G D Practice Sessions for helping them internalize basic Principles
(turn- taking, creative intervention, by using correct body language, courtesies &
other soft skills) of GD | 4P |
| 7) Honing ‘Reading Skills’ and its sub skills using Visual / Graphics/
Diagrams /Chart Display/Technical/Non Technical Passages
Learning Global / Contextual / Inferential Comprehension; | 2P |
| 8) Honing ‘Writing Skill’ and its sub skills by using
Language Lab Audio –Visual input; Practice Sessions | 2P |

Course Outcomes

- The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

MOOCs for B. Tech Honours



Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

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Maulana Abul Kalam Azad University of Technology, West Bengal

Notice

1st May, 2018

MOOCs for B.Tech Honours (Applicable from the session 2018-2019)

Preamble

All India Council for Technical Education (AICTE) has introduced Model Curriculum for Bachelor of Technology programme with 160 credits in the entire programme of 4 years, and additional 20 credits will be required to be done for the degree of Bachelor of Technology with Honours. These additional 20 credits will have to be acquired with online courses (MOOCs) as per AICTE. So students will have to complete additional 20 credits through MOOCs within 4 years of time. This creates an excellent opportunity for students to acquire the necessary skill set for employability through massive online courses where the rare expertise of world famous experts from academics and industry are available. Maulana Abul Kalam Azad University of Technology, West Bengal (MAKAUT,WB) has thus decided to introduce AICTE model curriculum for its B.Tech Programmes and suggest baskets for MOOCs available year wise for the four-year long B.Tech programme from the sessions 2018-2019. The basket for MOOCs will be a dynamic one, as courses keep on updating with time. Few essential skill sets required for employability are also identified year wise by MAKAUT,WB. For MOOCs platforms where examination or assessment is absent (like SWAYAM) or where certification is costly (like Coursera or edX), faculty members of the Institutes are to audit the courses and prepare the examination question papers, for the courses undertaken by the students of respective Institutes, so that MAKAUT,WB can conduct examination for the course. The total of 20 credits that is required to be attained for B.Tech Honours degree are distributed over four years in the following way:

For first year	:	8 credits
For second year	:	4 credits
For third year	:	4 credits
For fourth year	:	4 credits

A student of first year has to cover courses from at least three skills :

1. Computer Programing with Python / R
2. Soft skill
3. Ethics

Courses are * marked in the above areas

If a student is unable to cover the credits assigned for the first year, he/she can do these courses in either of the subsequent years, but he/she has to choose the courses from the basket of MOOCs announced by MAKAUT,WB from time to time. The same rule will be applicable for the other years of the programme.

The basket for MOOCs for the 1st year B. Tech for the session 2018-2019 are made available herewith.

By order.

MOOCs for First Year, Engineering and Technology

Sl. No	Course	Provider	Duration	Credits	Name of University / Institution
1.	Presentation Skills: Designing Presentation Slides	Coursera *	4 weeks	1	Tomsk State University
2.	Effective Problem-Solving and Decision-Making	Coursera	4 weeks	1	University of California
3.	Communication in the 21st Century Workplace	Coursera *	4 weeks	1	University of California
4.	Psychology at Work	Coursera *	6 weeks	2	University of Western Australia
5.	Critical Thinking & Problem Solving	EdX *	3 weeks	3	Rochester Institute of Technology
6.	Successful Career Development	Coursera	7 weeks	2	University System of Georgia
7.	Working in Teams: A Practical Guide	edX	4 weeks	1	University of Queensland
8.	Communication theory: bridging academia and practice	Coursera	9 weeks	3	Higher School of Economics
9.	Speaking Effectively	NPTEL *	8 weeks	3	Indian Institute of Technology, Kharagpur
10.	Introduction to Philosophy	Coursera	5 weeks	1	University of Edinburgh
11.	Moralities of Everyday Life	Coursera	6 weeks	2	Yale University
12.	Introduction to Logic	Coursera *	10 weeks	3	Stanford University
13	Write Professional Emails in English	Coursera *	5 weeks	2	Georgia Institute of Technology
14	Technical Writing	Coursera	5 weeks	1	Moscow Institute of Physics and Technology
15	Learn to Program: The Fundamentals	Coursera	7 weeks	2	University of Toronto
16	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
17	Introduction to Problem Solving and Programming	NPTEL	12 weeks	4	NPTEL
18	The Science of Well Being	Coursera	6 weeks	2	Yale University
19	Developing Soft Skills and Personality	NPTEL	8 weeks	3	
20	Programming Basics	edX	9 weeks	3	IIT Bombay
21	Introduction to Python: Absolute Beginner	EdX *	5 weeks	2	Microsoft
22	Inferential Statistics	Coursera *	7 weeks	2	University of Amsterdam
23	Linear Regression and Modelling	Coursera	4 weeks	1	Duke University
24	Foundation of Data Structures	edX	6 weeks	2	IIT Bombay
25	Introduction to Logic	NPTEL	12 weeks	4	NPTEL
26	Introduction to Probability and Data	Coursera *	5 weeks	1	Duke University
27	Ethics	NPTEL *	12 weeks	4	
28	Science, Technology and Society	NPTEL	12 weeks	4	
29	Creating Innovation	Coursera	6 weeks	2	Macquarie University
30	Ethical Leadership Through Giving Voice to Values	Coursera *	4 weeks	2	University of Virginia
31	Creativity, Innovation, and Change	Coursera *	6 weeks	2	Pennsylvania State University
32	Interpersonal Communication for Engineering Leaders	Coursera	4 weeks	1	Rice University

33	Learn to Program: The Fundamentals	Coursera *	7 weeks	3	University of Toronto
34	Introduction to Mathematical Thinking	Coursera *	9 weeks	3	Stanford University
35	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
36	A Life of Happiness and Fulfillment	Coursera	6 weeks	2	Indian School of Business
37	Model Thinking	Coursera	12 weeks	4	University of Michigan
38	Introduction to Philosophy: God, Knowledge, and Consciousness	edX	12 weeks	4	MIT
39	Soft skills	NPTEL *	12 Weeks	4	IIT Roorkee
40	Developing Soft Skills and Personality	NPTEL *	8 weeks	3	IIT Kanpur
41	Indian Fiction in English	NPTEL	12 Weeks	4	IIT Madras
42	Development of Sociology in India	NPTEL	4 Weeks	1	IIT Kanpur
43	Intellectual Property	NPTEL	12 Weeks	4	IIT Madras
44	Essential Statistics for Data Analysis using Excel	EdX *	Self Paced	3	Microsoft
45	Ethics and Law in Data and Analytics	edX	Self Paced	4	Microsoft
46	Climate Change Mitigation in Developing Countries	Coursera *	6 weeks	3	University of Cape town
47	Web Design for Everybody (Basics of Web Development and Coding) Specialization	Coursera	15weeks	4	University of Michigan
48	Ecology: Ecosystem Dynamics and Conservation	Coursera	5 weeks	1	American Museum of Natural History, Howard Hughes Medical Institute
49	Environmental Studies: A Global Perspective	EdX *	Self Paced	4	Curtin University
50	Introduction to Computer Science and Programming Using Python	edX *	Self Paced	4	MIT, USA
51	Statistics and R	edX *	Self Paced	4	Harvard University
52	Introduction to Programming in C	Coursera *	4 weeks	4	Duke University
53	Java Programming: Solving Problems with Software	Coursera	4 weeks	4	Duke University
54	Grammar and Punctuation	Coursera	4 weeks	1	University of California
55	How to Write an Essay	Coursera *	5 weeks	1	University of California, Berkeley
56	Conversational English Skills	EdX *	10 weeks	3	Tsinghua University
57	Advanced Writing	Coursera *	4 weeks	1	University of California, Irvine
58	Speak English Professionally: In Person, Online & On the Phone	Coursera *	5 weeks	1	Georgia Institute of Technology
59	English for Science, Technology, Engineering, and Mathematics	Coursera	5 weeks	1	University of Pennsylvania
60	English Composition	edX	8 weeks	3	Arizona State University
61	Take Your English Communication Skills to the Next Level	Coursera *	4 weeks	1	Georgia Institute of Technology

**Guidelines regarding
Mandatory Induction Program for
the new students**



Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Date: 06.12.2017

Maulana Abul Kalam Azad University of Technology, West Bengal

Guidelines regarding Induction Programme for the new students

(As per Model Curriculum for 1st Year UG degrees courses in Engineering & Technology, November 2017)

To be followed from the 2018-19 academic session

Preamble: Engineering education has evolved globally in a continuous manner to address the twin needs of industry and society. It is now an accepted fact that the institutions imparting technical education should aspire to create manpower who will possess strong technical knowledge and skill, have leadership qualities and be a team player, capable of coming up with innovative solutions and be alive to societal and community concerns.

The aim of the Induction Programme is to acclimatize the students to the environment of their engineering institution, give them a flavour of the exciting new world of education that they are entering, provide them with mentoring schemes, and make them aware of their neighbourhood, society and people. This will allow them to evolve as well rounded individuals.

The following schedule is laid down by the University to implement the three week long Induction Programme:

Week 1	1 st Half	Day 1	Overall introduction of the new students to the Institution, its different Departments & Faculty Members
	2 nd Half	Day 1	(a) Assignment of faculty mentors to the new students (b) Assessment and allotment for mentoring by senior students preferably from the second year
	2 hrs	Day 2, 3, 4, 5	Lectures by eminent personalities on different areas such as (a) Introduction to Engineering (b) Various topics of science and technology (c) Innovation and entrepreneurship (d) Creative and performing arts (e) Social issues
	2 hrs.	Day 2, 3, 4, 5	Participation in Games, Yoga, Meditation etc.
	2 hrs	Day 2, 3, 4, 5	Visit to the different Departments of the Institute
Week 2 (All Days)	2hrs		Scheduled class lectures as per time table.
	2hrs		Students to be conducted through proficiency modules to be prepared by respective Colleges for ascertaining English skills & Computer knowledge of the students

			and to prepare a report on the same
	2hrs		Participation in Games, Sports, Yoga, Creative arts etc.
Week 3	2hrs		Scheduled class lectures as per time table
		Day 1	Visits to neighbourhood locations
		Day 2	Visits to natural spots in adjoining areas to understand the effect of nature on society
		Day 3	Visits to Science Museum / laboratories
		Day 4	Visits to NGOs
		Day 5	

Any other activity, as deemed fit by the Director/Principal of the affiliated Colleges, may be proposed and discussed with the Academic Coordinator of the University, by sending email to the following address: academics.makaut@gmail.com.

Note: 1) If necessary, networking may be established with NGOs to facilitate the different components and aspects of the Induction Programme.

Mandatory Additional Requirement for earning B. Tech Degree



Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal
BF-142, Sector-I, Saltlake

Notice

Mandatory Additional Requirement for earning B.Tech Degree

Addressing the needs of the industry and the society: Globally, engineering education systems have continuously evolved, in order to address the needs of the industry and the society. It is becoming imperative that every University should create opportunities for the students to inculcate attributes, which are not restricted only to engineering knowledge and acumen. Industry needs professionals who can work successfully in teams, who have leadership qualities, who are alive to social and community needs and who can bring innovation and creativity to their work and who are also digitally proficient. Hence, in order to prepare its students to match these multiple requirements, MAKAUT, WB has created a unique mechanism of awarding 100 Activity Points over and above the academic grades. It is planned that the students at MAKAUT, WB will be able to reap benefits from these activities at their own pace and comfort. It is expected that by the time MAKAUT, WB's students reach their Final Year, they would have developed themselves so well both through their studies in the respective technological field and through their active participation in the co-curricular and extra-curricular activities as also through SAWYAM based learning activities that they would be well-prepared for contributing to building the India and the world of their dreams.

The additional requirement applies to: Every student, who is admitted to the 4 years B.Tech program from the academic year 2018-19 onwards, is required to earn minimum 100 Activity Points in addition to the required academic grades, for getting MAKAUT, WB's B.Tech degree. Similarly, it is mandatory to earn 75 Activity Points, in addition to the academic grades, for getting B.Tech degree by a student (Lateral Entry) who is admitted to the B.Tech program from the academic year 2018-19 onwards. *(Please see Table 1 for details.)* [Lateral Entry students will have a multiplying factor of 1.33 to bring uniformity in score].

Level of Entry in B.Tech Course	Total duration for earning Points	Minimum Points
1 st Year from the academic year 2018-19 onwards	1 st to 4 th Year	100
2 nd Year from the academic year 2018-19 onwards (Lateral Entry)	2 nd to 4 th Year	75

Table – I

For existing Students (except students in the 4th year): Every student, who is admitted to the 4 years B.Tech program prior to the academic year 2018-19, is required to earn minimum number of Activity Points as per Table II in addition to the required academic grades, for getting MAKAUT, WB's B.Tech degree.

Current Semester	Total Points to be earned During the full course
2 nd	100
4 th	75
6 th	50

Table –II

These points must be earned on the basis of active participation in co-curricular and extracurricular activities spanning through all the semesters of study. Every student may choose, as per his/her liking, activities in order to achieve the mandatory points (as per Table-III, depending on his/her entry level), before becoming eligible for award of the Degree. These activities can be spread over the years, as per convenience of the student.

Notes:

- **Current 4th year students who are going to sit for Final Semester examination in May-June, 2018 are outside the preview of this Mandatory Additional Requirement**
- Every student shall participate in the co-curricular and extra-curricular activities and produce documentary proof to the designated Faculty Members appointed by the Head of Department / Principal / Director in the respective college. Thereby the student should earn the required Points before *her* she appears for his/ her Final Examinations.
- A student's result of his/her Final Examinations will be withheld until he/she completes the minimum Activity Points by the end of his/her B.Tech Program.
- In every semester, every student is required to prepare a file containing documentary proofs of activities, done by him / her. This file will be duly verified and Activity Points will be assigned by the teachers as appointed above, at the end of every semester.
- The college will form a 3 members committee and finalize the Activity Points for each student before entering them into the Online Point Entry System (at the URL, as specified by the COE of the University).
- Every student has to earn at least 100 activity points. The points students has earned will be reflected in the student's marksheet.
- Activity points earned by Lateral Entry students will be multiplied by 1.33.

Table III provides a List of Activity Heads and Sub-Activity Heads along with their capping of the Activity Points that can be earned by the students during the entire B.Tech duration.

Sl. No.	Name of the Activity	Points	Maximum Points Allowed
1.	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) (per course)	20	40
2.	Tech Fest/Teachers Day/Freshers Welcome		
	Organizer	5	10
	Participants	3	6
5.	Rural Reporting	5	10
6.	Tree Plantation (per tree)	1	10
7.	Participation in Relief Camps	20	40
8.	Participation in Debate/Group Discussion/ Tech quiz	10	20
9.	Publication of Wall magazine in institutional level (magazine/article/internet)	10	20
10.	Publication in News Paper, Magazine & Blogs	10	20
11.	Research Publication (per publication)	15	30
12.	Innovative Projects (other than course curriculum)	30	60
13.	Blood donation	8	16
	Blood donation camp Organization	10	20
15.	Participation in Sports/Games		
	College level	5	10
	University Level	10	20
	District Level	12	24
	State Level	15	30
	National/International Level	20	20
21.	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20
22.	Member of Professional Society	10	20
23.	Student Chapter	10	20
24.	Relevant Industry Visit & Report	10	20
25.	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	5	10
26.	Participation in Yoga Camp (Certificate to be submitted)	5	10
27.	Self-Entrepreneurship Programme	20	20
28.	Adventure Sports with Certification	10	20
29.	Training to under privileged/Physically challenged	15	30
30.	Community Service & Allied Activities	10	20

Suggestions from the College Principals will be considered to append in the above Table-III.

Sd/-

Registrar(Acting)
MAKAUT,WB

Maulana Abul Kalam Azad University of Technology, West Bengal
Record of Activities for Mandatory Additional Requirement

Annexure-I
Rev:00

College Name (College Code):						Department:						
Student Name:				University Roll No:			Registration No:					
Sl No	Activity	Points	Max. Points Allowed	Points Earned								
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	Total
1	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) per course											
	For 12 weeks duration	20	40									
	For 8 weeks duration	16										
2	Tech Fest/Teachers Day/Freshers Welcome											
	Organizer	5	10									
	Participants	3	6									
3	Rural Reporting	5	10									
4	Tree Plantation and up keeping (per tree)	1	10									
5	Participation in Relief Camps	20	40									
6	Participation in Debate/Group Discussion/ Tech quiz	10	20									
7	Publication of Wall magazine in institutional level (magazine/article/internet)											
	Editor	10	20									
	Writer	6	12									
8	Publication in News Paper, Magazine & Blogs	10	20									
9	Research Publication (per publication)	15	30									
10	Innovative Projects (other than course curriculum)	30	60									
11	Blood donation	8	16									
	Blood donation camp Organization	10	20									

Maulana Abul Kalam Azad University of Technology, West Bengal
Record of Activities for Mandatory Additional Requirement

Annexure-I
Rev:00

Sl No	Activity	Points	Max. Points Allowed	Points Earned								Total
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	
12	<i>Participation in Sports/Games</i>											
	College level	5	10									
	University Level	10	20									
	District Level	12	24									
	State Level	15	30									
	National/International Level	20	20									
13	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20									
14	Member of Professional Society	10	20									
15	Student Chapter	10	20									
16	Relevant Industry Visit & Report	10	20									
17	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	5	10									
18	Participation in Yoga Camp (Certificate to be submitted)	5	10									
19	Self-Entrepreneurship Programme	20	20									
20	Adventure Sports with Certification	10	20									
21	Training to under privileged / Differently abled	15	30									
22	Community Service & Allied Activities	10	20									
Total Points												
Signature of Mentor												
Signature of HOD												
*Please abide strictly to the Notes at the end of the Notice by Registrar, MAKAUT, WB regarding Mandatory Additional Requirement for earning B.Tech Degree												
* <i>Annexure-I</i> is to be retained in the Institute records with all documentary proofs of activities (<i>to be verified by the University as and when required</i>).												

1st Year Curriculum for B.Tech courses in Engineering & Technology

(Applicable from the academic session 2018-2019)



Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits

B. Range of credits :

A range of credits from 150 to 160 for a student to be eligible to get B.Tech Degree in Engineering. A student will be eligible to get B.Tech Degree *with Honours*, if he/she completes an additional 20 credits. These could be acquired through Massive Open Online Courses (MOOCs).

C. MOOCs for B. Tech Honours

The additional 20 credits (for obtaining B. Tech with Honours) are to be gained through MOOCs. The complete description of the MOOCs relevant for the first year course are given in *Annexure-I*. The courses for subsequent years of study will be posted subsequently.

D. Guidelines regarding Mandatory Induction Program for the new students

All concerned are requested to follow the guidelines given in *Annexure-II* (Notice dt.06/12/2017) concerning Mandatory Induction Program. The colleges/ Institute may also refer to the AICTE Model Curriculum for Undergraduate Degree Courses in Engineering & Technology (January 2018) -Volume I (Page No.31-38), if necessary.

E. Mandatory Additional Requirement for earning B. Tech Degree

All concerned are requested to follow the guidelines in *Annexure-III* concerning Mandatory Additional Requirements.

F. Group division:

Group-A:

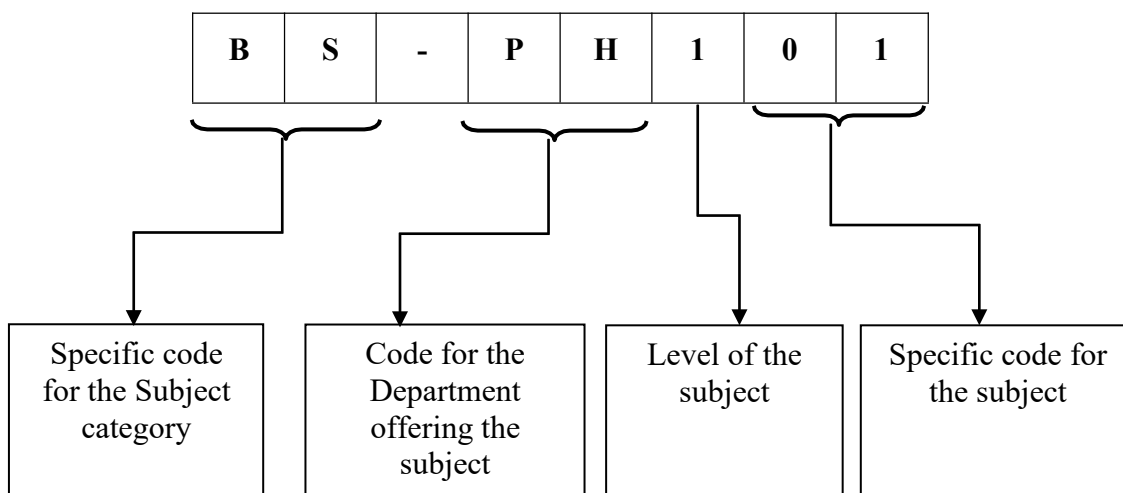
Chemistry based subjects: [Bio-Technology, Food Technology, Leather Technology, Textile Technology, Ceramic Technology, Chemical Engineering and any other Engineering that chooses to be Chemistry based] + Physics based subjects: [Mechanical Engineering, Production Engineering, Civil Engineering, Automobile Engineering, Marine Engineering, Apparel Production Engineering, Computer Science & Engineering, Information Technology.]

Group-B:

All Physics based subjects which are also Electrical & Electronics based [Electrical Engineering, Electronics & Communication Engineering, Applied Electronics & Instrumentation Engineering, Power Engineering, Electrical & Electronics Engineering, Bio-Medical Engineering, Instrumentation & Control Engineering]

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

G. Subject Numbering Scheme:



List of Codes for Subject Category	
Code	Category Name
BS	Basic Science Courses
ES	Engineering Science Courses
HM	Humanities and Social Sciences including Management courses
PC	Professional core courses
PE	Professional Elective courses
OE	Open Elective courses
MC	Mandatory courses
PW	Project

List of Codes for Departments			
Code	Name of the Department	Code	Name of the Department
APM	Apparel Production Engineering	ECE	Electronics & Communication Engineering
AEIE	Applied Electronics & Instrumentation Engineering	FT	Food Technology
AUE	Automobile Engineering	IT	Information Technology
BME	Bio-Medical Engineering	ICE	Instrumentation & Control Engineering
BT	Bio-Technology	LT	Leather Technology
CT	Ceramic Technology	MRE	Marine Engineering
CHE	Chemical Engineering	ME	Mechanical Engineering
CE	Civil Engineering	PWE	Power Engineering
CSE	Computer Science & Engineering	PE	Production Engineering
EEE	Electrical & Electronics Engineering	TT	Textile Technology
EE	Electrical Engineering		

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

First Year First Semester							
Mandatory Induction Program- 3 weeks duration							
Sl No.	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science course	BS-PH101/ BS-CH101	Physics-I (Gr-A)/ Chemistry-I(Gr-B)	3	1	0	4
2	Basic Science course	BS-M101/ BS-M102	Mathematics –IA*/ Mathematics –IB *	3	1	0	4
3	Engineering Science Courses	ES-EE101	Basic Electrical Engineering	3	1	0	4
	Total Theory			9	3	0	12
Practical							
1	Basic Science course	BS-PH191/ BS-CH191	Physics-I Laboratory (Gr-A)/ Chemistry-I Laboratory (Gr-B)	0	0	3	1.5
2	Engineering Science Courses	ES-EE191	Basic Electrical Engineering Laboratory	0	0	2	1
3	Engineering Science Courses	ES-ME191/ ES-ME192	Engineering Graphics & Design(Gr-B)/ Workshop/Manufacturing Practices(Gr-A)	1	0	4	3
	Total Practical			1		9	5.5
	Total of First Semester			10	3	9	17.5

* Mathematics –IA (BS-M101) - CSE & IT
 Mathematics –IB (BS-M102) - All stream except CSE & IT

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
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First Year Second Semester							
Sl No.	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science courses	BS-PH201/ BS-CH201	Physics-I (Gr-B)/ Chemistry-I (Gr-A)	3	1	0	4
2	Basic Science courses	BS-M201/ BS-M202	Mathematics –IIA [#] / Mathematics –IIB [#]	3	1	0	4
3	Engineering Science Courses	ES-CS201	Programming for Problem Solving	3	0	0	3
4	Humanities and Social Sciences including Management courses	HM-HU201	English	2	0	0	2
	Total Theory			11	2	0	13
Practical							
1	Basic Science courses	BS-PH291/ BS-CH291	Physics-I Laboratory (Gr-B)/ Chemistry-I Laboratory (Gr-A)	0	0	3	1.5
2	Engineering Science Courses	ES-CS291	Programming for Problem Solving	0	0	4	2
3	Engineering Science Courses	ES-ME291/ ES-ME292	Engineering Graphics & Design(Gr-A)/ Workshop/Manufacturing Practices(Gr-B)	1	0	4	3
4	Humanities and Social Sciences including Management courses	HM-HU291	Language Laboratory	0	0	2	1
	Total Practical			1	0	13	7.5
	Total of Second Semester			12	2	13	20.5

Mathematics –II (BS-M201) - CSE & IT
 Mathematics –II (BS-M202) - All stream except CSE & IT

	Group-A	Group-B
1 st Year 1 st Semester	Physics-I (BS-PH101); Workshop/Manufacturing Practices (ES-ME192)	Chemistry-I (BS-CH101); Engineering Graphics & Design (ES-ME191)
1 st Year 2 nd Semester	Chemistry-I (BS-CH201); Engineering Graphics & Design (ES-ME291)	Physics-I (BS-PH201); Workshop/Manufacturing Practices (ES-ME292)

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

Course Code : BS-PH101/ BS-PH201	Category : Basic Science Courses
Course Title : Physics-I	Semester : First/ Second
L-T-P : 3-1-0	Credit:4
Pre-Requisites:	

Course objectives :

Basic concepts of mechanics, optics and its applications, electricity, magnetism and qualitative understanding of concepts of quantum physics and statistical mechanics.

1. Mechanics (7L)

Problems including constraints & friction. Basic ideas of vector calculus and partial differential equations. Potential energy function $F = -\text{grad } V$, equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy & momentum. Non-inertial frames of reference. Harmonic oscillator; Damped harmonic motion forced oscillations and resonance. Motion of a rigid body in a plane and in 3D. Angular velocity vector. Moment of inertia.

2. Optics (5L)

- Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits (only the expressions for max;min, & intensity and qualitative discussion of fringes); diffraction grating(resolution formulac only), characteristics of diffraction grating and its applications.
- Polarisation : Introduction, polarisation by reflection, polarisation by double reflection, scattering of light, circular and elliptical polarisation, optical activity.
- Lasers : Principles and working of laser : population inversion, pumping, various modes, threshold population inversion with examples .

3. Electromagnetism and Dielectric Magnetic Properties of Materials (8L)

- Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielecrrics, internal fields in a solid, Clausius- Mossotti equation(expression only), applications of dielectrics.
- Magnetisation , permeability and susceptibility, classificationof magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.

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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
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4. Quantum Mechanics (16L)

- Introduction to quantum physics, black body radiation, explanation using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.

5. Statistical Mechanics (8L)

- Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics.

Course outcomes:

Students will be familiar with

- Basic concepts of mechanics
- Bragg's Law and introduction to the principles of lasers, types of lasers and applications.
- Various terms related to properties of materials such as, permeability, polarization, etc.
- Some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials.
- Simple quantum mechanics calculations.
-

Learning Resources:

1. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited
2. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker, Wiley
3. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press
4. Engineering Mechanics (In SI Units) (SIE), S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati, McGraw Hill Education
5. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education
6. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education
7. Engineering Mechanics, M.K. Harbola, Cengage India
8. An Introduction to Mechanics (SIE), David Kleppner, Robert Kolenkow, McGraw Hill Education
9. Principles of mechanics, John L. Synge and Byron A. Griffith, New York, McGraw-Hill
10. Mechanics (Dover Books on Physics), J. P. Den Hartog, Dover Publications Inc.
11. Engineering Mechanics: Dynamics, L.G. Kraige J.L. Meriam, Wiley
12. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, Robert Eisberg, Robert Resnick, Wiley
13. Introduction to Quantum Mechanics, J. Griffiths David, Pearson Education
14. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press
15. Optics, Hecht, Pearson Education
16. Optics, Ghatak, McGraw Hill Education India Private Limited
17. Fundamentals of Statistical and Thermal Physics, Reif, Sarat Book Distributors
18. Statistical Mechanics, Pathria, Elsevier
19. Statistical Physics, L.D. Landau, E.M. Lifshitz, Butterworth-Heinemann

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

Course Code : BS-CH101/ BS-CH201	Category : Basic Science Courses
Course Title : Chemistry-I	Semester : First/ Second
L-T-P : 3-1-0	Credit:4
Pre-Requisites:	

Detailed contents

i) Atomic and molecular structure (10 lectures)

Schrodinger equation. Particle in a box solutions and their applications for simple sample. Molecular orbitals of diatomic molecules (e.g.H₂). Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

ii) Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

iii) Inter-molecular forces and potential energy surfaces (4 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena.

iv) Use of free energy in chemical equilibria (8 lectures)

First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

v) Periodic properties (4 Lectures)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

vi) Stereochemistry (4 lectures)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
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vii) Organic reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

Learning Resources:

1. Engineering Chemistry, Satyaprakash, Khanna Book Publishing, Delhi
2. University chemistry, by B. H. Mahan
3. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
4. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
5. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
6. Physical Chemistry, by P. W. Atkins
7. Spectroscopy of Organic Compounds, by P.S.Kalsi, New Age International Pvt Ltd Publishers
8. Physical Chemistry, P. C. Rakshit, Sarat Book House
9. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition
<http://bcs.whfreeman.com/vollhardtschore5e/default.asp>

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Course Code : BS-M101	Category : Basic Science Course
Course Title : Mathematics – I A	Semester : First (CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic	Lectures Hours
1	<i>Calculus (Integration):</i> Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	<i>Calculus (Differentiation):</i> Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	<i>Matrices:</i> Matrices, Vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.	7
4	<i>Vector Spaces:</i> Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem, composition of linear maps, Matrix associated with a linear map.	9
5	<i>Vector Spaces (Continued):</i> Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.	10

Course Outcomes:

The students will be able to:

Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

Understand the domain of applications of mean value theorems to engineering problems.

Learn different types of matrices, concept of rank, methods of matrix inversion and their applications.

Understand linear spaces, its basis and dimension with corresponding applications in the field of computer science.

Learn and apply the concept of eigen values, eigen vectors, diagonalisation of matrices and orthogonalization in inner product spaces for understanding physical and engineering problems

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Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. S.K. Mapa, Higher Algebra: Abstract and Linear, Sarat Book House Pvt.Ltd.
8. Hoffman and Kunze: Linear algebra, PHI.

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Course Code : BS-M102	Category : Basic Science Course
Course Title : Mathematics –I B	Semester : First (All stream except CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic	Lectures Hours
1	<i>Calculus (Integration):</i> Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	<i>Calculus (Differentiation):</i> Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	<i>Sequence and Series:</i> Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.	11
4	<i>Multivariate Calculus:</i> Limit, continuity and partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, Curl and Divergence.	9
5	<i>Matrices:</i> Inverse and rank of a matrix, Rank-nullity theorem; System of linear equations; Symmetric, Skew-symmetric and Orthogonal matrices; Determinants; Eigenvalues and Eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.	8

Course Outcomes:

After completing the course the student will be able to

Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

Understand the domain of applications of mean value theorems to engineering problems.

Learn the tools of power series and Fourier series to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.

Apply the knowledge for addressing the real life problems which comprises of several variables or attributes and identify extremum points of different surfaces of higher dimensions.

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Understand different types of matrices, their eigen values, eigen vectors, rank and also their orthogonal transformations which are essential for understanding physical and engineering problems.

Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.

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Course Code : ES-EE101	Category : Engineering Science Courses
Course Title : Basic Electrical Engineering	Semester : First
L-T-P : 3-1-0	Credit: 4
Pre-Requisites:	

Detailed contents:

Module 1: DC Circuits (8 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers (6 hours)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 hours)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters (6 hours)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

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Course Outcomes

To understand and analyze basic electric and magnetic circuits

To study the working principles of electrical machines and power converters.

To introduce the components of low voltage electrical installations

Learning Recourses:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Book Publishing Co. (P) Ltd., Delhi.
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
4. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
5. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
6. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

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Course Code : BS-PH191/ BS-PH291	Category : Basic Science course
Course Title : Physics-I Laboratory	Semester : First/ Second
L-T-P : 0-0-3	Credit:1.5
Pre-Requisites:	

Choose 10 experiments including at least one from Optics, Electricity and Magnetism and Quantum Mechanics and at least a total of six from these three groups.

Experiments in Optics

1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of a monochromatic light by Newton's ring
3. Determination of wavelength of a monochromatic light by Fresnel's bi-prism
4. Determination of wavelength of the given laser source by diffraction method

Electricity & Magnetism experiments

1. Determination of thermo electric power of a given thermocouple.
2. Determination of specific charge (e/m) of electron by J.J. Thompson's method.
3. Determination of dielectric constant of a given dielectric material.
4. Determination of Hall coefficient of a semiconductor by four probe method.
5. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.
6. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
7. Determination of unknown resistance using Carey Foster's bridge
8. Study of Transient Response in LR, RC and LCR circuits using expeyes
9. Generating sound from electrical energy using expeyes

Experiments in Quantum Physics

1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Lande-g factor using Electron spin resonance spectrometer.
4. Determination of Rydberg constant by studying Hydrogen spectrum.
5. Determination of Band gap of semiconductor.
6. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

Miscellaneous experiments

1. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure
2. Determination of bending moment and shear force of a rectangular beam of uniform cross-section
3. Determination of modulus of rigidity of the material of a rod by static method
4. Determination of rigidity modulus of the material of a wire by dynamic method
5. To determine the moment of inertia of a body about an axis passing through its centre of gravity and to determine the modulus of rigidity of the material of the suspended wire
6. Determination of coefficient of viscosity by Poiseuille's capillary flow method

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Course Code : BS-CH191/ BS-CH291	Category : Basic Science Courses
Course Title : Chemistry-I Laboratory	Semester : First/ Second
L-T-P : 0-0-3	Credit:1.5
Pre-Requisites:	

Choose 10 experiments from the following:

1. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
2. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
3. Determination of dissolved oxygen present in a given water sample.
4. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution)
5. Determination of surface tension and viscosity
6. Thin layer chromatography
7. Ion exchange column for removal of hardness of water
8. Determination of the rate constant of a reaction
9. Determination of cell constant and conductance of solutions
10. Potentiometry - determination of redox potentials and emfs
11. Saponification/acid value of an oil
12. Chemical analysis of a salt
13. Determination of the partition coefficient of a substance between two immiscible liquids
14. Adsorption of acetic acid by charcoal
15. Use of the capillary viscosimeters to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

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Course Code : ES-EE191	Category : Engineering Science Courses
Course Title : Basic Electrical Engineering Laboratory	Semester : First
L-T-P : 0-0-2	Credit: 1
Pre-Requisites:	

Choose 10 experiments from the following:

1. First activity: Introduction to basic safety precautions and mentioning of the do's and Don'ts. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about the modalities of evaluation.
2. Introduction and uses of following instruments :
 - (a) Voltmeter
 - (b) Ammeter
 - (c) Multimeter
 - (d) Oscilloscope

Demonstration of real life resistors, capacitors with color code , inductors and autotransformer.

3. Demonstration of cut-out sections of machines: DC machine, Induction machine, Synchronous machine and single phase induction machine.
4. Calibration of ammeter and Wattmeter.
5. Determination of steady state and transient response of R-L, R-C and R-L-C circuit to a step change in voltage.
6. Determination of steady state response of R-L and R-C and R-L-C circuit and calculation of impedance and power factor.
7. Determination of resonance frequency and quality factor of series and parallel R-L-C circuit.
8. (a) Open circuit and short circuit test of a single-phase transformer
(b) Load test of the transformer and determination of efficiency and regulation
9. Demonstration of three phase transformer connections. Voltage and current relationship, phase shifts between the primary and secondary side.
10. Measurement of power in a three phase unbalanced circuit by two wattmeter method.
11. Determination of Torque –Speed characteristics of separately excited DC motor.
12. Determination of Torque speed characteristics and observation of direction reversal by change of phase sequence of connection of Induction motor.
13. Determination of operating characteristics of Synchronous generator.
14. Demonstration of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter for speed control of an Induction motor
15. Demonstration of components of LT switchgear.

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Course Code : ES-ME191/ ES-ME 291	Category : Engineering Science Courses
Course Title : Engineering Graphics & Design	Semester : First/ Second
L-T-P : 1-0-4	Credit: 3
Pre-Requisites:	

Sl. No.	Content	Lecture (L)	Practical (P)
1	INTRODUCTION TO ENGINEERING DRAWING Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes.	1	4
2	LETTERING, DIMENSIONING, SCALES Plain scale, Diagonal scale and Vernier Scales.	1	4
3	GEOMETRICAL CONSTRUCTION AND CURVES Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Archimedian Spiral.	1	4
4	PROJECTION OF POINTS, LINES, SURFACES Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle, pentagon, Hexagon etc.) inclined Planes - Auxiliary Planes.	1	4
5	PROJECTION OF REGULAR SOLIDS Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).	1	4
6	COMBINATION OF REGULAR SOLIDS, FLOOR PLANS Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.	1	4
7	ISOMETRIC PROJECTIONS Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;	1	4

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8	SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)	1	4
9	OVERVIEW OF COMPUTER GRAPHICS, CUSTOMISATION & CAD DRAWING listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;	1	4
	ANNOTATIONS, LAYERING & OTHER FUNCTIONS applying dimensions to objects, applying annotations to drawings;		
10	Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;	2	8

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11	DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).	2	8
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Course Outcomes

The student will learn:

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling

General Instructions

1. In every topic some problems are to be done in the class and some are to be given to students as home assignment.
2. The problems for class work are to be prepared on drawing sheet of A1 size in the class/ using AutoCAD software.
3. The problems for home assignments are to be prepared on drawing copy/ using AutoCAD software.
4. Print out of every assignment is to be taken for CAD Drawings on Drawing sheets (A4 Sheets).
5. A title block must be prepared in each sheet/ assignment.

Following is the list of drawing instruments that required for making engineering drawings on paper with perfection.

1. Drawing Board
2. Mini drafter/ Set-squares (45°–45° & 60°–90°), T-square
3. Protractor (180°, 360°)
4. Scales (Plain, Diagonal)
5. Compass (Small and Large)
6. Divider (Small and Large)

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7. French Curves
8. Drawing paper (A1 Size)
9. Drawing pencil (H, HB, B)
10. Sharpener
11. Eraser
12. Drawing pins & clips
13. Duster or handkerchief etc.

Learning Resources:

1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House
2. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
5. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
6. Corresponding set of CAD Software Theory and User Manuals

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Course Code : ES-ME192/ ES-ME 292	Category : Engineering Science Courses
Course Title : Workshop/ Manufacturing Practices	Semester : First/ Second
L-T-P : 1-0-4	Credit:3
Pre-Requisites:	

(i) Lectures & videos:

Detailed contents:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Electrical & Electronics
5. Carpentry
6. Plastic moulding, glass cutting
7. Metal casting
8. Welding (arc welding & gas welding), brazing

(ii) Workshop Practice:

Machine shop (8 hours)

Typical jobs that may be made in this practice module:

To make a pin from a mild steel rod in a lathe.

To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Fitting shop (8 hours)

Typical jobs that may be made in this practice module:

To make a Gauge from MS plate.

Carpentry (8 hours)

Typical jobs that may be made in this practice module:

To make wooden joints and/or a pattern or like.

Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs))

Typical jobs that may be made in this practice module:

ARC WELDING (4 hours): To join two thick (approx 6mm) MS plates by manual metal arc welding.

GAS WELDING (4 hours): To join two thin mild steel plates or sheets by gas welding.

Casting (8 hours)

Typical jobs that may be made in this practice module:

One/ two green sand moulds to prepare, and a casting be demonstrated.

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Smithy (4 hours) ~ 4 hours

Typical jobs that may be made in this practice module:

A simple job of making a square rod from a round bar or like.

Plastic moulding & Glass cutting (4 hours)

Typical jobs that may be made in this practice module:

For plastic moulding, making at least one simple plastic component should be made.

For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made.

Electrical & Electronics (8 hours)

Familiarization with LT switchgear elements, making its sketches and noting down its specification. Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable.

Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point.

Simple wiring exercise to be executed to understand the basic electrical circuit.

Simple soldering exercises to be executed to understand the basic process of soldering.

Fabrication of a single-phase full wave rectifier with a step down transformer using four diodes and electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes

Upon completion of this laboratory course, students will be able to fabricate components with their own hands.

They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

By assembling different components, they will be able to produce small devices of their interest.

Learning Resources:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. and Steven S. Schmid, “Manufacturing Engineering and Technology”, 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu, “Manufacturing Technology – I” Pearson Education, 2008.
4. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4th edition, Prentice Hall India, 1998.
5. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGrawHill House, 2017.

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Course Code : BS-M201	Category : Basic Science Course
Course Title : Mathematics – II A	Semester : Second (CSE &IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics and BS-M101	

Module No.	Description of Topic	Lectures Hours
1	Basic Probability: Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the Multinomial distribution, Poisson approximation to the Binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.	11
2	Continuous Probability Distributions: Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities.	4
3	Bivariate Distributions: Bivariate distributions and their properties, distribution of sums and quotients, Conditional densities, Bayes' rule.	5
4	Basic Statistics: Measures of Central tendency, Moments, Skewness and Kurtosis, Probability distributions: Binomial, Poisson and Normal and evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.	8
5	Applied Statistics: Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	8
6	Small samples: Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	4

Course Outcomes:

The students will be able to:

Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.

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Understand the basic ideas of statistics with different characterisation of a univariate and bivariate data set.

Apply statistical tools for analysing data samples and drawing inference on a given data set.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
3. S. Ross, A First Course in Probability, Pearson Education India
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.
5. John E. Freund, Ronald E. Walpole, Mathematical Statistics, Prentice Hall.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
7. N.G. Das, Statistical Methods (Combined Volume), Tata-McGraw Hill.

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Course Code : BS-M202	Category : Basic Science Course
Course Title : Mathematics – II B	Semester : Second (All stream except CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics and BS-M102	

Module No.	Description of Topic	Lectures Hours
1	<i>Multivariate Calculus (Integration):</i> Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, change of variables (Cartesian to Polar), Applications: Areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.	11
2	<i>First order ordinary differential equations:</i> Exact, linear and Bernoulli's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.	5
3	<i>Ordinary differential equations of higher orders:</i> Second order linear differential equations with constant coefficients, Use of D-operators, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.	9
4	<i>Complex Variable – Differentiation</i> Differentiation of complex functions, Cauchy-Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithmic) and their properties; Conformal mappings, Mobius transformations and their properties.	6
5	<i>Complex Variable – Integration</i> Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, Zeros of analytic functions, Singularities, Laurent's series; Residues, Cauchy residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.	9

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

Course Outcomes:

The students will be able to:

Learn the methods for evaluating multiple integrals and their applications to different physical problems.

Understand different techniques to solve first and second order ordinary differential equations with its formulation to address the modelling of systems and problems of engineering sciences.

Learn different tools of differentiation and integration of functions of a complex variable that are used with various other techniques for solving engineering problems.

Apply different types of transformations between two 2- dimensional planes for analysis of physical or engineering problems.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. E. L. Ince, Ordinary Differential Equations, Dover Publications.
8. J. W. Brown and R. V. Churchill, Complex Variables and Applications, Mc-Graw Hill.

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Course Code : ES-CS201	Category : Engineering Science Courses
Course Title : Programming for Problem Solving	Semester : Second
L-T-P : 3-0-0	Credit:3
Pre-Requisites:	

Detailed contents

Unit 1: Introduction to Programming (4 lectures)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - **(1 lecture)**.

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. **(1 lecture)**

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- **(2 lectures)**

Unit 2: Arithmetic expressions and precedence (2 lectures)

Unit 3: Conditional Branching and Loops (6 lectures)

Writing and evaluation of conditionals and consequent branching **(3 lectures)**

Iteration and loops **(3 lectures)**

Unit 4: Arrays (6 lectures)

Arrays (1-D, 2-D), Character arrays and Strings

Unit 5: Basic Algorithms (6 lectures)

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 6: Function (5 lectures)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Unit 7: Recursion (4 -5 lectures)

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 8: Structure (4 lectures)

Structures, Defining structures and Array of Structures

Unit 9: Pointers (2 lectures)

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Unit 10: File handling (only if time is available, otherwise should be done as part of the lab)

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

Course Outcomes

The student will learn

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical errors.
- To implement conditional branching, iteration and recursion.
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- To apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.

Learning Resources:

1. R. S. Salaria, Computer Concepts and Programming in C, Khanna Publishers
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Course Code : ES-CS291	Category : Engineering Science Courses
Course Title : Programming for Problem Solving	Semester : Second
L-T-P : 0-0-4	Credit:2
Pre-Requisites:	

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

Tutorial 12: File handling:

Lab 12: File operations

Laboratory Outcomes

To formulate the algorithms for simple problems

To translate given algorithms to a working and correct program

To be able to correct syntax errors as reported by the compilers

To be able to identify and correct logical errors encountered at run time

To be able to write iterative as well as recursive programs

To be able to represent data in arrays, strings and structures and manipulate them through a program

To be able to declare pointers of different types and use them in defining self-referential structures.

To be able to create, read and write to and from simple text files.

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Course Code : HM-HU201	Category : Humanities and Social Sciences including Management courses
Course Title : English	Semester : Second
L-T-P : 2-0-0	Credit:2
Pre-Requisites:	

Detailed contents

1. Vocabulary Building

- 1.1 The concept of Word Formation: Compounding, Backformation, Clipping, Blending.
- 1.2 Root words from foreign languages and their use in English
- 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
- 1.4 Synonyms, antonyms, and standard abbreviations: Acronyms

2. Basic Writing Skills

- 2.1 Sentence Structures & Types: Simple, Compound, Complex
- 2.2 Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration
- 2.3 Importance of proper punctuation
- 2.4 Creating coherence: Arranging paragraphs & Sentences in logical order
- 2.5 Creating Cohesion: Organizing principles of paragraphs in documents
- 2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

- 3.1 Subject-verb agreement
- 3.2 Noun-pronoun agreement
- 3.3 Misplaced modifiers
- 3.4 Articles
- 3.5 Prepositions
- 3.6 Redundancies
- 3.7 Clichés

4. Nature and Style of sensible Writing

- 4.1 Describing
- 4.2 Defining
- 4.3 Classifying
- 4.4 Providing examples or evidence
- 4.5 Writing introduction and conclusion

5. Writing Practices

- 5.1 Comprehension
- 5.2 Précis Writing
- 5.3 Essay Writing
- 5.4 Business Letter, Cover Letter & CV; E-mail

Addendum

Some examples of English words with foreign roots

Greek Root/Affix	Examples
Anti	Antisocial, antiseptic

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Auto	Automatic, autograph
Anthropos	Anthropology, philanthropy
Bio	Biography
Chronos	Time
Di	Dilemma
Bio	Biology
Biblio	Bibliography
Chron	Chronology
Cracy	Contradiction
Geo	Geology
Hyper	Hyperactive
Mania	Kleptomania
Mega	Megaserial
Eu	Eulogy, euphoria
Geo	Geology
Graph	autograph, photograph
Hetero	Heterogeneous
Hyper	Hyperactive
Hypo	hypodermic, hypoglycemia
Macro	Macrocosm
Mega	megalomania
Micro	microcosm

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Mono	Monarch
Pan	Panorama
Pathos	Pathetic
Phobia	Hydrophobia
Pod (Gk), ped (Latin)	Pseudopodia
Poly	polyglot
Tele	Telephone
Theo	Theology, theist
Latin Root	Examples
Aud	Audible
Bene	Beneficial
Brev	abbreviate, brief
circum	Circulate
Contra	Contradict
Cred	Credible
Dict	Diction
Femina	Feminine
Inter	Internet, interval
Magna	Magnificent
Mal	Malnutrition
Multi	multinational
Nova	Novel
Multi	Multiple, multiplex
Non	Nonstop

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Pre	Previous, predicate
Re	Redo, rewind
Scrib	Scripture
Spect	Spectator
Trans	Transport
Uni	Unity
Omni	Omnipotent
Semi	Semicircle
Sub	Subway
somnus	Insomnia,
Super	Superman
Sym	Sympathy
scribe	Describe, scribble(write illegibly), inscribe
Trans	Transform
Un	Unnecessary
Uni	Universal

Learning Resources:

- (i) Kulbushan Kumar, R S Salaria, Effective Communication Skills, Khanna Publishing House, Delhi.
- (ii) Practical English Usage. Michael Swan. OUP. 1995.
- (iii) Remedial English Grammar. F.T. Wood. Macmillan. 2007
- (iv) On Writing Well. William Zinsser. Harper Resource Book. 2001
- (v) Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- (vi) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
- (vii) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
- (viii) Universal English Prof. Prasad Kataria Publications, 2019.
- (ix) "Communication Skills for Professionals"-Nira Konar, Prentice Hall of India 2nd edition, New Delhi, 2011
- (x) Gajendra Singh Chauhan, Smita Kashiramka and L. Thimmesha. Functional English. Cengage , 2019.

Course Outcomes

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Course Code : HM-HU291	Category : Humanities and Social Sciences including Management courses
Course Title : Language Laboratory	Semester : Second
L-T-P : 0-0-2	Credit:1
Pre-Requisites:	

- | | |
|---|----|
| 1) Honing ‘Listening Skill’ and its sub skills through Language Lab Audio device; | 3P |
| 2) Honing ‘Speaking Skill’ and its sub skills | 2P |
| 3) Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/
Voice modulation/ Stress/ Intonation/ Pitch & Accent) of connected speech | 2P |
| 4) Honing ‘Conversation Skill’ using Language Lab Audio –Visual input;
Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone &
Role Play Mode) | 2P |
| 5) Introducing ‘Group Discussion’ through audio –Visual input and acquainting them
with key strategies for success | 2P |
| 6) G D Practice Sessions for helping them internalize basic Principles
(turn- taking, creative intervention, by using correct body language, courtesies &
other soft skills) of GD | 4P |
| 7) Honing ‘Reading Skills’ and its sub skills using Visual / Graphics/
Diagrams /Chart Display/Technical/Non Technical Passages
Learning Global / Contextual / Inferential Comprehension; | 2P |
| 8) Honing ‘Writing Skill’ and its sub skills by using
Language Lab Audio –Visual input; Practice Sessions | 2P |

Course Outcomes

- The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

MOOCs for B. Tech Honours



Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal

Notice

1st May, 2018

MOOCs for B.Tech Honours (Applicable from the session 2018-2019)

Preamble

All India Council for Technical Education (AICTE) has introduced Model Curriculum for Bachelor of Technology programme with 160 credits in the entire programme of 4 years, and additional 20 credits will be required to be done for the degree of Bachelor of Technology with Honours. These additional 20 credits will have to be acquired with online courses (MOOCs) as per AICTE. So students will have to complete additional 20 credits through MOOCs within 4 years of time. This creates an excellent opportunity for students to acquire the necessary skill set for employability through massive online courses where the rare expertise of world famous experts from academics and industry are available. Maulana Abul Kalam Azad University of Technology, West Bengal (MAKAUT,WB) has thus decided to introduce AICTE model curriculum for its B.Tech Programmes and suggest baskets for MOOCs available year wise for the four-year long B.Tech programme from the sessions 2018-2019. The basket for MOOCs will be a dynamic one, as courses keep on updating with time. Few essential skill sets required for employability are also identified year wise by MAKAUT,WB. For MOOCs platforms where examination or assessment is absent (like SWAYAM) or where certification is costly (like Coursera or edX), faculty members of the Institutes are to audit the courses and prepare the examination question papers, for the courses undertaken by the students of respective Institutes, so that MAKAUT,WB can conduct examination for the course. The total of 20 credits that is required to be attained for B.Tech Honours degree are distributed over four years in the following way:

For first year	:	8 credits
For second year	:	4 credits
For third year	:	4 credits
For fourth year	:	4 credits

A student of first year has to cover courses from at least three skills :

1. Computer Programing with Python / R
2. Soft skill
3. Ethics

Courses are * marked in the above areas

If a student is unable to cover the credits assigned for the first year, he/she can do these courses in either of the subsequent years, but he/she has to choose the courses from the basket of MOOCs announced by MAKAUT,WB from time to time. The same rule will be applicable for the other years of the programme.

The basket for MOOCs for the 1st year B. Tech for the session 2018-2019 are made available herewith.

By order.

MOOCs for First Year, Engineering and Technology

Sl. No	Course	Provider	Duration	Credits	Name of University / Institution
1.	Presentation Skills: Designing Presentation Slides	Coursera *	4 weeks	1	Tomsk State University
2.	Effective Problem-Solving and Decision-Making	Coursera	4 weeks	1	University of California
3.	Communication in the 21st Century Workplace	Coursera *	4 weeks	1	University of California
4.	Psychology at Work	Coursera *	6 weeks	2	University of Western Australia
5.	Critical Thinking & Problem Solving	EdX *	3 weeks	3	Rochester Institute of Technology
6.	Successful Career Development	Coursera	7 weeks	2	University System of Georgia
7.	Working in Teams: A Practical Guide	edX	4 weeks	1	University of Queensland
8.	Communication theory: bridging academia and practice	Coursera	9 weeks	3	Higher School of Economics
9.	Speaking Effectively	NPTEL *	8 weeks	3	Indian Institute of Technology, Kharagpur
10.	Introduction to Philosophy	Coursera	5 weeks	1	University of Edinburgh
11.	Moralities of Everyday Life	Coursera	6 weeks	2	Yale University
12.	Introduction to Logic	Coursera *	10 weeks	3	Stanford University
13	Write Professional Emails in English	Coursera *	5 weeks	2	Georgia Institute of Technology
14	Technical Writing	Coursera	5 weeks	1	Moscow Institute of Physics and Technology
15	Learn to Program: The Fundamentals	Coursera	7 weeks	2	University of Toronto
16	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
17	Introduction to Problem Solving and Programming	NPTEL	12 weeks	4	NPTEL
18	The Science of Well Being	Coursera	6 weeks	2	Yale University
19	Developing Soft Skills and Personality	NPTEL	8 weeks	3	
20	Programming Basics	edX	9 weeks	3	IIT Bombay
21	Introduction to Python: Absolute Beginner	EdX *	5 weeks	2	Microsoft
22	Inferential Statistics	Coursera *	7 weeks	2	University of Amsterdam
23	Linear Regression and Modelling	Coursera	4 weeks	1	Duke University
24	Foundation of Data Structures	edX	6 weeks	2	IIT Bombay
25	Introduction to Logic	NPTEL	12 weeks	4	NPTEL
26	Introduction to Probability and Data	Coursera *	5 weeks	1	Duke University
27	Ethics	NPTEL *	12 weeks	4	
28	Science, Technology and Society	NPTEL	12 weeks	4	
29	Creating Innovation	Coursera	6 weeks	2	Macquarie University
30	Ethical Leadership Through Giving Voice to Values	Coursera *	4 weeks	2	University of Virginia
31	Creativity, Innovation, and Change	Coursera *	6 weeks	2	Pennsylvania State University
32	Interpersonal Communication for Engineering Leaders	Coursera	4 weeks	1	Rice University

33	Learn to Program: The Fundamentals	Coursera *	7 weeks	3	University of Toronto
34	Introduction to Mathematical Thinking	Coursera *	9 weeks	3	Stanford University
35	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
36	A Life of Happiness and Fulfillment	Coursera	6 weeks	2	Indian School of Business
37	Model Thinking	Coursera	12 weeks	4	University of Michigan
38	Introduction to Philosophy: God, Knowledge, and Consciousness	edX	12 weeks	4	MIT
39	Soft skills	NPTEL *	12 Weeks	4	IIT Roorkee
40	Developing Soft Skills and Personality	NPTEL *	8 weeks	3	IIT Kanpur
41	Indian Fiction in English	NPTEL	12 Weeks	4	IIT Madras
42	Development of Sociology in India	NPTEL	4 Weeks	1	IIT Kanpur
43	Intellectual Property	NPTEL	12 Weeks	4	IIT Madras
44	Essential Statistics for Data Analysis using Excel	EdX *	Self Paced	3	Microsoft
45	Ethics and Law in Data and Analytics	edX	Self Paced	4	Microsoft
46	Climate Change Mitigation in Developing Countries	Coursera *	6 weeks	3	University of Cape town
47	Web Design for Everybody (Basics of Web Development and Coding) Specialization	Coursera	15weeks	4	University of Michigan
48	Ecology: Ecosystem Dynamics and Conservation	Coursera	5 weeks	1	American Museum of Natural History, Howard Hughes Medical Institute
49	Environmental Studies: A Global Perspective	EdX *	Self Paced	4	Curtin University
50	Introduction to Computer Science and Programming Using Python	edX *	Self Paced	4	MIT, USA
51	Statistics and R	edX *	Self Paced	4	Harvard University
52	Introduction to Programming in C	Coursera *	4 weeks	4	Duke University
53	Java Programming: Solving Problems with Software	Coursera	4 weeks	4	Duke University
54	Grammar and Punctuation	Coursera	4 weeks	1	University of California
55	How to Write an Essay	Coursera *	5 weeks	1	University of California, Berkeley
56	Conversational English Skills	EdX *	10 weeks	3	Tsinghua University
57	Advanced Writing	Coursera *	4 weeks	1	University of California, Irvine
58	Speak English Professionally: In Person, Online & On the Phone	Coursera *	5 weeks	1	Georgia Institute of Technology
59	English for Science, Technology, Engineering, and Mathematics	Coursera	5 weeks	1	University of Pennsylvania
60	English Composition	edX	8 weeks	3	Arizona State University
61	Take Your English Communication Skills to the Next Level	Coursera *	4 weeks	1	Georgia Institute of Technology

**Guidelines regarding
Mandatory Induction Program for
the new students**



Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Date: 06.12.2017

Maulana Abul Kalam Azad University of Technology, West Bengal

Guidelines regarding Induction Programme for the new students

(As per Model Curriculum for 1st Year UG degrees courses in Engineering & Technology, November 2017)

To be followed from the 2018-19 academic session

Preamble: Engineering education has evolved globally in a continuous manner to address the twin needs of industry and society. It is now an accepted fact that the institutions imparting technical education should aspire to create manpower who will possess strong technical knowledge and skill, have leadership qualities and be a team player, capable of coming up with innovative solutions and be alive to societal and community concerns.

The aim of the Induction Programme is to acclimatize the students to the environment of their engineering institution, give them a flavour of the exciting new world of education that they are entering, provide them with mentoring schemes, and make them aware of their neighbourhood, society and people. This will allow them to evolve as well rounded individuals.

The following schedule is laid down by the University to implement the three week long Induction Programme:

Week 1	1 st Half	Day 1	Overall introduction of the new students to the Institution, its different Departments & Faculty Members
	2 nd Half	Day 1	(a) Assignment of faculty mentors to the new students (b) Assessment and allotment for mentoring by senior students preferably from the second year
	2 hrs	Day 2, 3, 4, 5	Lectures by eminent personalities on different areas such as (a) Introduction to Engineering (b) Various topics of science and technology (c) Innovation and entrepreneurship (d) Creative and performing arts (e) Social issues
	2 hrs.	Day 2, 3, 4, 5	Participation in Games, Yoga, Meditation etc.
	2 hrs	Day 2, 3, 4, 5	Visit to the different Departments of the Institute
Week 2 (All Days)	2hrs		Scheduled class lectures as per time table.
	2hrs		Students to be conducted through proficiency modules to be prepared by respective Colleges for ascertaining English skills & Computer knowledge of the students

			and to prepare a report on the same
	2hrs		Participation in Games, Sports, Yoga, Creative arts etc.
Week 3	2hrs		Scheduled class lectures as per time table
		Day 1	Visits to neighbourhood locations
		Day 2	Visits to natural spots in adjoining areas to understand the effect of nature on society
		Day 3	Visits to Science Museum / laboratories
		Day 4	Visits to NGOs
		Day 5	

Any other activity, as deemed fit by the Director/Principal of the affiliated Colleges, may be proposed and discussed with the Academic Coordinator of the University, by sending email to the following address: academics.makaut@gmail.com.

Note: 1) If necessary, networking may be established with NGOs to facilitate the different components and aspects of the Induction Programme.

Mandatory Additional Requirement for earning B. Tech Degree



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Notice

Mandatory Additional Requirement for earning B.Tech Degree

Addressing the needs of the industry and the society: Globally, engineering education systems have continuously evolved, in order to address the needs of the industry and the society. It is becoming imperative that every University should create opportunities for the students to inculcate attributes, which are not restricted only to engineering knowledge and acumen. Industry needs professionals who can work successfully in teams, who have leadership qualities, who are alive to social and community needs and who can bring innovation and creativity to their work and who are also digitally proficient. Hence, in order to prepare its students to match these multiple requirements, MAKAUT, WB has created a unique mechanism of awarding 100 Activity Points over and above the academic grades. It is planned that the students at MAKAUT, WB will be able to reap benefits from these activities at their own pace and comfort. It is expected that by the time MAKAUT, WB's students reach their Final Year, they would have developed themselves so well both through their studies in the respective technological field and through their active participation in the co-curricular and extra-curricular activities as also through SAWYAM based learning activities that they would be well-prepared for contributing to building the India and the world of their dreams.

The additional requirement applies to: Every student, who is admitted to the 4 years B.Tech program from the academic year 2018-19 onwards, is required to earn minimum 100 Activity Points in addition to the required academic grades, for getting MAKAUT, WB's B.Tech degree. Similarly, it is mandatory to earn 75 Activity Points, in addition to the academic grades, for getting B.Tech degree by a student (Lateral Entry) who is admitted to the B.Tech program from the academic year 2018-19 onwards. *(Please see Table 1 for details.)* [Lateral Entry students will have a multiplying factor of 1.33 to bring uniformity in score].

Level of Entry in B.Tech Course	Total duration for earning Points	Minimum Points
1 st Year from the academic year 2018-19 onwards	1 st to 4 th Year	100
2 nd Year from the academic year 2018-19 onwards (Lateral Entry)	2 nd to 4 th Year	75

Table – I

For existing Students (except students in the 4th year): Every student, who is admitted to the 4 years B.Tech program prior to the academic year 2018-19, is required to earn minimum number of Activity Points as per Table II in addition to the required academic grades, for getting MAKAUT, WB's B.Tech degree.

Current Semester	Total Points to be earned During the full course
2 nd	100
4 th	75
6 th	50

Table –II

These points must be earned on the basis of active participation in co-curricular and extracurricular activities spanning through all the semesters of study. Every student may choose, as per his/her liking, activities in order to achieve the mandatory points (as per Table-III, depending on his/her entry level), before becoming eligible for award of the Degree. These activities can be spread over the years, as per convenience of the student.

Notes:

- **Current 4th year students who are going to sit for Final Semester examination in May-June, 2018 are outside the preview of this Mandatory Additional Requirement**
- Every student shall participate in the co-curricular and extra-curricular activities and produce documentary proof to the designated Faculty Members appointed by the Head of Department / Principal / Director in the respective college. Thereby the student should earn the required Points before *her* she appears for his/ her Final Examinations.
- A student's result of his/her Final Examinations will be withheld until he/she completes the minimum Activity Points by the end of his/her B.Tech Program.
- In every semester, every student is required to prepare a file containing documentary proofs of activities, done by him / her. This file will be duly verified and Activity Points will be assigned by the teachers as appointed above, at the end of every semester.
- The college will form a 3 members committee and finalize the Activity Points for each student before entering them into the Online Point Entry System (at the URL, as specified by the COE of the University).
- Every student has to earn at least 100 activity points. The points students has earned will be reflected in the student's marksheet.
- Activity points earned by Lateral Entry students will be multiplied by 1.33.

Table III provides a List of Activity Heads and Sub-Activity Heads along with their capping of the Activity Points that can be earned by the students during the entire B.Tech duration.

Sl. No.	Name of the Activity	Points	Maximum Points Allowed
1.	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) (per course)	20	40
2.	Tech Fest/Teachers Day/Freshers Welcome		
	Organizer	5	10
	Participants	3	6
5.	Rural Reporting	5	10
6.	Tree Plantation (per tree)	1	10
7.	Participation in Relief Camps	20	40
8.	Participation in Debate/Group Discussion/ Tech quiz	10	20
9.	Publication of Wall magazine in institutional level (magazine/article/internet)	10	20
10.	Publication in News Paper, Magazine & Blogs	10	20
11.	Research Publication (per publication)	15	30
12.	Innovative Projects (other than course curriculum)	30	60
13.	Blood donation	8	16
	Blood donation camp Organization	10	20
15.	Participation in Sports/Games		
	College level	5	10
	University Level	10	20
	District Level	12	24
	State Level	15	30
	National/International Level	20	20
21.	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20
22.	Member of Professional Society	10	20
23.	Student Chapter	10	20
24.	Relevant Industry Visit & Report	10	20
25.	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	5	10
26.	Participation in Yoga Camp (Certificate to be submitted)	5	10
27.	Self-Entrepreneurship Programme	20	20
28.	Adventure Sports with Certification	10	20
29.	Training to under privileged/Physically challenged	15	30
30.	Community Service & Allied Activities	10	20

Suggestions from the College Principals will be considered to append in the above Table-III.

Sd/-

Registrar(Acting)
MAKAUT,WB

Maulana Abul Kalam Azad University of Technology, West Bengal
Record of Activities for Mandatory Additional Requirement

Annexure-I
Rev:00

College Name (College Code):						Department:						
Student Name:				University Roll No:			Registration No:					
Sl No	Activity	Points	Max. Points Allowed	Points Earned								
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	Total
1	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) per course											
	For 12 weeks duration	20	40									
	For 8 weeks duration	16										
2	Tech Fest/Teachers Day/Freshers Welcome											
	Organizer	5	10									
	Participants	3	6									
3	Rural Reporting	5	10									
4	Tree Plantation and up keeping (per tree)	1	10									
5	Participation in Relief Camps	20	40									
6	Participation in Debate/Group Discussion/ Tech quiz	10	20									
7	Publication of Wall magazine in institutional level (magazine/article/internet)											
	Editor	10	20									
	Writer	6	12									
8	Publication in News Paper, Magazine & Blogs	10	20									
9	Research Publication (per publication)	15	30									
10	Innovative Projects (other than course curriculum)	30	60									
11	Blood donation	8	16									
	Blood donation camp Organization	10	20									

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Record of Activities for Mandatory Additional Requirement

Annexure-I
Rev:00

Sl No	Activity	Points	Max. Points Allowed	Points Earned								Total
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	
12	Participation in Sports/Games											
	College level	5	10									
	University Level	10	20									
	District Level	12	24									
	State Level	15	30									
	National/International Level	20	20									
13	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20									
14	Member of Professional Society	10	20									
15	Student Chapter	10	20									
16	Relevant Industry Visit & Report	10	20									
17	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	5	10									
18	Participation in Yoga Camp (Certificate to be submitted)	5	10									
19	Self-Entrepreneurship Programme	20	20									
20	Adventure Sports with Certification	10	20									
21	Training to under privileged / Differently abled	15	30									
22	Community Service & Allied Activities	10	20									
Total Points												
Signature of Mentor												
Signature of HOD												
*Please abide strictly to the Notes at the end of the Notice by Registrar, MAKAUT, WB regarding Mandatory Additional Requirement for earning B.Tech Degree												
* <i>Annexure-I</i> is to be retained in the Institute records with all documentary proofs of activities (to be verified by the University as and when required).												

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SEMESTER –III (2ND YR)

CE(BS)301	Biology (Biology for Engineers)	2L + 1T =	3 Credits
Module 1	Introduction Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry. Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry		2L
Module 2	Classification Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e) Habitataaquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus Purpose: To convey that classification <i>per se</i> is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted.		3L
Module 3	Genetics Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics. Purpose: To convey that "Genetics is to biology what Newton's laws are to Physical Sciences"		4L
Module 4	Biomolecules Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids. Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine		4L
Module 5	Enzymes Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyzereactions. Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis. Purpose: To convey that without catalysis life would not have existed on earth		4L
Module 6	Information Transfer Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structurefrom single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.\ Purpose: The molecular basis of coding and decoding genetic information is universal		4L
Module 7	Macromolecular analysis Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements. Purpose: How to analyses biological processes at the reductionistic level		5L
Module 8	Metabolism Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO ₂ + H ₂ O (Glycolysis and Krebs cycle) and synthesis of glucose from CO ₂ and H ₂ O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge Purpose: The fundamental principles of energy transactions are the same in physical and biological world.		4L
Module 9	Microbiology Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.		3L
Reference	1) Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd		

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	2) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons 3) Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company 4) Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher 5) Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995, 2nd edition Wm, C. Brown Publishers 6) Biology of Engineers, McGraw Hill (ISBN: 978-11-21439-931)	
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CE(ES)301	Engineering Mechanics	3L + 1T =	4 Credits
Module 1	Introduction to Engineering Mechanics Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy		6L
Module 2	Friction Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack;		3L
Module 3	Basic Structural Analysis Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines;		4L
Module 4	Centroid and Centre of Gravity Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia-Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.		5L
Module 5	Virtual Work and Energy Method- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.		4L
Module 6	Review of particle dynamics- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2 nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).		4L
Module 7	Introduction to Kinetics of Rigid Bodies Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation;		5L
Module 8	Mechanical Vibrations Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums;		5L
Tutorials	From the above modules covering, To find the various forces and angles including resultants in various parts of wall crane, roof truss, pipes, etc.; To verify the line of polygon on various forces; To find coefficient of friction between various materials on inclined plane; Free body diagrams various systems including block-pulley; To verify the principle of moment in the disc apparatus; Helical block; To draw a load efficiency curve for a screw jack		6L
Reference	1. D.S. Bedi (2018), Engineering Mechanics, Khanna Publishing House, 2019 2. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall 3. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, -Dynamics, 9th Ed, Tata McGraw Hill 4. R.C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press. 5. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press 6. Shames and Rao (2006), Engineering Mechanics, Pearson Education, 7. Hibler and Gupta (2010), Engineering Mechanics (Statics, Dynamics) by Pearson Education 8. Reddy Vijaykumar K. and K. Suresh Kumar (2010), Singer's Engineering Mechanics 9. Bansal R.K. (2010), A Text Book of Engineering Mechanics, Laxmi Publications 10. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co. 11. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications		

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CE(ES)302	Energy Science & Engineering	1L + 1T =	2 Credits
Module 1	Introduction to Energy Science Scientific principles and historical interpretation to place energy use in the context of pressing societal, environmental and climate issues; Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment. Tutorials: Compile a World map showing Energy Reserves by source, Total Energy consumption, Per capita energy consumption and Carbon Footprint		3L
Module 2	Energy Sources Overview of energy systems, sources, transformations, efficiency, and storage. Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen; Sustainability and environmental trade-offs of different energy systems; possibilities for energy storage or regeneration (Ex. Pumped storage hydro power projects, superconductor-based energy storages, high efficiency batteries) Tutorials: Compile a Word Map showing Alternative Energy source usage; Compile a Process diagram for a Pumped Storage project; Collect details of a typical North Sea oil platform. Compile a map of India showing existing potential and utilized potential for hydro power. List the pros and cons for Thermal, hydro, nuclear and solar power projects.		4L
Module 3	Energy & Environment Energy efficiency and conservation; introduction to clean energy technologies and its importance in sustainable development; Carbon footprint, energy consumption and sustainability; introduction to the economics of energy; How the economic system determines production and consumption; linkages between economic and environmental outcomes; How future energy use can be influenced by economic, environmental, trade, and research policy Tutorials: Study the functioning of an Electro Static Precipitator in a thermal power plant; study the uses of coarse and fine Fly Ash from thermal power plants. Compile the safety provisions in design and construction of a reactor containment building		5L
Module 4	Civil Engineering Projects connected with the Energy Sources Coal mining technologies, Oil exploration offshore platforms, Underground and under-sea oil pipelines, solar chimney project, wave energy caissons, coastal installations for tidal power, wind mill towers; hydropower stations above-ground and underground along with associated dams, tunnels, penstocks, etc.; Nuclear reactor containment buildings and associated buildings, design and construction constraints and testing procedures for reactor containment buildings; Spent Nuclear fuel storage and disposal systems Tutorials: Compile a process diagram for a typical underground hydropower project; Collect details of a model solar chimney project; collect details of a wave energy project at Vizhinjam; Collect details of the Kalpasar (Tidal energy) project		10L
Module 5	Engineering for Energy conservation Concept of Green Building and Green Architecture; Green building concepts (Green building encompasses everything from the choice of building materials to where a building is located, how it is designed and operated); LEED ratings; Identification of energy related enterprises that represent the breath of the industry and prioritizing these as candidates; Embodied energy analysis and use as a tool for measuring sustainability. Energy Audit of Facilities and optimization of energy consumption. Tutorials: Draw a typical geometrical orientation of a house in your area to avoid sun's radiation in the bed room in the evening; Identify typical examples of Indian buildings having various LEED ratings; List various building materials with their embodied energy content. Do an Energy Audit of your Departmental Building in the college		8L
Reference	1. O.P. Gupta, Energy Technology, Khanna Book Publishing, (2019) 2. Boyle, Godfrey (2004), Renewable Energy (2nd edition). Oxford University Press 3. Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press 4. Chakrabarti, Energy Engineering & Management, PHI 5. Schaeffer, John (2007), Real Goods Solar Living Sourcebook: The Complete Guide to Renewable Energy Technologies and Sustainable Living, Gaia 6. Jean-Philippe; Zaccour, Georges (Eds.), (2005), Energy and Environment Set: Mathematics of Decision Making, Loulou, Richard; Waaub, XVIII, 7. Ristinen, Robert A. Kraushaar, Jack J. A Kraushaar, Jack P. Ristinen, Robert A. (2006) Energy and the Environment, 2nd Edition, John Wiley 8. UNDP (2000), Energy and the Challenge of Sustainability, World Energy assessment 9. E H Thorndike (1976), Energy & Environment: A Primer for Scientists and Engineers, Addison-Wesley Publishing Company 10. Related papers published in international journals		

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CE(BS)302	Mathematics-III (Transform & Discrete Mathematics)	2L + 0T	2 Credits
(Prerequisite 2c, 5b-d, 6b)			
Module 1	Transform Calculus -1 Polynomials – Orthogonal Polynomials – Lagrange's, Chebysev Polynomials; Trigonometric Polynomials; Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method.		6 L
Module 2	Transform Calculus-2 Fourier transforms, Z-transform and Wavelet transforms: properties, methods, inverses and their applications.		6 L
Module 3	Sets, relations and functions Basic operations on sets, Cartesian products, disjoint union (sum), and power sets. Different types of relations, their compositions and inverses. Different types of functions, their compositions and inverses.		4 L
Module 4	Propositional Logic Syntax and semantics, proof systems, satisfiability, validity, soundness, completeness, deduction theorem, etc. Decision problems of propositional logic. Introduction to first order logic and first order theory.		4 L
Module 5	Partially ordered sets Complete partial ordering, chain, lattice, complete, distributive, modular and complemented lattices. Boolean and pseudo Boolean lattices.		4 L
Module 6	Algebraic Structures Algebraic structures with one binary operation – semigroup, monoid and group. Cosets, Lagrange's theorem, normal subgroup, homomorphic subgroup. Congruence relation and quotient structures. Error correcting code. Algebraic structures with two binary operations- ring, integral domain, and field. Boolean algebra and boolean ring (Definitions and simple examples only).		4 L
Module 7	Introduction to Counting Basic counting techniques – inclusion and exclusion, pigeon-hole principle, permutation, combination, summations. Introduction to recurrence relation and generating functions.		3 L
Module 8	Introduction to Graphs Graphs and their basic properties – degree, path, cycle, subgraph, isomorphism, Eulerian and Hamiltonian walk, trees.		3 L
Reference	1. C. L. Liu, Elements of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 2000. 2. R. C. Penner, Discrete Mathematics: Proof Techniques and Mathematical Structures, World Scientific, 1999. 3. R.L. Graham, D. E. Knuth, and O. Patashnik, Concrete Mathematics, 2nd Ed., Addison-Wesley, 1994. 4. K. H. Rosen, Discrete Mathematics and its Applications, 6th Ed., Tata McGraw-Hill, 2007. 5. J. L. Hein, Discrete Structures, Logic, and Computability, 3rd Ed., Jones and Bartlett, 2010. 6. N. Deo, Graph Theory, Prentice Hall of India, 1974. 7. S. Lipschutz and M. L. Lipson, Schaum's Outline of Theory and Problems of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 1999. 8. J. P. Tremblay and R. P. Manohar, Discrete Mathematics with Applications to Computer Science, Tata McGraw-Hill, 1997. 9. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006. 10. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010. 11. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000. 12. S.B. Singh. Discrete Structures, Khanna Publishing House, 2019 13. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008. 14. Chandrika Prasad, Advanced Engineering Mathematics, KPB		

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CE(HS)301	Humanities-I (Effective Technical Communication)	3L + 0T	3 Credits
Module 1	Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.		4L
Module 2	Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Human factors, Managing technical communication projects, time estimation, Single sourcing, Localization.		8L
Module 3	Self Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, Taking notes; Complex problem solving; Creativity		8L
Module 4	Communication and Technical Writing- Public speaking, Group discussion, Oral presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.		8L
Module 5	Ethics- Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.		8L
Reference	1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Wiley. New York, 2004 2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843) 3. Kulbhushan Kumar, Effective Communication Skills, Khanna Publishing House 4. Shiv Khera, You Can Win, Macmillan Books, New York, 2003. 5. Raman Sharma, Technical Communications, Oxford Publication, London, 2004. 6. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4) 7. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002. 8. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)		

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CE(HS)302	Introduction to Civil Engineering	1L + 1T=	2 Credits
Module 1	Basic Understanding: What is Civil Engineering/ Infrastructure? Basics of Engineering and Civil Engineering; Broad disciplines of Civil Engineering; Importance of Civil Engineering, Possible scopes for a career Tutorials Develop a matrix of various disciplines and possible roles for engineers in each		1 L
Module 2	History of Civil engineering: Early constructions and developments over time; Ancient monuments & Modern marvels; Development of various materials of construction and methods of construction; Works of Eminent civil engineers Tutorials Identify 10 ancient monuments and ten modern marvels and list the uniqueness of each		1 L
Module 3	Overview of National Planning for Construction and Infrastructure Development; Position of construction industry vis-à-vis other industries, five year plan outlays for construction; current budgets for infrastructure works Tutorials Develop a Strategic Plan for Civil Engineering works for next ten years based on past investments and identify one typical on-going mega project in each area		1 L
Module 4	Fundamentals of Architecture & Town Planning: Aesthetics in Civil Engineering, Examples of great architecture, fundamentals of architectural design & town planning; Building Systems (HVAC, Acoustics, Lighting, etc.); LEED ratings; Development of Smart cities Tutorials Identify ten best civil engineering projects with high aesthetic appeal with one possible factor for each; List down the possible systems required for a typical Smart City		1 L
Module 5	Fundamentals of Building Materials: Stones, bricks, mortars, Plain, Reinforced & Prestressed Concrete, Construction Chemicals; Structural Steel, High Tensile Steel, Carbon Composites; Plastics in Construction; 3D printing; Recycling of Construction & Demolition wastes Tutorials Identify three top new materials and their potential in construction; Visit a Concrete Lab and make a report		2 L
Module 6	Basics of Construction Management & Contracts Management: Temporary Structures in Construction; Construction Methods for various types of Structures; Major Construction equipment; Automation & Robotics in Construction; Modern Project management Systems; Advent of Lean Construction; Importance of Contracts Management Tutorials Identify 5 typical construction methods and list their advantages/ positive features		2 L
Module 7	Environmental Engineering & Sustainability: Water treatment systems; Effluent treatment systems; Solid waste management; Sustainability in Construction Tutorials Sustainability principles, Sustainable built environment, water treatment systems, and good practices of wastewater management. examples of Solid and hazardous waste management, Air pollution and control		2L
Module 8	Geotechnical Engineering: Basics of soil mechanics, rock mechanics and geology; various types of foundations; basics of rock mechanics & tunnelling Tutorials List top five tunnel projects in India and their features; collect and study geotechnical investigation report of any one Metro Rail (underground) project; Visit a construction site and make a site visit report		2 L
Module 9	Hydraulics, Hydrology & Water Resources Engineering: Fundamentals of fluid flow, basics of water supply systems; Underground Structures; Underground Structures Multi-purpose reservoir projects Tutorials Identify three river interlinking projects and their features; visit a Hydraulics Lab and make a report		1 L
Module 10	Ocean Engineering: Basics of Wave and Current Systems; Sediment transport systems; Ports & Harbours and other marine structures Tutorials Identify 5 typical ports in India and list the structures available in them; Visit a related/similar		1 L

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	facility, if possible in nearby place and make a report	
Module 11	Power Plant Structures: Chimneys, Natural & Induced Draught Colling towers, coal handling systems, ash handling systems; nuclear containment structures; hydro power projects Tutorials Collect the typical layout for a large thermal powerplant and a large hydro power plant and identify all the structures and systems falling in them.	1 L
Module 12	Structural Engineering: Types of buildings; tall structures; various types of bridges; Water retaining structures; Other structural systems; Experimental Stress Analysis; Wind tunnel studies; Tutorials Identify 5 unique features for typical buildings, bridges, tall structures and large span structures; Visit Structures Testing Lab/facility and make a report	3 L
Module 13	Surveying & Geomatics: Traditional surveying techniques, Total Stations, Development of Digital Terrain Models; GPS, LIDAR; Tutorials Collect visual representations prepared by a Total Station and LIDAR and compare; Study typical Google street map and Google Earth Map and study how each can facilitate the other	1 L
Module 14	Traffic & Transportation Engineering: Investments in transport infrastructure development in India for different modes of transport; Developments and challenges in integrated transport development in India: road, rail, port and harbour and airport sector; PPP in transport sector; Intelligent Transport Systems; Urban Public and Freight Transportation; Road Safety under heterogeneous traffic; Sustainable and resilient pavement materials, design, construction and management; Case studies and examples. Tutorials Investments in transport infrastructure; Developments and challenges; Intelligent Transport Systems; Smart Cities, Urban Transport; Road Safety; Sustainable and resilient highway design principles; Plan a sustainable transport system for a city; Identify key features/components in the planning and design of a green field highway/airport/port/railway and the cost – economics.	1 L
Module 15	Repairs & Rehabilitation of Structures: Basics of corrosion phenomena and other structural distress mechanisms; some simple systems of rehabilitation of structures; Non-Destructive testing systems; Use of carbon fibre wrapping and carbon composites in repairs. Tutorials Collect the history of a major rehabilitation project and list the interesting features	1 L
Module 16	Computational Methods, IT, IoT in Civil Engineering: Typical software used in Civil Engineering- Finite Element Method, Computational Fluid Dynamics; Computational Geotechnical Methods; highway design (MX), Building Information Modelling; Highlighting typical available software systems (SAP, STAAD, ABAQUS, MATLAB, ETAB, NASTRAN, NISA, MIKE 21, MODFLOW, REVIT, TEKLA, AUTOCAD, ... GEOSTUDIO, EDUSHAKE, MSP, PRIMAVERA, ArcGIS, VisSIM, ...) Tutorials Visit an AutoCad lab and prepare a report; Identify ten interesting software systems used in Civil Engg and their key features	2 L
Module 17	Industrial lectures: Case studies of large civil engineering projects by industry professionals, covering comprehensive planning to commissioning; Tutorials For each case study list the interesting features	2 L
Module 18	Basics of Professionalism: Professional Ethics, Entrepreneurial possibilities in Civil Engineering, Possibilities for creative & innovative working, Technical writing Skills enhancement; Facilities Management; Quality & HSE Systems in Construction	3 L
Tutorials	List 5 cases of violation of professional ethics and list preventive measures; Identify 5 interesting projects and their positive features; Write 400 word reports on one ancient monument and a modern marvel of civil engineering	5L
Reference	1. Patil, B.S.(1974), Legal Aspects of Building and Engineering Contract 2. The National Building Code, BIS, (2017) 3. RERA Act, (2017) 4. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset 5. Chandiramani, Neelima (2000), The Law of Contract: An Outline, 2nd Edn. Avinash Publications Mumbai 6. Avtarsingh (2002), Law of Contract, Eastern Book Co. 7. Dutt (1994), Indian Contract Act, Eastern Law House 8. Anson W.R.(1979), Law of Contract, Oxford University Press 9. Kwatra G.K.(2005), The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration, Indian Council of Arbitration 10. Avtarsingh (2005), Law of Arbitration and Conciliation, Eastern Book Co.	

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	<p>11. Wadhwa (2004), Intellectual Property Rights, Universal Law Publishing Co. 12. P. S. Narayan (2000), Intellectual Property Rights, Gogia Law Agency 13. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House 14. Bare text (2005), Right to Information Act 15. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers 16. K.M. Desai(1946), The Industrial Employment (Standing Orders) Act 17. Rustamji R.F., Introduction to the Law of Industrial Disputes, Asia Publishing House 18. Vee, Charles & Skitmore, Martin (2003) Professional Ethics in the Construction Industry, Engineering Construction and Architectural management, Vol.10, Iss. 2, pp 117-127, MCB UP Ltd 19. American Society of Civil Engineers (2011) ASCE Code of Ethics – Principles Study and Application 20. Ethics in Engineering- M.W.Martin&R.Schinzinger, McGraw-Hill 21. Engineering Ethics, National Institute for Engineering Ethics, USA 22. www.ieindia.org 23. Engineering ethics: concepts and cases – C. E. Harris, M.S. Pritchard, M.J.Rabins 24. Resisting Bureaucratic Corruption: Alacrity Housing Chennai (Teaching Case Study) -S. Ramakrishna Velamuri -CEIBS 25. CONSTRUCTION CONTRACTS, http://www.jnormanstark.com/contract.htm 26. Internet and Business Handbook, Chap 4, CONTRACTS LAW, http://www.laderapress.com/laderapress/contractsaw1.html 27. Contract &Agreements , http://www.tco.ac.ir/law/English/agreements/General/Contract%20Law/C.htm 28. Contracts, http://206.127.69.152/jgretch/crj/211/ch7.ppt 29. Business & Personal Law. Chapter 7. “How Contracts Arise”, http://yucaipahigh.com/schriestensen/lawweb/lawch7.ppt 30. Types of Contracts, http://cmsu2.cmsu.edu/public/classes/rahm/meiners.con.ppt 31. IV. TYPES OF CONTRACTS AND IMPORTANT PROVISIONS, http://www.worldbank.org/html/opr/consult/guidetxt/types.html 32. Contract Types/Pricing Arrangements Guideline- 1.4.G (11/04/02), http://www.sandia.gov/policy/14g.pdf</p>	
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LABORATORY/ SESSIONAL

CE(ES)391	Basic Electronics	1L + 2P	2 Credits
Theory			
Module 1	Diodes and Applications covering, Semiconductor Diode - Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications; Silicon Controlled Rectifier (SCR) – Operation, Construction, Characteristics, Ratings, Applications;		4L
Module 2	Transistor Characteristics covering, Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Voltage Divider Bias Configuration; Field Effect Transistor (FET)– Construction, Characteristics of Junction FET, Depletion and Enhancement type Metal Oxide Semiconductor (MOS) FETs, Introduction to CMOS circuits;		4L
Module 3	Transistor Amplifiers and Oscillators covering, Classification, Small Signal Amplifiers – Basic Features, Common Emitter Amplifier, Coupling and Bypass Capacitors, Distortion, AC Equivalent Circuit; Feedback Amplifiers – Principle, Advantages of Negative Feedback, Topologies, Current Series and Voltage Series Feedback Amplifiers; Oscillators – Classification, RC Phase Shift, Wien Bridge, High Frequency LC and Non-Sinusoidal type Oscillators;		4L
Module 4	Operational Amplifiers and Applications covering, Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal OpAmp, Concept of Virtual Ground;		4L
Practical			
Module 1	Laboratory Sessions covering, Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Switches (SPDT, DPDT and DIP), Bread Boards and Printed Circuit Boards (PCBs); Identification, Specifications, Testing of Active Devices – Diodes, BJTs, JFETs, MOSFETs, Power Transistors, SCRs and LEDs;		
Module 2	Study and Operation of Digital Multi Meter, Function / Signal Generator, Regulated Power Supply (RPS), Cathode Ray Oscilloscopes; Amplitude, Phase and Frequency of Sinusoidal Signals using Lissajous Patterns on CRO; (CRO);		
Module 3	Experimental Verification of PN Junction Diode Characteristics in A) Forward Bias B) Reverse Bias, Zener Diode Characteristics and Zener Diode as Voltage Regulator, Input and Output Characteristics of BJT in Common Emitter (CE) Configuration, Drain and Transfer Characteristics of JFET in Common Source (CS) Configuration;		

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Module 4	Study of Half Wave and Full Wave Rectification, Regulation with Filters, Gain and Bandwidth of BJT Common Emitter (CE) Amplifier, Gain and Bandwidth of JFET Common Source (CS) Amplifier, Gain and Bandwidth of BJT Current Series and Voltage Series Feedback Amplifiers, Oscillation Frequency of BJT based RC Phase Shift, Hartley and Colpitts Oscillators;	
Module 5	Op-Amp Applications – Adder, Subtractor, Voltage Follower and Comparator; Op-Amp Applications – Differentiator and Integrator, Square Wave and Triangular Wave Generation, Applications of 555 Timer – Astable and Monostable Multivibrators;	
Module 6	Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR Integrated Circuits (ICs); Truth Tables and Functionality of Flip-Flops – SR, JK and D Flip-Flop ICs; Serial-In-Serial-Out and Serial-In-Parallel-Out Shift operations using 4-bit/8-bit Shift Register ICs; Functionality of Up-Down / Decade Counter ICs;	
Reference	1. David. A. Bell (2003), Laboratory Manual for Electronic Devices and Circuits, Prentice Hall, India 2. Santiram Kal (2002), Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India 3. Thomas L. Floyd and R. P. Jain (2009), Digital Fundamentals by Pearson Education, 4. Paul B. Zbar, A.P. Malvino and M.A. Miller (2009), Basic Electronics – A Text-Lab. Manual, TMH 5. R.T. Paynter (2009), Introductory Electronic Devices & Circuits, Conventional Flow Version, Pearson	

CE(ES)392	Computer-aided Civil Engineering Drawing	1L + 2P	2 Credits
Module 1	INTRODUCTION Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings to show information concisely and comprehensively; optimal layout of drawings and Scales; Introduction to computer aided drawing, co-ordinate systems, reference planes. Commands: Initial settings, Drawing aids, Drawing basic entities, Modify commands, Layers, Text and Dimensioning, Blocks. Drawing presentation norms and standards.		2 L
Module 2	SYMBOLS AND SIGN CONVENTIONS Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawings symbols, welding symbols; dimensioning standards		2 L
Module 3	MASONRY BONDS English Bond and Flemish Bond – Corner wall and Cross walls -One brick wall and one and half brick wall		1 L
Module 4	BUILDING DRAWING Terms, Elements of planning building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundation plan. Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity		5 L
Module 5	PICTORIAL VIEW Principles of isometrics and perspective drawing. Perspective view of building. Fundamentals of Building Information Modelling (BIM)		2 L
Drawings			
1	Buildings with load bearing walls including details of doors and windows.		6P
2	Taking standard drawings of a typical two storeyed building including all MEP, joinery, rebars, finishing and other details and writing out a description of the Facility in about 500-700 words		4P
3	RCC framed structures		6P
4	Reinforcement drawings for typical slabs, beams, columns and spread footings		6P
5	Industrial buildings - North light roof structures – Trusses		4P
6	Perspective view of one and two storey buildings		4P
Reference	1. Subhash C Sharma & Gurucharan Singh (2005), “Civil Engineering Drawing”, Standard Publishers 2. Pradeep Jain & A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House (2019) 3. Ajeet Singh (2002), “Working with AUTOCAD 2000 with updates on AUTOCAD 2007”, Tata- Mc Graw-Hill Company Limited, New Delhi 4. Sham Tickoo Swapna D (2009), “AUTOCAD for Engineers and Designers”, Pearson Education, 5. Venugopal (2007), “Engineering Drawing and Graphics + AUTOCAD”, New Age International Pvt. Ltd., 6. Shah, Engineering Drawings and Computers, Pearson 7. Balagopal and Prabhu (1987), “Building Drawing and Detailing”, Spades publishing KDR building, Calicut,		

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	8. (Corresponding set of) CAD Software Theory and User Manuals. 9. Malik R.S., Meo, G.S. (2009) Civil Engineering Drawing, Computech Publication Ltd New Asian. 10. Sikka, V.B. (2013), A Course in Civil Engineering Drawing, S.K.Kataria& Sons,	
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CE(ES)393	Life Science	1L + 2P	2 Credits
Module 1A	Plant Physiology Transpiration; Mineral nutrition		3 L
Module 1B	Ecology Ecosystems- Components, types, flow of matter and energy in anecosystem; Community ecology- Characteristics, frequency, life forms, and biological spectrum;Ecosystem structure- Biotic and a-biotic factors, food chain, food web, ecological pyramids;		3 L
Module 2A	Population Dynamics Population ecology- Population characteristics,ecotypes; Population genetics- Concept of gene pool and genetic diversity in populations,polymorphism and heterogeneity;		3 L
Module 2B	Environmental Management Principles: Perspectives, concerns andmanagement strategies; Policies and legal aspects- Environment Protection Acts and modification,International Treaties; Environmental Impact Assessment- Case studies (International Airport,thermal power plant);		3 L
Module 3A	Molecular Genetics Structures of DNA and RNA; Concept of Gene, Generegulation, e.g., Operon concept		3 L
Module 3B	Biotechnology Basic concepts: Totipotency and Cell manipulation; Plant &Animal tissue culture- Methods and uses in agriculture, medicine and health; Recombinant DNATechnology- Techniques and applications		3 L
Module 4	Biostatistics Introduction to Biostatistics:-Terms used, types of data;Measures of Central Tendencies- Mean, Median, Mode, Normal and Skewed distributions; Analysisof Data- Hypothesis testing and ANNOVA (single factor)		4 L
Module 5	Laboratory & FieldworkSessions Comparison of stomatal index in differentplants; Study of mineral crystals in plants; Determination of diversity indices in plant communities;To construct ecological pyramids of population sizes in an ecosystem; Determination of ImportanceValue Index of a species in a plant community; Seminar (with PPTs) on EIA of a Mega-Project (e.g.,Airport, Thermal/Nuclear Power Plant/ Oil spill scenario); Preparation and extraction of genomic DNA and determination of yield by UV absorbance; Isolation of Plasmid DNA and its separation byGel Electrophoresis; Data analysis using Bio-statistical tools;		15 P
References	1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd 2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons 3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company 4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher 5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers 6. Life Sciences, Vol. I & II, Pathfinder Publications		

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Semester IV [Second year]

CE(ES)401	Introduction to Fluid Mechanics	2L + 0T	2 Credits
Course Outcome	On successful completion of this course, student should be able to: <ol style="list-style-type: none"> 1. define basic terms, values and laws in the areas of fluids properties, statics, kinematics and dynamics of fluids, and hydraulic design of pipe systems; 2. describe methods of implementing fluid mechanics laws and phenomena while analyzing the operational parameters of hydraulic problems; 3. practically apply tables and diagrams, and equations that define the associated laws; 4. calculate and optimize operational parameters of hydraulic problems; 5. explain the correlation between different operational parameters; 6. select engineering approach to problem solving based on the acquired physics and mathematical knowledge. 		
Prerequisite	Introduction to Civil Engineering, Physics.		
Module 1	Properties of fluids: Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, capillarity and surface tension.	3L	
Module 2	Fluid statics: Pressure at a point, basic equation for pressure field, pressure variation in a fluid at rest- incompressible fluid, compressible fluid, absolute pressure, gauge pressure; pressure measurements by manometers – general, inclined, inverted, micro-manometer; pressure and forces on submerged planes and curved surfaces, centre of pressure, buoyancy and floatation, Stability of submerged and floating bodies, metacentric height.	4L	
Module 3:	Fluid Kinematics: The velocity field, Eulerian and Lagrangian flow descriptions, concepts of: - one-, two- and three-dimensional flows, steady and unsteady flows, streamlines, streaklines, pathlines; The acceleration field; Control volume and system representation, Continuity Equation, Momentum Equation, Moment-of-momentum equation, applications to pipe bends.	6L	
Module 4:	Fluid Dynamics: Application of Newton's Law along a streamline, Bernoulli Equation, Kinetic energy head, potential energy head and pressure energy head, total energy head, Pitot tube, Examples of use of Bernoulli Equation, measurement of flows - venturimeter, energy line and hydraulic grade line.	7L	
Module 5:	Dimensional Analysis: Buckingham Pi Theorem, determination of Pi terms, correlation data, examples.	3L	
Module 6	Flow through Pipes: Laminar flow, Reynolds number, critical velocity, turbulent flow, shear stress at pipe wall, velocity distribution, loss of head for laminar flow, Darcy-Weisbach Formula, friction factor, contraction and expansion head losses. Concept of boundary layer and its growth.	7L	
Module 7	Pipeline Systems: Pipes in series, pipes in parallel, equivalent pipes, branching pipes, pipe networks.	7L	
Module 8	Hydraulic Machines: Basics of hydraulic machines, specific speed of pumps and turbines.	3L	
Reference	Sl.	Book Name	Author
	1	Fluid Mechanics	Sadhu Singh
	2	A Textbook of Fluid Mechanics	R. K. Bansal
	3	Hydraulics & Fluid Mechanics Including Hydraulics Machines	P. N. Modi and S. M. Seth
	4	Introduction to Fluid Mechanics and Fluid Machines	S. K. Som, G. Biswas and S. Chakraborty
	5	Fluid Mechanics	F. M. White
	6	Fluid Mechanics and Hydraulic Machines	K. Subramanya

CE(ES)402	Introduction to Solid Mechanics	2L + 0T	2 Credits
Course Outcome	After going through this course, the students will be able to: <ol style="list-style-type: none"> 1. To identify the equilibrium conditions and elastic properties of axially loaded bars through stress-strain and force-displacement curves. 2. To identify the principal plane and principal stresses through Mohr circle. 3. To calculate the hoop and meridional stresses in thin cylinders and spherical shells. 4. To identify different degrees of freedoms for support conditions like hinge, roller and fixed 		

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	constraints. 5. To calculate the bending moment, shear force and deflection of beams for uniformly distributed, concentrated, linearly varying and external concentrated moment. 6. To calculate the member forces in a plane truss using Method of Joint and Method of Section. 7. To identify torsional moment and twist on a circular shaft and calculate the shear stress. 8. To know the concepts of strain energy due to axial load, bending and shear. 9. To calculate the buckling load of columns using Euler's theory for different support constraints			
Prerequisite	Engineering Mechanics (CE(ES)301), Basic Calculus			
Module 1	Review of Basic Concepts of Stress and Strain: Normal stress, Shear stress, Bearing stress, Normal strain, Shearing strain; Hooke's law; Poisson's ratio; Stress-strain diagram of ductile and brittle materials; Elastic limit; Ultimate stress; Yielding; Modulus of elasticity; Factor of safety, Beam Statics: Support reactions, concepts of redundancy, axial force, shear force and bending moment diagrams for concentrated, uniformly distributed, linearly varying load, concentrated moments in simply supported beams, cantilever and overhanging beams		6L	
Module 2	Symmetric Beam Bending: Basic kinematic assumption, moment of inertia, elastic flexure formulae and its application, Bending and shear stress for regular sections, shear centre		3L	
Module 3:	Deflection of statically determinate beams: Fundamental concepts: Elastic curve, moment Curvature relationship, governing differential equation, boundary conditions: Direct integration solution		4L	
Module 4:	Analysis of determinate plane trusses: Concepts of redundancy, Analysis by method of joints, method of sections		4L	
Module 5:	Two Dimensional Stress Problems: Principal stresses, maximum shear stresses, Mohr's circle of stresses, construction of Mohr's circle		3L	
Module 6	Introduction to thin cylindrical & spherical shells: Hoop stress and meridional - stress and volumetric changes		3L	
Module 7	Torsion: Pure torsion, torsion of circular solid shaft and hollow shafts, torsional equation, torsional rigidity, closed coil helical; springs		4L	
Module 8	Columns: Fundamentals, criteria for stability in equilibrium, column buckling theory, Euler's load for columns with different end conditions, limitations of Euler's theory – problems, eccentric load and secant formulae.		3L	
Reference	Sl.	Book Name	Author	Publishing House
	1	Strength of Materials	D.S. Bedi	Khanna Publishing House
	2	Elements of Strength of Material	S. P. Timoshenko and D. H. Young	EWP Pvt. Ltd
	3	Mechanics of Material	R.C. Hibbeler	Pearson
	4	Mechanics of Material	Beer, Jhonston, DeWolf, Mazurek	McGrawHill Education
	5	Strength of Materials	R. Subramanian	OXFORD University Press
	6	Strength of Materials	S S Bhavikatti	Vikas Publishing House Ltd
	7	Strength of Materials	R.K. Bansal	Laxmi Publication
	8	Fundamentals of Strength of Material	Nag & Chandra	WIE

CE(PC)401	Soil Mechanics – I	2L + 1T	3 Credits
Course Outcome	After going through this course, the students will be able to: 1. Classify soil as per grain size distribution curve and understand the index properties of soil. 2. Apply the concept of total stress, effective stress and pore water pressure for solving geotechnical problems. 3. Assess the permeability of different types of soil and solve flow problems. 4. Estimate the seepage loss, factor of safety against piping failure using flow net related to any hydraulic structure. 5. Determine vertical stress on a horizontal plane within a soil mass subjected to different types of loading on the ground surface and also the maximum stressed zone or isobar below a loaded area. 6. Apply the concept of shear strength to analyze different geotechnical problems and determine the shear strength parameters from lab and field tests.		
Prerequisite	Engineering Mechanics		
Module 1	PHYSICAL PROPERTIES OF SOILS: Soil Formation Introduction, Origin of Soil, Formation and Types of soil, Formative classification, Typical Indian Soil, Some Special Types of Soils, Structure and Composition, Clay Mineralogy. Soil as a Three Phase System Basic Definitions, Weight - Volume Relationship, Measurement of Physical	10L + 5T	

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	Properties of Soil: Insitu Density, Moisture Content, Specific Gravity, Relative density, Functional Relationships. Index Properties of Soil Introduction, Particle Size Distribution, Mechanical Analysis - Sieve Analysis, Sedimentation Analysis – Hydrometer and Pipette Methods. Consistency of Soil – Atterberg Limits, Different Indices, Discussion on Limits and Indices. Classification of Soil Classification by Structure, Particle Size Classification, Textural System, PRA System (AASHTO Classification), Unified Classification System, As per IS Code Recommendation, Field Identification of Soil, Classification by Casagrande's Plasticity Chart.																					
Module 2	Soil Hydraulics Modes of Occurrence of Water in Soil – Free Water, Held Water, Structural Water, Capillary Water, Gravitational Water, Adsorbed Water, Pore Water, Pore Water Pressure, Effective Pressure, Total Pressure, Effective Pressure under Different Conditions and in Different Cases of Flow through Soils, Critical Hydraulic Gradient, Quick Sand Condition.	3L + 1T																				
Module 3:	Permeability Introduction, Darcy's Law, Coefficient of Permeability, Discharge Velocity, Seepage Velocity, Factors Affecting Permeability. Determination of Coefficient of Permeability – Constant Head and Falling Head Methods, Permeability of Stratified Soil Deposits, Field Determination of Permeability – Unconfined and Confined Aquifers.	3L + 1T																				
Module 4:	Seepage Analysis Introduction, Seepage, Seepage Pressure, Two Dimensional Flow, Laplace's Equations, Continuity equation, Flow Nets, Flow through Earthen Dam, Estimation of Seepage, Construction, Properties and Use of Flow Nets, Piping and Heaving, Uplift due to Seepage, Design of Fillers.	3L + 1T																				
Module 5:	STRESS DISTRIBUTION IN SOILS Introduction, Geostatic Stress, Boussinesq's Equation, Determination of Stress due to Point Load, Vertical Stress Distribution on a Horizontal Plane, Isobar and Pressure Bulb, Vertical Stress Distribution on a Vertical Plane, Vertical Stress under Uniformly Loaded Circular Area, Vertical Stress Beneath a Corner of a Rectangular Area, Equivalent Point Load Method, 2:1 Method, Newmark's Influence Chart, Vertical Stress Beneath Line and Strip Loads. Westergaard Analysis, Comparison of Boussinesq and Westergaard Theories, Contact Pressure.	4L + 2T																				
Module 6	SHEARING STRENGTH OF SOILS Shear Strength of Soil Introduction, Basic Concept of Shear Resistance and Shear Strength of Soil, Mohr Circle of Stress, Sign Conventions, Mohr - Coulomb Theory, Relationship between Principal Stresses and Cohesion. Determination of Shear Parameters of Soil Stress Controlled and Strain Controlled Tests, Laboratory Determination of Soil Shear Parameters- Direct Shear Test, Triaxial Test, Classification of Shear Tests Based on Drainage Conditions, Unconfined Compression Test, Vane Shear Test as per Relevant IS Codes. Stress- Strain Relationship of Clays and Sands, Concept of Critical Void Ratio. Skempton's Pore Pressure Parameters. Sensitivity and Thixotropy of clay. Concept of Stress path.	5L + 3T																				
Reference	<table><tr><td>Sl.</td><td>Book Name</td><td>Author</td><td>Publishing House</td></tr><tr><td>1</td><td>Textbook of Soil Mechanics and Foundation Engineering (Geotechnical Engineering Series)</td><td>V.N.S. Murthy</td><td>CBS Publishers</td></tr><tr><td>2</td><td>Soil Mechanics and Foundations</td><td>Punmia, B.C. and Jain A. K</td><td>Laxmi Publications (P) Ltd</td></tr><tr><td>3</td><td>Basic and Applied Soil Mechanics</td><td>Gopal Ranjan & A.S.R. Rao</td><td>New Age International Pvt.Ltd, Publishers</td></tr><tr><td>4</td><td>Principles of Geotechnical Engineering</td><td>B.M. Das</td><td>Thomson Brooks / Cole</td></tr></table>	Sl.	Book Name	Author	Publishing House	1	Textbook of Soil Mechanics and Foundation Engineering (Geotechnical Engineering Series)	V.N.S. Murthy	CBS Publishers	2	Soil Mechanics and Foundations	Punmia, B.C. and Jain A. K	Laxmi Publications (P) Ltd	3	Basic and Applied Soil Mechanics	Gopal Ranjan & A.S.R. Rao	New Age International Pvt.Ltd, Publishers	4	Principles of Geotechnical Engineering	B.M. Das	Thomson Brooks / Cole	
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1	Textbook of Soil Mechanics and Foundation Engineering (Geotechnical Engineering Series)	V.N.S. Murthy	CBS Publishers																			
2	Soil Mechanics and Foundations	Punmia, B.C. and Jain A. K	Laxmi Publications (P) Ltd																			
3	Basic and Applied Soil Mechanics	Gopal Ranjan & A.S.R. Rao	New Age International Pvt.Ltd, Publishers																			
4	Principles of Geotechnical Engineering	B.M. Das	Thomson Brooks / Cole																			

CE(PC)402	Environmental Engineering – I	2L + 1T	3 Credits
Course Outcome	<p>After going through this course, the students will be able to:</p> <ol style="list-style-type: none"> 1. Define the basic concepts and terminologies of water supply engineering and solid waste management 2. Describe different surface and groundwater sources; and composition and characteristics of municipal solid waste 3. Apply the methods of quantifying water requirement and MSW generation 4. Solve different mathematical problems regarding different components of water supply systems, distribution networks and MSW management systems 		

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	5. Compare between different water samples based on their physical, chemical and biological characteristics 6. Design different unit processes and operations involved in water treatment and MSW management			
Prerequisite	Class-XII level knowledge of Physics, Chemistry, Mathematics, Biology and Environmental Science; Undergraduate level knowledge of Engineering Mechanics, Fluid Mechanics and Hydraulics			
Module 1	Water Requirement Estimation Water Demand: Different types of water demand; Per capita demand; Variations in demand; Factors affecting water demand Future Demand Forecasting: Design period; Population forecasting methods			2L + 2T
Module 2	Sources of Water Surface Water Sources; Ground Water Sources			4L + 2T
Module 3:	Water Quality Water Quality Characteristics: Physical, Chemical, and Biological parameters Drinking Water Standards: BIS; WHO; USEPA Water Quality Indices: Basic concept and examples			4L + 2T
Module 4:	Water Treatment Typical flow chart for surface and groundwater treatments Unit Operation and Processes: Aeration, Plain Sedimentation, Sedimentation with Coagulation and Flocculation, Water Softening, Filtration, Disinfection			9L + 3T
Module 5:	Water Conveyance and Distribution Hydraulic design of pressure pipes; Analysis of distribution network; Storage and distribution reservoirs; Capacity of reservoirs.			4L + 2T
Module 6	Characteristics of Municipal Solid Waste (MSW) Composition and characteristics of MSW			1L + 1T
Module 7	Handling of MSW Generation, collection and transportation of MSW			1L + 1T
Module 8	Engineered Systems for MSW Management Methods of reuse/ recycle, energy recovery, treatment and disposal of MSW			3L + 1T
Reference	Sl.	Book Name	Author	Publishing House
	1	Environmental Engineering	S.C. Sharma	Khanna Publishing House
	2	Environmental Engineering. Volume-1 and Volume-2	Garg, S.K.	Khanna Publishers
	3	Environmental Engineering	Peavy, H.S, Rowe, D.R, Tchobanoglous, G	Tata McGraw Hill Indian Edition
	4	Introduction to Environmental Engineering and Science	Masters, G.M., Ela, W.P.	Prentice Hall / Pearson
	5	Elements of Environmental Pollution Control	O.P. Gupta	Khanna Publishing House
	6`	Elements of Solid & Hazardous Waste Management	O.P. Gupta	Khanna Publishing House
	7	Manual on Water Supply and Treatment	CPHEEO	Govt. of India
	8	Manual on Municipal Solid Waste Management.	CPHEEO	Govt. of India

CE(PC)403	Surveying & Geomatics	2L + 1T	3 Credits
Course Outcome	Upon completing the course, the students will be able to: <ol style="list-style-type: none"> 1. Define and state the scope of surveying and geomatics in civil engineering 2. Understand the basic principles of surveying and geomatics engineering 3. Apply the different methods of surveying and geomatics to measure the features of interest 4. Analyze the traditional and advanced methods of surveying 5. Evaluate the different techniques of surveying and geomatics in solving real world problems. 6. Design and construct solutions for real world problems related to surveying and geomatics. 		
Prerequisite	Knowledge of Mathematics and Physics in Class-XII		
Module 1	Principles of Surveying:	4L + 2T	

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	Introduction, Principles and classification of surveying; Concept of scales; Survey stations and lines – ranging and bearing; Chain surveying – Concept, Instruments, numerical problems on errors due to incorrect chain; Plane table surveying – Advantages, disadvantages, parts, methods; Elements of simple and compound curves.			
Module 2	Levelling: Levelling – Principles, Precautions and Difficulties; Differential levelling, -- Concepts and numerical problems; Contouring.	3L + 1T		
Module 3:	Triangulation and Trilateration: Theodolite survey – Instruments, measurements of horizontal and vertical angles; Triangulation – Network, signals, numerical examples; Baseline measurement – site selection, measuring equipments, numerical problems on baseline corrections; Trigonometric levelling – Axis signal correction.	4L + 2T		
Module 4:	Advanced Surveying: Principle of Electronic Distance Measurement (EDM); Types of EDM instruments; Distomats; Total Station – Parts, advantages, applications, field procedure and errors; Global Positioning System (GPS) – Concept, applications, segments, location determination, errors; Principle of Differential GPS; Terrestrial laser scanner.	3L + 2T		
Module 5:	Photogrammetric Surveying: Concept; Classification of photogrammetric surveying – terrestrial, aerial and satellite; scale of a vertical photograph; relief displacement and object height determination; Stereoscopic vision – depth perception, parallaxic angle, stereoscopes; Object height determination using parallax; Parallax bar; Flight planning – Concept and numerical problems; Photo mosaic; Orthophotography; Stereoscopic plotting instruments.	4L + 2T		
Module 6	Remote Sensing: Energy sources and radiation principles; Concept of Electromagnetic Spectrum; Energy interactions in the atmosphere and earth surface features; Data acquisition and interpretation; Platforms and sensors – Geostationary and sun-synchronous orbits, pushbroom and whiskbroom scanning system, characteristics of IRS, Landsat and Sentinel sensors; Visual image interpretation	3L + 2T		
Module 7	Digital Image Processing: Concept; Image rectification and restoration; Image enhancement; Image classification; Accuracy assessment and post classification smoothing.	4L + 2T		
Module 8	Applications of Geomatics in Civil Engineering: 3D mapping; Earthquake and landslides; Runoff modelling; Groundwater targeting; Flood risk assessment; Urban planning; Highway and transportation	3L + 1T		
Reference	Sl.	Book Name	Author	Publishing House
	1	Surveying & Levelling	N. N. Basak	McGraw Hill Education (India) Private Limited
	2	Surveying – Vol. I, II & III	B. C. Punmia Ashok Kumar Jain Arun Kumar Jain	Laxmi Publications (P) Ltd.
	3	Surveying – Vol. I & II	S. K. Duggal	McGraw Hill Education (India) Private Limited
	4	Surveying & Levelling – Part I & II	T. P. Kanetkar S. V. Kulkarni	Pune Vidyarthi Griha Prakashan
	5	Remote Sensing and Image Interpretation	Thomas M. Lillesand Ralph W. Kiefer Jonathan W. Chipman	Wiley India Edition
	6	Remote Sensing and GIS	Basudeb Bhatta	Oxford University Press
	7	Principles of Geoinformatics	P.K. Garg	Khanna Publishing House
	8	Applications of Geomatics in Civil Engineering	J. K. Ghosh I. de Silva (Eds.)	Springer

CE(PC)404	Concrete Technology	2L + 1T	3 Credits
Course Outcome	On completion of the course, the students will be able to: <ol style="list-style-type: none"> 1. test all the required properties of concrete materials as per IS code. 2. compute the properties of concrete at fresh and hardened state. 3. design the concrete mix as per latest IS code methods. 4. ensure quality control while testing/ sampling. 5. Design the special type of concrete for specific application purposes. 6. Use the admixture as per requirement. 		
Prerequisite	Introduction to Civil Engineering CE(HS)302, Chemistry BS-CH101.		

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Module 1	Cement: Manufacturing of cement, Oxides composition of cement and the calculation of compounds, Heat of hydration, Types of cement-OPC, RPC. Low heat cement, PPC, PSC, Sulphate resisting cement, High Alumina cement, Expansive cement, White cement; Test on cement- fineness, consistency, initial setting time & final setting time, soundness test, strength test, specific gravity of cement, storage of cement.			5L + 3T
Module 2	Aggregates: Classification, Grading, alkali-aggregate reaction, deleterious substances in aggregates, physical properties, testing of aggregates- fineness modulus, bulking, specific gravity, sieve analysis, flakiness & elongation index. Quality of Water for mixing and curing - use of sea water for mixing concrete.			3L + 1T
Module 3:	Properties of fresh concrete: Workability, factors affecting workability, segregation and bleeding, tests on workability- slump test, compacting factor test, vee-bee test, flow table test.			3L + 1T
Module 4:	Properties of Hardened concrete: Tensile & compressive strength, flexural strength, stress-strain characteristics, modulus of elasticity, poisson's ratio, Creep, shrinkage, permeability of concrete, micro cracking of concrete.			3L + 1T
Module 5:	Strength of concrete: curing methods, water-cement ratio. gel-space ratio, maturity of concrete,			3L + 1T
Module 6	Admixtures: types, uses, superplasticizers, plasticizers, Bonding admixtures.			2L + 1T
Module 7	Mix Design – Objective, factors influencing mix proportion - Mix design by I.S. 10262-2019. (with & without admixture)			3L + 1T
Module 8	Non-destructive test: Rebound hammer and Ultra-sonic pulse velocity testing methods. Quality control - Sampling and testing, Acceptance criteria.			3L + 1T
Module 9	Special Concrete – Ferrocement - Fibre reinforced concrete - Polymer concrete - Sulphur Concrete - Self compacting concrete. Ready mix concrete, Batching plant.			4L + 1T
Reference	Sl.	Book Name	Author	Publishing House
	1	Concrete Technology (Theory & Practice)	Shetty, M.S.	S. Chand and Co.
	2	Concrete Technology	Gambhir, M.L.	Tata McGraw Hill
	3	Concrete Technology	A. M. Neville and J.J. Brooks	Pearson Education India Ltd.
	4	Properties of Concrete	A.M.Neville	Pearson India

CE(HS)401	Civil Engineering – Societal and Global Impact	2L + 0T	2 Credits
Course Outcome	On completion of the course, the students will be able to: 1. The impact which Civil Engineering projects have on the Society at large and on the global arena and using resources efficiently and effectively. 2. The extent of Infrastructure, its requirements for energy and how they are met: past, present and future 3. The Sustainability of the Environment, including its Aesthetics, 4. The potentials of Civil Engineering for Employment creation and its Contribution to the GDP 5. The Built Environment and factors impacting the Quality of Life 6. The precautions to be taken to ensure that the above-mentioned impacts are not adverse but beneficial. 7. Applying professional and responsible judgement and take a leadership role;		
Prerequisite			
Module 1	Introduction to Course and Overview; Understanding the past to look into the future: Preindustrial revolution days, Agricultural revolution, first and second industrial revolutions, IT revolution; Recent major Civil Engineering breakthroughs and innovations; Present day world and future projections, Ecosystems in Society and in Nature; the steady erosion in Sustainability; Global warming, its impact and possible causes; Evaluating future requirements for various resources; GIS and applications for monitoring systems; Human Development Index and Ecological Footprint of India Vs other countries and analysis;	3L	
Module 2	Understanding the importance of Civil Engineering in shaping and impacting the world; The ancient and modern Marvels and Wonders in the field of Civil Engineering; Future Vision for Civil Engineering	3L	
Module 3:	Infrastructure - Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy); Water provisioning;	8L	

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	Telecommunication needs (towers, above-ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability;			
Module 4:	Environment -Traditional & futuristic methods; Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River interlinking), Multi-purpose water projects, Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationarity and non-stationarity; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability.			7L
Module 5:	Built environment -Facilities management, Climate control; Energy efficient built environments and LEED ratings, Recycling, Temperature/ Sound control in built environment, Security systems; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures & Heritage structures; Innovations and methodologies for ensuring Sustainability			5L
Module 6	Civil Engineering Projects – Environmental Impact Analysis procedures; Waste (materials, manpower, equipment) avoidance/ Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects; New Project Management paradigms & Systems (Ex. Lean Construction), contribution of Civil Engineering to GDP, Contribution to employment(projects, facilities management), Quality of products, Health & Safety aspects for stakeholders; Innovations and methodologies for ensuring Sustainability during Project development			4L
Reference	Sl.	Book Name	Author	Publishing House
	1	Global Challenges and the Role of Civil Engineering. Chapter 3 in: Fischinger M. (eds) Performance-Based Seismic Engineering: Vision for an Earthquake Resilient Society. Geotechnical, Geological and Earthquake Engineering, Vol. 32.	Žiga Turk (2014)	Springer
	2	Elements of Environmental Pollution Control	O.P. Gupta	Khanna Publishing House
	3	Engineering impacting Social, Economical and Working Environment	Brito, Ciampi, Vasconcelos, Amarol, Barros (2013)	120th ASEE Annual Conference and Exposition

CE(MC)401	Management – I (Organizational Behaviour)	2L + 0T	2 Credits
Module 1	Introduction to Organizational Behaviour-Concept, Importance, Challenges and Opportunities Personality-Meaning of Personality, Personality Determinants and Traits, Psychoanalytic Theory, Argyris Immaturity to Maturity Continuum Impact on organization. Attitude-Concept, Components, Cognitive Dissonance Theory, Attitude Surveys.		5L
Module 2	Perception- Concept, Nature and Importance, Process of Perception, Factors influencing perception, Perceptual Selectivity, Shortcuts to Judge Others: Halo Effect, Stereotyping, Projection and Contrast Effects, Impact on Organization. Motivation-Definition, Theories of Motivation-Maslow's Hierarchy of Needs Theory, McGregor's Theory X&Y, Herzberg's Motivation-Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory.		6L
Module 3:	Leadership-Concept, Leadership Styles, Theories-Behavioural Theory: Ohio Studies, Michigan Studies, Blake & Mouton Managerial Grid; Contingency Theory: Fielder Theory. Group Behaviour: Definition, Characteristics of Group, Types of Groups: Formal & Informal; Stages of Group Development, Group Decision making, Group Decision Making Vs Individual Decision Making.		8L
Module 4:	Organizational Design-Various organizational structures and their pros and cons. Concepts of organizational climate and culture, Organizational Politics-Concept, Factors influencing degree of Politics Conflict management- Concept, Sources of conflict, Stages of conflict process, Conflict resolution techniques, Tools-Johari Window to analyse and reduce		5L

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	interpersonal conflict, Impact on organization.		
Reference	Sl.	Book Name	Author
	1	Organization Behaviour	Stephen Robbins
	2	Organization Behaviour	Luthans
	3	Organization Behaviour	L.M. Prasad
	4	Organization Behaviour : Text, Cases & Games	K. Aswathappa

CE(ES)491	Fluid Mechanics Laboratory	2P	1 Credits
Course Outcome	On completion of the course, the students will be able to: <ol style="list-style-type: none"> 1. Calibrate the notch and orifice meter. 2. Evaluate the performance of pump and turbine. 3. Determine the various hydraulic coefficients. 4. Determine the minor losses through pipes. 5. Measure the water surface profile due to formation of hydraulic jump. 6. Measure the water surface profile for flow over Broad crested weir. 		
Prerequisite	Introduction to Fluid Mechanics CE(ES)401		
Experiment 1	Calibration of Notches		
Experiment 2	Calibration of Orifice meter		
Experiment 3	Determination of Hydraulic Coefficient of an Orifice		
Experiment 4	Performance Test on Centrifugal Pump		
Experiment 5	Performance Test on Reciprocating Pump		
Experiment 6	Determination of Minor Losses in Pipes due to Sudden Enlargement and Sudden Contraction		
Experiment 7	Performance Test on Pelton Wheel Turbine		
Experiment 8	Measurement of water surface profile for flow over Broad crested weir		
Experiment 9	Measurement of water surface profile for a hydraulic jump		

CE(ES)492	Solid Mechanics Laboratory	2P	1 Credits
Course Outcome	After going through this course, the students will be able to: <ol style="list-style-type: none"> 1. Demonstrate the method and findings of tension and compression tests on ductile and brittle materials. 2. Explain the method of bending tests on mild steel beam and concrete beam. 3. Demonstrate the method and findings of Torsion test on mild steel circular bar and concrete beam. 4. Illustrate the concept of hardness and explain the procedure and findings of Brinell and Rockwell tests. 5. Demonstrate the concept and procedure of calculation of spring constant and elaborate its use in Civil Engineering. 6. Demonstrate the method and findings of Izod and Charpy impact tests. 7. Understand the concepts of fatigue test. 		
Prerequisite	Introduction to Solid Mechanics (CE(ES)402)		
Experiment 1	Tension test on Structural Materials: Mild Steel and Tor steel (HYSD bars)		
Experiment 2	Compression Test on Structural Materials: Timber, bricks and concrete cubes		
Experiment 3	Bending Test on Mild Steel		
Experiment 4	Torsion Test on Mild Steel Circular Bar		
Experiment 5	Hardness Tests on Ferrous and Non-Ferrous Metals: Brinell and Rockwell Tests		
Experiment 6	Test on closely coiled helical spring		
Experiment 7	Impact Test: Izod and Charpy		
Experiment 8	Demonstration of Fatigue Test		

CE(ES)493	Engineering Geology Laboratory	2P	1 Credits
Course Outcome	Upon completion of the course, the students will be able to: <ol style="list-style-type: none"> 1. Define and state the role of engineering geology in civil engineering 		

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	<ol style="list-style-type: none"> 2. Understand origin of rocks and geologic structures 3. Apply different tools to identify rocks and minerals in hand specimen and under microscope 4. Analyze the geological structures through drawing the cross sections from the geological maps 5. Evaluate the results obtained from different geological experiments 6. Investigate the natural hazards/disasters that are caused by the geological reasons
Prerequisite	Knowledge of basic physics and chemistry
Experiment 1	Identification of minerals in hand specimen
Experiment 2	Identification of igneous rocks in hand specimen
Experiment 3	Identification of sedimentary rocks in hand specimen
Experiment 4	Identification of metamorphic rocks in hand specimen
Experiment 5	Study of crystals with the help of crystal models
Experiment 6	Study of geologic structures with the help of models
Experiment 7	Interpretation of geological maps: horizontal, vertical, unclinal, folded and faulted structures
Experiment 8	Microscopic study of rocks and minerals

CE(PC)493	Surveying & Geomatics Laboratory	2P	1 Credits
Course Outcome	Upon completion of the course, the students will be able to: <ol style="list-style-type: none"> 1. State the interdependency and advancement of different surveying methods 2. Comprehend the working principles of different surveying and geomatics instruments and experiments 3. Execute the different methods of surveying and geomatics to measure the features of interest 4. Examine the results obtained from the surveying and geomatics experiments 5. Critically appraise the different techniques of surveying and geomatics in measuring and assessing the features of interest 6. Design and construct solutions for real world problems related to surveying and geomatics. 		
Prerequisite	Surveying & Geomatics [CE(PC)403]		
Experiment 1	Traverse survey by Prismatic Compass: Procedure; Computation and checks on closed traverse; Preparation of field book; Plotting the traverse; Sources of errors.		
Experiment 2	Theodolite Survey: Closed traverse by transit theodolite, Preparation of field book		
Experiment 3	Differential Levelling using Dumpy level: Collimation and Rise and Fall methods, Field book preparation		
Experiment 4	Total Station Survey: Traversing and Levelling		
Experiment 5	Visual Image Interpretation		
Experiment 6	Satellite Image Pre-processing		
Experiment 7	Digital Image Classification and Accuracy Assessment		
Experiment 8	Stereoscopic fusion of aerial photographs using mirror stereoscope		

CE(PC)494	Concrete Technology Laboratory	2P	1 Credits
Course Outcome	On completion of the course, the students will be able to: <ol style="list-style-type: none"> 1. Demonstrate the method and findings of tension and compression tests on concrete. 2. Understand the concepts of different test on hardened concrete. 3. Calculate the specific gravity of concrete ingredients. 4. Find out the mix proportion of high grade of concrete. 5. Measure the workability of concrete mix. 6. Know about the quality of concrete. 7. Understand the different properties of cement. 		
Prerequisite	Concrete Technology CE(PC)404		
Test on Fine aggregates	Bulking, Specific gravity, Bulk Density, Percentage voids, Fineness Modulus. Grading curve.		
Test on Coarse aggregates	Specific gravity, Bulk Density, Percentage voids, Fineness Modulus. Grading curve.		
Test on Cement	Normal consistency, fineness, Initial setting and final setting time of cement. Specific gravity, soundness and Compressive strength of Cement.		

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Test on Fresh Concrete	Concrete mix design, Various workability tests – slump, compacting factor, vee-bee test.
Test on Hardened Concrete	Split-tensile strength test, Flexure test, NDT Tests (Rebound hammer and Ultra-sonic pulse velocity), Poission ratio.

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Semester V [Third year]

CE(PC)501	Design of RC Structures	2L + 1T	3 Credits
Course Outcome	After going through this course, the students will be able to: <ol style="list-style-type: none"> 1. Understand material properties and design methodologies for reinforced concrete structures. 2. Assess different type of loads and prepare layout for reinforced concrete structures. 3. Identify and apply the applicable industrial design codes relevant to the design of reinforced concrete members. 4. Analyse and design various structural elements of reinforced concrete building like beam, slab, column, footing, and staircase. 5. Assessment of serviceability criteria for reinforced concrete beam and slab. 6. Prepare structural drawings and detailing and produce design calculations and drawing in appropriate professional format. 		
Prerequisite	Introduction to Solid Mechanics (CE(ES)402), Concrete Technology (CE(PC)404).		
Module 1:	Introduction: Principles of design of reinforced concrete members - Working stress and Limit State method of design	1L	
Module 2:	Working stress method of design: Basic concepts and IS code provisions (IS: 456 2000) for design against bending moment and shear forces - Balanced, under reinforced and overreinforced beam/ slab sections; design of singly and doubly reinforced sections	2L+2T	
Module 3:	Limit state method of design: Basic concepts and IS code provisions (IS: 456 2000) for design against bending moment and shear forces; concepts of bond stress and development length; Use of 'design aids for reinforced concrete' (SP:16).	5L+2T	
Module 4:	Beam Design by LSM: Analysis, design and detailing of singly reinforced rectangular, 'T', 'L' and doubly reinforced beam sections by limit state method.	3L+2T	
Module 5:	Slab Design by LSM : Design and detailing of one-way and two-way slab panels as per IS code provisions	2L+1T	
Module 6:	Continuous slab and beam design by LSM: Design and detailing of continuous beams and slabs as per IS code provisions	2L+1T	
Module 7:	Design of Staircases by LSM: Types; Design and detailing of reinforced concrete doglegged staircase	3L+1T	
Module 8	Design of Columns by LSM: Design and detailing of reinforced concrete short columns of rectangular and circular crosssections under axial load. Design of short columns subjected to axial load with moments (uniaxial and biaxial bending) – using SP 16.	4L+1T	
Module 9	Design of Foundation by LSM: Design and detailing of reinforced concrete isolated square and rectangular isolated and combined footing for columns as per IS code provisions by limit state method Design and detailing of Pile foundation as per IS code provisions.	6L+2T	
IS Codes	1	IS: 456 - 2000	
	2	IS 875 – I (1987), II (1987), -III (2015), -IV(1987), V (1987)	
	3	SP: 16 Design Aid to IS 456	
Reference	Sl.	Book Name	Author
	1	Reinforced Concrete Design	Pillai and Menon
	2	Reinforced Concrete Design	Krishna Raju & Pranesh
	3	R.C.C. Design	B.C. Punmia
	4	Reinforced concrete structures	N. Subramanian
	5	Limit State Design of Reinforced Concrete	P. C. Varghese
	6	Reinforced concrete	S.N. Sinha
			Publishing House
			TMH
			New Age
			Laxmi Publication
			OXFORD University Press
			PHI
			TMH

CE(PC)502	Engineering Hydrology	3L + 0T	3 Credits
Course Outcome	On completion of the course, the students will be able to: <ol style="list-style-type: none"> 1. study the source, occurrence, movement and distribution of water which is a prime resource for development of a nation. 2. learn about the functioning of reservoirs and estimation of storage capacities. 3. learn about flood hazards, estimation of design floods for various structures and methods of estimating effects of passage of floods through rivers and reservoirs. 4. know the basic principles of measurement of flow in rivers. 		
Prerequisite	Introduction to Civil Engineering CE(HS)302, CE(ES)401_Fluid Mechanics, Chemistry BS-CH101, Physics BS-PH101.		
Module 1	Hydrology: Hydrologic Cycle, Global Water Budget, India's Water Budget.		1L

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Module 2	Catchment: Definition & Descriptions, Various Types of Catchment, Factors Characterizing a Catchment, Delineation of Catchment Boundary.			2L
Module 3:	Measurement of Precipitation: Precipitation, Description and Functioning of Various Types of Rain gauges, Rain gauge Network- Codal Provisions, Optimum Number of Raingauge Stations.			2L
Module 4:	Processing of Rainfall Data: Normal Rainfall, Estimation of Missing Rainfall Data, Test for Consistency of Record; Mass Curve of Rainfall, Hyetograph, Point Rainfall; Mean Precipitation over an Area– Arithmetic Mean, Thiessen Polygon and Isohyetal Method.			4L
Module 5:	Losses from Precipitation: Evaporation – Evaporation Process, Factors affecting Evaporation, Measurement of Evaporation– Description and Functioning of Pan Evaporimeter, Pan Coefficient, Evapotranspiration: AET, PET, Measurement of ET, Estimation of ET–Blaney Criddle Formulae; Infiltration– Process, Factors Affecting Infiltration, Infiltration Rate and Infiltration Capacity, Measurement of Infiltration, Infiltration Equations, Infiltration Indices.			6L
Module 6	Streamflow Measurement: Importance, Direct and Indirect Methods, Measurement of Stage– Various Gauges and Recorders, Measurement of Velocity–Current Meters, their Functioning and Calibration; Velocity Distribution, Floats; Streamflow Computation– Area-Velocity Method, Moving Boat Method, Dilution Technique, Electromagnetic Method, Ultrasonic Method; Indirect Methods– Flow Measuring Structures, Slope Area Method; Stage-Discharge Relation, Permanent Control, Stage for Zero Discharge, Shifting Control– Backwater Effect, Unsteady Flow Effect, Extension of the Rating Curve.			12L
Module 7	Runoff: Description of the Process, Components of Runoff, Factors Affecting Runoff, Characteristics of Streams, Rainfall Runoff Relationships. Hydrographs: Types, Base Flow Separation, Effective Rainfall.			2L
Module 8	Unit Hydrograph– Definition, Assumptions, Applications– Derivation of Unit Hydrograph, Distribution Graph, Unit Hydrograph of Different Durations– Method of Superposition and S-Curve.			4L
Module 9	Floods: Concept of flood as a natural hazard; Estimation of flood discharge in a river – rational method, empirical formulae, unit hydrograph method; flood frequency studies – return period.			2L
Module 10	Flood Routing: Concept of flood routing in channels and through a reservoir, basic routing equations; reservoir routing – Modified Pul's method; channel routing – Muskingum method.			5L
Reference	Sl.	Book Name	Author	Publishing House
	1	Engineering Hydrology (4th Ed.	K. Subramanya	McGraw Hill Education (India) Private Limited, New Delhi, 2013.
	2	Engineering Hydrology	R. Srivastava and A. Jain	McGraw Hill Education (India) Private Limited, New Delhi, 2017.
	3	Applied Hydrology	V. T. Chow, D. Maidment, L. Mays	Tata McGraw Hill Edition, New Delhi, 2010.
	4	Hydrology	M. M. Das, M. Das Saikia	PHI Learning Private Limited, New Delhi, 2009.

CE(PC)503	Structural Analysis – I	2L + 1T	3 Credits
Course Outcome	After going through this course, the students will be able to: <ol style="list-style-type: none"> 1. Distinguish between stable and unstable and statically determinate and indeterminate structures. 2. Apply equations of equilibrium to structures and compute the reactions. 3. Calculate the internal forces in cable and arch type structures. 4. Evaluate and draw the influence lines for reactions, shears and bending moments in beams due to moving loads. 5. Use approximate methods for analysis of statically indeterminate structures. 6. Calculate the deflections of truss structures and beams. 		
Prerequisite	Introduction to Solid Mechanics (CE(ES)402)		
Module 1	Basics of Structural Analysis: Concept of static and kinematic indeterminacy, Determination of degree of indeterminacy for different types of structures. Theorem of minimum potential energy, law of conservation energy, principle of virtual work, the first and second theorems of Castiglano, Betti's law, Clark Maxwell's theorem of reciprocal deflection	3L+1T	
Module 2	Analysis of Determinate Structures: Portal Frames, Three hinged arches, Cables	3L+2T	

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Module 3	Deflection of Determinate Structures: Energy methods. Unit Load method for beams, Deflection of trusses and Simple Portal Frames.			3L+2T
Module 4	Influence Line Diagram: Statically determinate beams and trusses under series of concentrated and uniformly distributed rolling loads, criteria for maximum and absolute maximum moments and shear.			6L+3T
Module 5	Analysis of Statically Indeterminate Beams: Theorem of three moments, Energy methods, Force method (Method of consistent deformation) [For analysis of propped cantilever, fixed beams and continuous beams (maximum two degree of indeterminacy) for simple loading case], Analysis of two hinged arch.			8L+4T
Module 6	Influence Line Diagram for Indeterminate Structures: Muller – Breslau principle.			3L+2T
Reference	Sl.	Book Name	Author	Publishing House
	1	Structural Analysis	R. Agor	Khanna Publishing House
	2	Structural Analysis (Vol I & Vol II)	S S Bhavikatti	Vikas Publishing House Pvt. Ltd
	3	Structural Analysis	Ramamurtham	
	4	Strength of Materials and Theory of Structures (Vol I & Vol II)	Punmia, Jain, Jain	Laxmi Publication
	5	Structural Analysis	R.C. Hibbeler	Prentice Hall
	6	Theory of Structures	Timoshenko and Young	McGrawHill
	7	Structural Analysis	Pandit and Gupta	TMH

CE(PC)504	Soil Mechanics – II	2L + 1T	3 Credits
Course Outcome	After going through this course, the students will be able to: 1. Assess the compaction and consolidation characteristics of soil for solving geotechnical problems. 2. Calculate earth pressure on rigid retaining walls on the basis of classical earth pressure theories. 3. Analyze and design rigid retaining walls (cantilever types) from geotechnical engineering consideration. 4. Evaluate the bearing capacity of shallow foundation by applying established theory. 5. Estimate settlement in soils by different methods. 6. Compute safety of dams and embankments on the basis of various methods of slope stability analysis.		
Prerequisite	Soil Mechanics – I (CE(PC)401)		
Module 1	Consolidation of Soil Terzaghi's theory of one dimensional consolidation, Compressibility characteristics of soils, Compression index, Coefficient of compressibility and volume change, Coefficient of consolidation, Degree and rate of consolidation, Time factor, Settlement computation, Consolidometer and laboratory one dimensional consolidation test as per latest IS Code, Determination of consolidation parameters.		5L+3T
Module 2	Compaction of Soil Principles of compaction, Standard and modified proctor compaction test, Field compaction methods, Field compaction control, Factors affecting compaction, Effect of compaction on soil properties.		3L+1T
Module 3	Earth Pressure Theories Plastic equilibrium of soil, Earth pressure at rest, Active and passive earth pressures, Rankine's and Coulomb's earth pressure theories, Different types of backfill, Wedge method of analysis. Analytical and graphical methods for determination of earth pressure against various earth retaining structures. Stability of retaining walls: Cantilever retaining wall.		7L+3T
Module 4	Bearing capacity of shallow foundations Bearing capacity, Definition, Factors affecting bearing capacity, Modes of failures, Methods of determining bearing capacity of soils. Terzaghi's bearing capacity theory, Effect of depth of embedment, Eccentricity of load, Foundation shape on bearing capacity, Effect of 11 water table and eccentric loads. Isolated footings with combined action of loads and moments, Bearing capacity as per IS: 6403.		7L+4T
Module 5	Settlement Allowable bearing pressure and settlement analysis (as per IS: 8009), Immediate and consolidation settlements, Rigidity and depth factor corrections, Settlement values as per IS: 1904 recommendations.		2L+1T
Module 6	Stability of slopes Types of failure, Analysis of finite and infinite slopes, Swedish and friction circle method, Ordinary method of slices, Factor of safety, Taylor's stability number,		3L+2T

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	Bishop's simplified method of stability analysis.			
Reference	Sl.	Book Name	Author	Publishing House
	1	Textbook of Soil Mechanics and Foundation Engineering (Geotechnical Engineering Series)	V.N.S. Murthy	CBS Publishers
	2	Soil Mechanics and Foundations	Punmia, B.C. and Jain A. K	Laxmi Publications (P) Ltd
	3	Basic and Applied Soil Mechanics	Gopal Ranjan & A.S.R. Rao	New Age International Pvt.Ltd, Publishers
	4	Principles of Geotechnical Engineering	B.M. Das	Thomson Brooks / Cole

CE(PC)505	Environmental Engineering – II		2L + 1T	3 Credits
Course Outcome	After going through this course, the students will be able to: <ol style="list-style-type: none"> 1. Define the basic concepts and terminologies of waste water engineering and hazardous waste management 2. Describe different home plumbing systems for water supply and wastewater disposal 3. Apply the methods of quantifying sanitary sewage and storm sewage 4. Solve different mathematical problems regarding different components of sewerage system 5. Compare between different wastewater samples based on their physical, chemical and biological characteristics 6. Design different unit processes and operations involved in wastewater treatment 			
Prerequisite	Class-XII level knowledge of Physics, Chemistry, Mathematics, Biology and Environmental Science; Undergraduate level knowledge of Engineering Mechanics, Fluid Mechanics and Hydraulics; Environmental Engineering – I (CE(PC)402)			
Module 1	Sewage and Drainage Definition of Common Terms: Sewage or Sanitary Sewage, Drainage or Storm Sewage, Sullage, Black Water, Grey Water Sewerage Systems: Separate system, Combined System, Partially Separate System; applicability, advantages and disadvantages			1L+1T
Module 2	Sewage and Drainage Quantity Quantity estimation for sanitary sewage; Quantity estimation for storm sewage			3L+1T
Module 3	Conveyance of Sewage Sewers: Shapes; Design parameters; Operation and maintenance of sewers; Sewer appurtenances Hydraulic Design of Sewers: Partial flow diagrams and Nomograms			4L+2T
Module 4	Wastewater Characteristics Physical, chemical and biological characteristics of municipal and domestic sewage; Effluent discharge standards			4L+2T
Module 5	Wastewater Treatment Primary, secondary and tertiary treatment of wastewater; aerobic and anaerobic treatment options Primary and Secondary Treatment of Domestic Wastewater: Typical Flow Chart of STP; Screen and Bar Racks; Grit Chamber; Primary and Secondary Sedimentation Tank; Activated Sludge Process; Trickling Filter			8L+4T
Module 6	Sludge Handling and Disposal Sludge Thickening; Sludge Digestion; Sludge Drying Bed			3L+1T
Module 7	Building Plumbing Introduction to various types of home plumbing systems for water supply and waste water disposal; high rise building plumbing; Pressure reducing valves; Break pressure tanks; Storage tanks; Building drainage for high rise buildings; various kinds of fixtures and fittings used			3L+1T
Module 8	Hazardous waste Types and nature of hazardous waste as per the HW Schedules of regulating authorities			3L+1T
Reference	Sl.	Book Name	Author	Publishing House
	1	Environmental Engineering	S.C. Sharma	Khanna Publishing House
	2	Environmental Engineering. Volume-1 and Volume-2	Garg, S.K.	Khanna Publishers
	3	Environmental Engineering	Peavy, H.S, Rowe, D.R, Tchobanoglous, G	Tata McGraw Hill Indian Edition
	4	Elements of Environmental Pollution Control	O.P. Gupta	Khanna Publishing House
	5	Elements of Solid & Hazardous	O.P. Gupta	Khanna Publishing House

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	Waste Management		
6	Introduction to Environmental Engineering and Science	Masters, G.M., Ela, W.P.	Prentice Hall / Pearson
7	Manual on Sewerage and Sewage Treatment	CPHEEO	Govt. of India
8	Manual on Municipal Solid Waste Management.	CPHEEO	Govt. of India
9	Hazardous and other waste (Management and Transboundary Movement) Rules, 2016	MoEF	Govt. of India

CE(PC)506	Transportation Engineering	2L + 1T	3 Credits																				
Course Outcome	After going through this course, the students will be able to: <ol style="list-style-type: none"> 1. Understand the knowledge of planning, design and the fundamental properties of highway materials in highway engineering. 2. Apply the knowledge of geometric design and draw appropriate conclusion. 3. Interpret the concept of different methods in design, construction of the pavement. 4. Interpret traffic parameters by applying the knowledge in traffic planning and intersection design. 																						
Prerequisite	Class-XII level knowledge of Physics, Mathematics; Undergraduate level knowledge of Engineering Mechanics, Strength of Materials, Soil Mechanics																						
Module 1	Introduction to Highway Engineering Scope of Highway Engineering; Jayakar Committee Report: Recommendations – CRF, IRC, CRRI; Scope of Motor Vehicle Act; Recommendations of Nagpur Road conference; Road Classification as per third 20 years road development plan (1981-2001); Basic types of Road Patterns and its scope of application	2L+1T																					
Module 2	Highway alignment Factors controlling Highway Alignment; Engineering Surveys for Highway Alignment.	1L+1T																					
Module 3	Geometric Design Cross-sectional elements of highway; Design Parameters (as per IRC) – Vehicle dimensions, Carriageway width, Design speed, Frictional coefficients (Lateral and Longitudinal) etc; Design Principles of Horizontal Alignment: Camber, Sight Distance (PIEV theory, SSD, OSD, ISD); Horizontal Curves – [Radius, Super elevation, Extra widening, Set back distance, Transition curve]; Design Principles of Vertical Alignment: Gradients; Grade Compensation; Vertical Curves – Summit Curve, Valley curve.	8L+4T																					
Module 4	Traffic Engineering Traffic studies: Fundamental parameters of Traffic Flow (speed, flow, density, capacity) and their basic relations; Basics of Spot Speed Studies- Speed and Delay study- O & D study; Intersections and Channelization: At Grade and Grade Separated intersections; Conflict points; Salient features of Rotary; Traffic Signs; Signal Design – Basic concepts of IRC design method, 2 phase signal design by Webster method.	7L+3T																					
Module 5	Pavement Design Pavement materials: Bitumen, Aggregate, Subgrade soil; Types of Pavement: Flexible and Rigid pavements and their typical cross-sections; Design parameters: Wheel Load, ESWL, Tyre Pressure, CBR, Resilient Modulus & Poisson's Ratio of various layers, Subgrade Modulus etc. Design of Flexible Pavement using IRC 37:2018 Design of Rigid Pavement: Wheel Stresses, Frictional Stresses and Warping Stresses; Expansion, Contraction and Construction Joints; Design of Rigid Pavement thickness, Dowel Bar and Tie Bar. Distresses in Pavements	8L+5T																					
Module 6	Sustainability Scope of adoption of sustainable construction techniques by using recyclable hazardous materials- fly ash, plastics, recyclable construction materials.	1L+1T																					
Reference	<table border="1"> <thead> <tr> <th>Sl.</th><th>Book Name</th><th>Author</th><th>Publishing House</th></tr> </thead> <tbody> <tr> <td>1</td><td>Transportation Engineering</td><td>Kadiyali L.R</td><td>Khanna Book Publishing Co. (P) Ltd.</td></tr> <tr> <td>2</td><td>Traffic Engineering and Transport Planning</td><td>Kadiyali L.R</td><td>Khanna Publishers</td></tr> <tr> <td>3</td><td>Highway Engineering</td><td>Khanna, S.K. and C.E.G. Justo</td><td>Nem Chand and Bros</td></tr> <tr> <td>4</td><td>Transportation Engineering – An</td><td>Jotin Khisty C. and B.</td><td>Prentice Hall of India Pvt.</td></tr> </tbody> </table>	Sl.	Book Name	Author	Publishing House	1	Transportation Engineering	Kadiyali L.R	Khanna Book Publishing Co. (P) Ltd.	2	Traffic Engineering and Transport Planning	Kadiyali L.R	Khanna Publishers	3	Highway Engineering	Khanna, S.K. and C.E.G. Justo	Nem Chand and Bros	4	Transportation Engineering – An	Jotin Khisty C. and B.	Prentice Hall of India Pvt.		
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		Introduction	Kent Lall	Ltd
	5	Principles of Transportation and Highway Engineering	Rao G.V.	Tata McGraw-Hill Publishing Company Ltd
	6	Specifications for Road and Bridge Works, Fourth Edition	Indian Roads Congress	Ministry of Road Transport and Highways

CE(PC)591	RC Design Sessional	2P	1 Credits
Course Outcome	After going through this course, the students will be able to: <ol style="list-style-type: none"> 1. Understand material properties and design methodologies for reinforced concrete structures. 2. Assess different type of loads and prepare layout for reinforced concrete structures. 3. Identify and apply the applicable industrial design codes relevant to the design of reinforced concrete members. 4. Analyse and design various structural elements of reinforced concrete building like beam, slab, column, footing, and staircase. 5. Assessment of serviceability criteria for reinforced concrete beam and slab. 6. Prepare structural drawings and detailing and produce design calculations and drawing in appropriate professional format. 		
Prerequisite	Design of RC Structures (CE(PC)501)		
	Design of a small RCC framed building using Limit State method of design including preparation of necessary working drawing and report in accordance with CE(PC)501		

CE(PC)594	Soil Mechanics Laboratory	2P	1 Credits
Course Outcome	After going through this course, the students will be able to: <ol style="list-style-type: none"> 1. Identify different types of soil by visual inspection. 2. Determine natural moisture content and specific gravity of various types of soil. 3. Estimate in-situ density by core cutter method and sand replacement method. 4. Analyze grain size distribution and Atterberg limits for soil. 5. Perform laboratory tests to determine permeability and compaction characteristics of soil. 6. Determine shear strength parameters of soil by unconfined compression test and vane shear test. 7. Determine shear strength parameters of soil by direct shear test. 8. Perform triaxial test to determine shear strength parameters of soil. 9. Determine California Bearing Ratio (CBR) of soil. 10. Prepare technical laboratory report 		
Prerequisite	Soil Mechanics – I (CE(PC)401) and Soil Mechanics – II (CE(PC)504)		
Experiment 1	Field identification of different types of soil as per Indian Standards [collection of field samples and identifications without laboratory testing].		
Experiment 2	Determination of natural moisture content.		
Experiment 3	Determination of specific gravity of cohesionless and cohesive soils.		
Experiment 4	Determination of in-situ density by core cutter method and sand replacement method.		
Experiment 5	Determination of grain size distribution by sieve and hydrometer analysis.		
Experiment 6	Determination of Atterberg limits (liquid limit, plastic limit and shrinkage limit).		
Experiment 7	Determination of co-efficient of permeability by constant and variable head permeability tests.		
Experiment 8	Determination of compaction characteristics of soil by standard proctor compaction test.		
Experiment 9	Determination of unconfined compressive strength of soil by unconfined compression test.		
Experiment 10	Determination of shear strength parameters of soil by direct shear test.		
Experiment 11	Determination of undrained shear strength of soil by vane shear test.		
Experiment 12	Determination of shear strength parameters of soil by unconsolidated undrained triaxial test.		
Experiment 13	Determination of California Bearing Ratio (CBR) of soil.		
Experiment 14	Determination of relative density of soil.		
Experiment 15	Standard Penetration Test.		
Reference	<ol style="list-style-type: none"> 1. Soil Mechanics Laboratory Manual by Braja Mohan Das (Oxford university press). 2. SP: 36 (Part - I and Part - II) 		

CE(PC)595	Environmental Engineering Laboratory	2P	1 Credits
Course Outcome	On completion of the course the students will be able to: <ol style="list-style-type: none"> 1. Experiment various physical characteristics for a given sample of water and wastewater 2. Determine various chemical characteristics for a given sample of water and wastewater 3. Examine the bacteriological characteristics for a given sample of water and wastewater 4. Examine the suitability of a few treatment options for a given sample of water and wastewater 		

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	5. Compare the determined quality parameters with standards to decide on the suitability of use for the tested water and disposal of tested wastewater
Prerequisite	Class-XII level knowledge of Physics, Chemistry, Mathematics, Biology and Environmental Science; Undergraduate level knowledge of Environmental Engineering, Biology for Engineers, Chemistry Laboratory, Physics Laboratory
Experiment 1	Determination of turbidity for a given sample of water
Experiment 2	Determination of electrical conductivity for a given sample of water
Experiment 3	Determination of Total Solids, Suspended Solids, Dissolved Solids and Volatile Solids in a given sample of water
Experiment 4	Determination of pH for a given sample of water
Experiment 5	Determination of carbonate, bi-carbonate and hydroxide alkalinity for a given sample of water
Experiment 6	Determination of acidity for a given sample of water
Experiment 7	Determination of hardness for a given sample of water
Experiment 8	Determination of concentration of Iron in a given sample of water
Experiment 9	Determination of concentration of Chlorides in a given sample of water
Experiment 10	Determination of the Optimum Alum Dose for a given sample of water through Jar Test
Experiment 11	Determination of the Chlorine Demand and Break-Point Chlorination for a given sample of water
Experiment 12	Determination of amount of Dissolved Oxygen (DO) in a given sample of water
Experiment 13	Determination of the Biochemical Oxygen Demand (BOD) for a given sample of wastewater
Experiment 14	Determination of the Chemical Oxygen Demand (COD) for a given sample of wastewater
Experiment 15	Determination of Coliform Bacteria: presumptive test, Confirmative test and Determination of MPN
Reference	<ol style="list-style-type: none"> 1. Garg, S.K. <i>Environmental Engineering</i>. Volume-1 and Volume-2. Khanna Publishers 2. Peavy, H.S, Rowe, D.R, Tchobanoglous, G. <i>Environmental Engineering</i>. McGraw Hill International Edition / Tata McGraw Hill Indian Edition 3. Sawyer, C.N., McCarty, P.L., Parkin, G.F. <i>Chemistry for Environmental Engineering and Science</i>. McGraw Hill International Edition / Tata McGraw Hill Indian Edition 4. IS: 3025 (Different Parts), "METHODS OF SAMPLING AND TEST (PHYSICAL AND CHEMICAL) FOR WATER AND WASTE WATER". 5. APHA Standard Methods for the Examination of Water and Wastewater. 6. IS: 10500 – 2012, "DRINKING WATER SPECIFICATION (SECOND REVISION)".

CE(PC)596	Transportation Engineering Laboratory	2P	1 Credits
Prerequisite	Transportation Engineering (CE(PC)506)		
Introduction	Introduction on pavement construction materials		
Experiment 1	Shape test of aggregate		
Experiment 2	Crushing Strength Test of aggregate		
Experiment 3	Impact test of aggregate		
Experiment 4	Los Angeles Abrasion test of aggregate		
Experiment 5	Specific Gravity and Water Absorption test of aggregate		
Experiment 6	Specific Gravity test		
Experiment 7	Penetration test		
Experiment 8	Static or Kinematic viscosity		
Experiment 9	Softening point test		
Experiment 10	Flash and Fire Point test		
Experiment 11	Ductility test		
Experiment 12	CBR value of sub-grade (Soaked and unsoaked)		
Experiment 13	Marshall Stability test		
Demonstration	Demonstration on Stripping value and Loss on heating tests of bitumen, Benkelman Beam and Bump Integrator test.		

CE(PC)597	Computer Applications in Civil Engineering	2P	1 Credits
Course Outcome	On successful completion of this course, student should be able to: <ol style="list-style-type: none"> 1. Use the computer as a problem-solving tool. 2. Identify and formulate Civil Engineering problems solvable by computers. 3. Perform linear algebra and matrix operations and their application to solve Civil Engineering problems 4. Solve sets of linear equations and determine roots and nonlinear equations 		

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	5. Construct, interpret and solve simple optimization problems 6. Develop programs for Civil Engineering analysis and design problems. 7. Use various software used in industries for analysis and design.
Prerequisite	ES-CS291 Programming for Problem Solving, CE(ES)392 Computer-aided Civil Engineering Drawing.
Module 1	Introduction: Concept of problem-solving using computer, use of programming language and software for problem solving; Identification of various design and analysis problems in different fields of Civil Engineering to be solved using computers; Procedure, formulae and data related to the analysis and design of such problems.
Module 2	Use of spreadsheets: Learning spreadsheets like MS Excel, matrix analysis, use of Goal Seek and Solver, Optimization Tools; Plotting. Applications to problems involving tabular data, CE estimation, surveying, and design problems.
Module 3	Programming Languages: Learning at least one language: Fortran 2003/2008/2018, C++11/C++14, Python 3, VBA 7.0; Computing platforms like Matlab/Scilab/MathCAD; Solving analysis and design problems in areas like surveying, hydraulics, structural analysis, RCC design, soil mechanics and foundation, transportation, water resources, etc.
Module 4	Use of Software: Familiarity with widely used Civil Engineering software like STAAD Pro, HEC-RAS, HEC-HMS, SWMM, Mx Roads, etc.; Solving at least two such analysis/design problems.

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Semester VI [Third year]

CE(PC)601	Construction Engineering & Management		2L + 0T	2 Credits
Course Outcome	On completion of the course, the students will have: 1. An idea of how structures are built and projects are developed on the field 2. An understanding of modern construction practices 3. A good idea of basic construction dynamics- various stakeholders, project objectives, processes, resources required and project economics 4. A basic ability to plan, control and monitor construction projects with respect to time and cost 5. An idea of how to optimise construction projects based on costs 6. An idea how construction projects are administered with respect to contract structures and issues. 7. An ability to put forward ideas and understandings to others with effective communication processes			
Module 1	Planning: General consideration, Definition of aspect, prospect, roominess, grouping, circulation, Privacy.			2L
Module 2	Regulation and Bye laws Bye Laws in respect of side space, Back and front space, Covered areas, height of building etc., Lavatory blocks , ventilation, Requirements for stairs, lifts in public assembly building, offices			4L
Module 3:	Fire Protection Fire fighting arrangements in public assembly buildings, planning , offices, auditorium			2L
Module 4:	Planning &Scheduling of constructions Projects Planning by CPM Preparation of network, Determination of slacks or floats. Critical activities. Critical path. Project duration. Planning by PERT Expected mean time, probability of completion of project, Estimation of critical path, problems			6L
Module 5:	Construction Methods basics Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with blockwork walls; Modular construction methods for repetitive works; Precast concrete construction methods; Basics of Slip forming for tall structures; Basic construction methods for steel structures; Basics of construction methods for Bridges.			4L
Module 6	Construction plants & Equipment Plants & equipment for earth moving, road constructions, excavators, dozers, scrapers, spreaders, rollers, their uses. Plants &Equipment for concrete construction Batching plants, Ready Mix Concrete, concrete mixers, Vibrators etc., quality control.			3L
Module 7	Contracts Management basics Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price. Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Dispute Resolution methods.			4L
Module 8	Management Professional practice, Definition, Rights and responsibilities of owner, engineer, Contractors, types of contract			3L
Module 9	Departmental Procedures Administration, Technical and financial sanction, operation of PWD, Tenders and its notification, EMD and SD, Acceptance of tenders, Arbitration			2L
Reference	Sl.	Book Name	Author	Publishing House
	1	<i>Construction Engineering & Management</i>	S.V. Deodhar & S.C. Sharma	Khanna Publishing House
	2	<i>Building Construction</i>	Varghese, P.C.	Prentice Hall India,
	3	<i>National Building Code</i>	Bureau of Indian Standards	
	4	<i>Construction Technology</i>	Chudley, R.	ELBS Publishers

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	5	Construction Planning, Methods and Equipment	Peurifoy, R.L.	McGraw Hill
	6	Construction Methods and Management,	Nunnally, S.W.	Prentice Hall
	7	Project Planning with PERT and CPM	Punmia, B.C., Khandelwal, K.K.	Laxmi Publications

CE(PC)602	Engineering Economics, Estimation & Costing	2L + 0T	2 Credits
Course Outcome	On completion of the course, the students will: <ol style="list-style-type: none"> 1. Have an idea of Economics in general, Economics of India particularly for public sector agencies and private sector businesses 2. Be able to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives. 3. Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives. 4. Be able to understand the technical specifications for various works to be performed for a project and how they impact the cost of a structure. 5. Be able to quantify the worth of a structure by evaluating quantities of constituents, derive their cost rates and build up the overall cost of the structure. 6. Be able to understand how competitive bidding works and how to submit a competitive bid proposal. 		
Module 1	Basic Principles and Methodology of Economics. Demand/Supply – elasticity – Government Policies and Application. Theory of the Firm and Market Structure. Basic Macroeconomic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes		3L
Module 2	Elements of Business/Managerial Economics and forms of organizations. Cost & Cost Control –Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money (present and future worth of cash flows). Business Forecasting – Elementary techniques. Statements – Cash flow, Financial. Case Study Method.		3L
Module 3:	Estimation / Measurements for various items Introduction to the process of Estimation; Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams, Estimating Earthwork and Foundations, Estimating Concrete and Masonry, Finishes, Interiors, MEP works; BIM and quantity take-offs; adding equipment costs; labour costs; rate analysis; Material survey-Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, market survey of basic materials. Use of Computers in quantity surveying		9L
Module 4:	Specifications Types, requirements and importance, detailed specifications for buildings, roads, minor bridges and industrial structures.		3L
Module 5:	Rate analysis Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment/ productivity.		3L
Module 6	Tender- Preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. general and special conditions, termination of contracts, extra work and Changes, penalty and liquidated charges, Settlement of disputes, R.A. Bill & Final Bill, Payment of advance, insurance, claims, price variation, etc. Preparing Bids- Bid Price buildup: Material, Labour, Equipment costs, Risks, Direct & Indirect Overheads, Profits; Bid conditions, alternative specifications; Alternative Bids. Bid process management		3L
Module 7	Valuation Values and cost, gross income, outgoing, net income, scrap value, salvage value, market value, Book Value, sinking fund, capitalised value, Y. P., depreciation, obsolescence, deferred income, freehold and leasehold property, mortgage, rent fixation, valuation table		3L
Module 8	Introduction to Acts pertaining to-Minimum wages, Workman's compensation, Contracts, Arbitration, Easement rights.		2L

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Reference	Sl.	Book Name	Author	Publishing House
	1	Estimating, Costing Specifications & Valuation	M Chakravarty	
	2	Typical PWD Rate Analysis documents.		
	3	Estimating and Costing in Civil Engineering (Theory & Practice)	Dutta, B.N.	UBS Publishers
	4	Sociology & Economics for Engineers	Premvir Kapoor	Khanna Publishing House
	5	Distributors, Estimating and Costing in Civil Engineering: Theory and Practice including Specification and Valuations		UBS Publishers

CE(PC)603	Water Resources Engineering		2L + 0T	2 Credits
Course Outcome	<p>On successful completion of this course, student should be able to:</p> <ol style="list-style-type: none"> 1. Understand the fundamentals of flow in open channels. 2. Understand the concepts of irrigation. 3. Estimate the quantity of water required by different crops in different seasons, and accordingly the irrigation water requirement. 4. Design channels and other irrigation structures required for irrigation, drainage, soil conservation, flood control and other water-management projects. 5. Learn about groundwater resources, aquifers and wells. 			
Prerequisite	Introduction to Civil Engineering, Introduction to Fluid Mechanics CE(ES)401			
Module 1	Open Channel Flow: Channel Characteristics and parameters, Energy-depth relationships, Specific Energy concept, Critical Flow, Hydraulic Jump, Uniform flow, Efficient sections, Slope profiles, Gradually Varied Flow, Water surface profiles.			8L
Module 2	Irrigation: Definition, Necessity, Scope, Benefits of Irrigation; Types, techniques and sources of irrigation; Development of irrigation in India.			3L
Module 3:	Soil-water-plant Relationship: Types of crops, cropping seasons, water requirement of crops, base period, kor period, Duty, Delta, Commanded area, Net Irrigation Requirement, Field Irrigation Requirement, Gross Irrigation Requirement, Intensity of irrigation, Consumptive use of water, estimation of evapotranspiration, Blaney-Criddle method, Modified Penman's method, Irrigation efficiencies, Frequency of irrigation.			6L
Module 4:	Canal irrigation: Classification of irrigation canals, canals in alluvium; Design of unlined canals: Kennedy's method, Lacey's method; Lined canals: advantages, materials used, typical sections, design of lined canals, economics of canal lining; Canal sections – filling, cutting, partial cutting and partial filling.			6L
Module 5:	Land drainage: Water logging issues in irrigation, provision of drains, design and maintenance of open drains, closed drains, discharge and spacing of closed drains.			4L
Module 6	Groundwater: Occurrence of groundwater– Aquifers, Various Types of Aquifers, Aquifer Parameters: Specific Yield, Specific Retention, Storage Coefficient, Transmissivity.			4L
Reference	Sl.	Book Name	Author	Publishing House
	1	Irrigation and Water Power Engineering	B. C. Punmia, A. K. Jain and P. B. Lal	Laxmi Publications (P) Ltd., New Delhi, 2019.
	2	Irrigation, Water Resources and Water Power Engineering	P. N. Modi	Standard Book House, New Delhi, 2019.
	3	Irrigation Engineering and Hydraulic Structures	S. K. Sharma	S Chand Publishing, New Delhi, 2017.2012.
	4	Irrigation Engineering	N. N. Basak	Tata McGraw Hill Education India Private Limited, 2017.
	5	Open Channel Flow	Saiful Islam	Khanna Publishing House
	6	Irrigation and Water Resources Engineering	G. L. Asawa	New Age Publishers, New Delhi, 2005.

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CE(PC)604	Design of Steel Structures	2L + 0T	2 Credits
Course Outcome	After going through this course, the students will be able to: <ol style="list-style-type: none"> 1. Identify the material properties of structural steel. Moreover, the students will identify different bolted and welded connections, analyse and design them for axial and eccentric loads. 2. Design different steel sections subjected to axial compression and tension following Indian codes of practices. 3. Comprehend the differences between laterally supported and unsupported flexure members. Designing of the flexure members using Indian codes of practice. 4. Analyse and design rolled and built up compression members along with base connection subjected to axial compression, bending and tension. 5. Calculate shear force and bending moment on rolled and built up girders, dimension the section and finally design it following Indian standard design guidelines. 6. Identify different components of gantry system, calculate lateral and vertical loads acting on the system, dimension the components and design them. 7. Design different components of an industrial building. 		
Prerequisite	Introduction to Solid Mechanics (CE(ES)402)		
Module 1	Materials and Specification: Rolled steel sections, mechanical properties of steel and their specifications for structural use. Codes of practices. Design of Steel structures using tubular , rectangular and square section	1L	
Module 2	Structural connections: Riveted, welded and bolted including High strength friction grip bolted joints. – types of riveted & bolted joints, assumptions, failure of joints, efficiency of joints, design of bolted, riveted & welded joints for axial load. Eccentric connection:- Riveted & bolted joints subjected to torsion & shear, tension & shear, design of riveted, bolted & welded connection.	6L	
Module 3	Design of Tension members: Design of tension members, I.S code provisions. Permissible stresses, Design rules, Examples.	3L	
Module 4	Design of Compression members: Effective lengths about major & minor principal axes, I.S code provisions. Permissible stresses, Design rules, Design of one component, two components and built up compression members under axial load. Examples. Built up columns under eccentric loading: Design of lacing and batten plates, Different types of Column Bases- Slab Base, Gusseted Base, Connection details	6L	
Module 5	Design of Beams: Permissible stresses in bending, compression and tension. Design of rolled steel sections, plated beams. simple Beam end connections, beam -Column connections. I.S code provisions	4L	
Module 6	Design of Plate girders: Design of webs & flanges, Concepts of curtailment of flanges – Riveted & welded web stiffeners, web flange splices - Riveted, welded & bolted.	4L	
Module 7	Design of Gantry Girder: Design gantry girder considering lateral buckling – I.S code provisions.	4L	
IS Codes	1	IS 800 – 2007(Latest Revised code)	
	2	IS 875 – I (1987), II (1987), -III (2015), -IV(1987), V (1987)	
	3	S.P.: 6(1) – 1964 Structural Steel Sections	
	4	IS 1161 : 2014	
Reference	Sl.	Book Name	Publishing House
	1	Steel structures	N. Subramanian
	2	Design Of Steel Structures	S.K.Duggal
	3	Design Of Steel Structures	Bhavikatti
			I.K. Publishing House

CE(PE)601A	Stability of Slopes	2L + 0T	2 Credits
Course Outcome	On successful completion of this course, student should be able to: <ol style="list-style-type: none"> 1. Understand the fundamental theories and knowledge in the stability analysis of soil slopes. 2. Measure the finite and infinite slope stability. 3. Develop the analytical and numerical skills in treating a complicated practical slope problem. 4. Evaluate the safety and design proper slope protection measures. 5. Analyse the strength parameters in slope stability. 		
Prerequisite	Introduction to Civil Engineering (CE(HS)302), Soil Mechanics – I (CE(PC)401), Soil Mechanics – II (CE(PC)504).		
Module 1	Introduction: slope failure- causes, short- and long-term failure.	2L	
Module 2	Landslides: types, multiple and complex slides, rate of land movement, factor of safety, examples.	4L	
Module 3:	Slope stability analysis: basic concepts, finite and infinite slopes, analysis of	8L	

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	infinite slopes-dry or moist cohesive slope, non-cohesive slope, cohesive slope with seepage;			
Module 4:	Analysis of finite slopes: planar failure surface, circular failure surface, friction circle method, Taylors stability chart, locaton of critical circle, total stress analysis,		8L	
Module 5:	Method of Slices: Fellenius method, Bishop’s simplified method, effective stress stability chart.		4L	
Module 6	Non-circular failure surfaces, selection of strength parameter in slope stability, various slope protection measures.		2L	
Reference	Sl.	Book Name	Author	Publishing House
	1	Soil Mechanics and Foundation Engineering	P. Purushothama Raj	Pearson publication
	2	Principles of Foundation Engineering	Braja M. Das	Thomson Asia Pvt. Ltd., Singapore, 2005.
	3	Soil strength and slope stability	J.M. Duncan, S.G. Wright	John Wiley & Sons (Imprint: Hoboken, N.J.), 2005.
	4	Slope Analysis.	R. Chowdhury	Elsevier Scientific Publishing
	5	The Stability of Slopes.	E.N. Bromhead	Blackie Academic & Professional

CE(PE)601B	Foundation Engineering	2L + 0T	2 Credits
Course Outcome	On successful completion of this course, student should be able to: <ol style="list-style-type: none"> 1. Determine the load carrying capacity of pile foundation. 2. Compute the efficiency and settlement of pile group. 3. Understand different subsoil exploration methods and interpret field and laboratory test data to obtain design parameters for geotechnical analysis. 4. Correlate bearing capacity of shallow foundation from field test data. 5. Analyze and design sheet pile structure on the basis of earth pressure theories. 6. Understand and apply various types of ground improvement methods for solving complex geotechnical problems. 		
Prerequisite	Introduction to Civil Engineering (CE(HS)302), Soil Mechanics – I (CE(PC)401), Soil Mechanics – II (CE(PC)504).		
Module 1	Introduction Classification, selection- shallow and deep foundations.		2L
Module 2	Deep foundations Pile foundation: Types of piles, material, Suitability and uses, Method of installation of piles - classification of piles based on material, Installation Techniques – Selection and uses, Determination of types and lengths of piles, Load transfer mechanism, Determination of load carrying capacities of piles by static and dynamic formulae as per IS codes, Pile spacing and group action, Group efficiency, Negative skin friction, Pile load test, Settlement of pile group, Lateral load capacity of pile by IS: 2911 and Reese & Matlock methods, Uplift capacity of pile - introduction.		9L
Module 3:	Site Investigation & Soil Exploration Planning of sub-surface exploration, Methods of boring, sampling, Different types of samples, Spacing, Depth and number of exploratory borings, Bore log, Preparation of sub-soil investigation report. In-situ tests Standard penetration test, Static cone penetration test, Dynamic cone penetration test, Field vane shear test, Plate load test. Indirect methods of soil exploration Geophysical method: seismic refraction and electrical resistivity methods.		6L
Module 4:	Shallow Foundations Bearing Capacity from SPT, SCPT and Plate load Test data.		3L
Module 5:	Sheet pile structures Type of sheet piling, Design of sheet pile, Cantilever sheet piling, Anchored sheet piling, Free earth and fixed earth support methods, Analysis with anchored bulk heads.		4L
Module 6	Introduction to Ground Improvement Techniques Introduction, Economic considerations, Consolidation by preloading and sand		6L

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	drains, Stone columns, Compaction by vibro-floatation, Grouting techniques and principles, Applications of geo-synthetics, Ground anchors and soil nailing.			
Reference	Sl.	Book Name	Author	Publishing House
	1	Textbook of Soil Mechanics and Foundation Engineering (Geotechnical Engineering Series)	V.N.S. Murthy	CBS Publishers
	2	Soil Mechanics and Foundations	Punmia, B.C. and Jain A. K	Laxmi Publications (P) Ltd
	3	Basic and Applied Soil Mechanics	Gopal Ranjan & A.S.R. Rao	New Age International Pvt.Ltd, Publishers
	4	Principles of Geotechnical Engineering	B.M. Das	Thomson Brooks / Cole
	4	Soil Mechanics and Foundation Engineering	P. Purushothama Raj	Pearson publication
	5	Soil strength and slope stability	J.M. Duncan, S.G. Wright	John Wiley & Sons (Imprint: Hoboken, N.J.), 2005.
	6	Slope Analysis.	R. Chowdhury	Elsevier Scientific Publishing
	7	The Stability of Slopes.	E.N. Bromhead	Blackie Academic & Professional

CE(PE)601C	Ground Improvement Technique		2L + 0T	2 Credits
Course Outcome	On successful completion of this course, student should be able to: 1. gain competence in properly devising alternative solutions to difficult and earth construction 2. evaluate their effectiveness before, during and after construction. 3. understand different approaches to the ground modification. 4. Understand the soil stabilisation for reinforced earth construction.			
Prerequisite	Introduction to Civil Engineering CE(HS)302, Soil Mechanics – II CE(PC)504, Soil Mechanics – I CE(PC)401.			
Module 1	Introduction: ground modification by vibro-replacement, stone columns, preloading and prefabricated drains, Reinforced earth structures,			4L
Module 2	Insitu densification: Introduction, Compaction: methods and controls Densification of granular soil: Vibration at ground surface, Impact at ground surface, Vibration at depth (Vibroflotation), Impact at depth.			6L
Module 3:	Geo-textiles: Introduction to geotextiles and geomembranes, applications of geotextiles, design methods using geotextiles, geogrids, geonets, geomembranes, geotubes,			6L
Module 4:	Grouting: Over view: Suspension and Solution grout, Grouting equipment and methods, Grout design and layout, Grout monitoring schemes.			6L
Module 5:	Soil stability: Reinforced earth fundamentals, Soil nailing, Soil and Rock Anchors, Underpinning			4L
Module 6	Densification of Cohesive Soils: Preloading and dewatering, Design of Sand drains and Stone columns, Electrical and thermal methods.			4L
Reference	Sl.	Book Name	Author	Publishing House
	1	Construction and Geotechnical methods in foundation engineering	R.M. Koener	McGraw Hill
	2	Reinforced Earth	T S Ingold	Thoam Telford
	3	Designing with Geosynthetics	R M Koerner	Prentice Hall
	4	Ground Improvement Techniques	P. Purushothama Raj	Laxmi Publications Pvt Limited, 2 nd edition.
	5	Principles and Practice of Ground Improvement	Jie Han	Wiley publishers, 1 st edition.

CE(PE)602A	Building Construction Practice	2L + 0T	2 Credits
Module 1	Specifications, details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork - masonry – stone		12L

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	masonry – Bond in masonry - concrete hollow block masonry – flooring – damp proof courses – construction joints – movement and expansion joints – pre cast pavements – Building foundations – basements – temporary shed – centering and shuttering – slip forms – scaffoldings – de-shuttering forms – Fabrication and erection of steel trusses – frames – braced domes – laying brick – weather and water proof – roof finishes – acoustic and fire protection;	
Module 2	Sub Structure Construction Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement-Tunnelling techniques – Piling techniques - well and caisson - sinking cofferdam - cable anchoring and grouting-driving diaphragm walls, sheet piles - shoring for deep cutting - well points – Dewatering and stand by Plant equipment for underground open excavation;	10L
Module 3	Super Structure Construction Launching girders, bridge decks, off shore platforms – special forms for shells - techniques for heavy decks – in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors -Erection of articulated structures, braced domes and space decks	8L

CE(PE)602B	Structural Analysis – II	2L + 0T	2 Credits	
Course Outcome	After going through this course, the students will be able to: 1. Apply the Slope Deflection and Moment Distribution Method to analyze indeterminate structures. 2. Develop and analyze the concept of suspension bridge and stiffness girders 3. Apply and analyze the concepts of curved beam analysis in hooks, rings and Bow girders. 4. Develop the concept bending in unsymmetrical beams. 5. Develop the fundamental concepts of plastic analysis using kinematic method and apply them in frames and continuous beam analysis. 6. Develop and analyze the portal frames using Portal and Cantilever method. Develop and analyze the indeterminate structures (continuous beams and frames) using flexibility and stiffness matrix method.			
Prerequisite	Introduction to Solid Mechanics (CE(ES)402), Structural Analysis – I (CE(PC)503)			
Module 1	Analysis of statically Indeterminate Structures: Moment distribution method-solution of continuous beam, effect of settlement and rotation of support, frames with or without side sway. Slope deflection method: method and application in continuous beams and frames. Suspension Bridge and stiffening girders.	8L		
Module 2	Curved Beam analysis: Hooks, rings and Bow girders. Unsymmetrical bending.	8L		
Module 3	Plastic analysis of structures: beams and portal frames.	5L		
Module 4	Approximate method of analysis of structures: Portal and Cantilever methods.	4L		
Module 5	Matrix methods of structural analysis – Stiffness and flexibility approaches for analysis of beam.	5L		
Reference	Sl.	Book Name	Author	Publishing House
	1	Structural Analysis	R. Agor	Khanna Publishing House
	2	Structural Analysis (Vol I & Vol II)	S S Bhavikatti	Vikas Publishing House Pvt. Ltd
	3	Structural Analysis	Ramammurtham	
	4	Strength of Materials and Theory of Structures (Vol I & Vol II)	Punmia, Jain, Jain	Laxmi Publication
	5	Structural Analysis	R.C. Hibbeler	Prentice Hall
	6	Theory of Structures	Timoshenko and Young	McGrawHill
	7	Structural Analysis	Pandit and Gupta	TMH
	8	Theory of Matrix Structural Analysis	J.S. Przemieniecki	DOVER PUBLICATIONS, INC.

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CE(PE)602C	Industrial Structure	2L + 0T	2 Credits	
Course Outcome	After going through this course, the students will be able to: 1. To perform the analysis and design of reinforced concrete members and their connections. 2. To identify and apply the industrial design codes relevant to the design of Reinforced concrete members. 3. To be familiar with the professional and contemporary design issues and fabrication of Reinforced concrete members.			
Prerequisite	Introduction to Solid Mechanics (CE(ES)402), Structural Analysis – I (CE(PC)503), Design of RC Structures (CE(PC)501)			
Module 1	Overall Review of RC Design: Review of Limit State Design of Beams, Slabs & Columns according to IS 456-2000. Yield line theory, Biaxial Bending & Slander Column. Analysis and Design of beams curved in plan: Design principle, structural design of beams curved in plan of circular and rectangular types. Flat slabs: Introduction, components – IS code provisions Design method – Design for flexure and shear and Detailing.	8L		
Module 2	Deep beams: Introduction, Flexural and shear stresses in deep beam and Design and Detailing. Water tank: Introduction, Types, Analysis and Design of water tanks e.g. Underground & Elevated water tank (Circular, Rectangle and Intz)	7L		
Module 3	Raft Foundation: Introduction, Types and Design of raft foundation. Design of folded plate Design of shear wall as per IS 13920	7L		
Module 4	Design of bunkers and silos: Introduction, Difference between Bunkers and Silo (rectangular, square and circular bunker and silo design for storage of cement). Analysis and design of chimneys: Introduction and different type of linings, wind load calculation on chimney (Static and dynamic) Analysis and design of chimney linings, foundation types.	8L		
IS Codes	1	IS: 456 – 2000 (latest revision)		
	2	IS 875 – I (1987), II (1987), -III (2015), -IV(1987), V (1987)		
	3	SP: 16 Design Aid to IS 456		
	4	IS 1893-Part-I: 2016, IS 1893-Part-II: 2014		
	5	IS 3370 –I (1967), II (2009), III (1967), IV (1967)		
Reference	Sl.	Book Name	Author	Publishing House
	1	R.C.C. Design	B.C. Punmia	Laxmi Publication
	2	Reinforced concrete structures	N. Subramanian	OXFORD University Press
	3	Advanced Reinforced Concrete Design	P. C. Varghese	PHI
	4	Advanced Reinforced Concrete Design	N. KrishnaRaju	CBS Publishers

CE(OE)601A	Soft Skills and Interpersonal Communication – I	2L + 0T	2 Credits
Course Outcome	<ol style="list-style-type: none"> Analyse the dynamics of business communication and communicate accordingly. Write business letters and reports Learn to articulate opinions and views with clarity Appreciate the use of language to create beautiful expressions Analyse and appreciate literature. Communicate in an official and formal environment. 		
Module 1	Communication Skill Definition, nature & attributes of Communication Process of Communication Models or Theories of Communication Types of Communication Levels or Channels of Communication Barriers to Communication	3L	
Module 2	Business Communication- Scope & Importance Writing Formal Business Letters Writing Reports Organizational Communication: Agenda & minutes of a meeting, notice, memo, circular Project Proposal Technical Report Writing Organizing e-mail messages E-mail etiquette Tips for e-mail effectiveness	8L	
Module 3	Language through Literature Modes of literary & non-literary expression Introduction to Fiction, (An Astrologer's Day by R.K. Narayan and Monkey's Paw by W.W. Jacobs), Drama (The Two Executioners by Fernando Arrabal) or (Lithuania by Rupert Brooke) & Poetry (Night of the Scorpion by Nissim Ezekiel and Palanquin Bearers by Sarojini Naidu)	8L	

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Module 4	Grammar in usage (nouns, verbs, adjectives, adverbs, tense, prepositions, voice change) - to be dealt with the help of the given texts.			10L
Reference	Sl.	Book Name	Author	Publishing House
	1	Theories of Communication: A Short Introduction	Armand Matterlart and Michele Matterlart	Sage Publications Ltd
	2	Professional Writing Skills	Chan, Janis Fisher, and Diane Lutovich	San Anselmo, CA: Advanced Communication Designs, 1997.
	3	Effective Business Communications	Kulbhushan Kumar	Khanna Publishing House
	3	Writing and Speaking at Work: A Practical Guide for Business Communication	Edward P. Bailey	Prentice-Hall
	4	Intercultural Business Communication	Lillian Chaney and Jeanette Martin	Prentice Hall

CE(OE)601B	Introduction to Philosophical Thoughts	2L + 0T	2 Credits
Module 1	Introduction to Indian Philosophy: Brief discussion on Veda and Upanishads; Origin of Indian Philosophy		1L
Module 2	Charvaka Philosophy: Epistemology; Metaphysics		2L
Module 3	Samkhya Philosophy: Metaphysics; Theory of Causation. --Prakṛti, Purusa, Evolution; Epistemology		3L
Module 4	Yoga Philosophy: Organization of the YogaSutras; Psychology of Yoga -- Stages of Citta, Forms of Citta, Modifications of Citta, Kinds of Klesas; The Eight-Fold Yoga; God and Liberation		3L
Module 5	Nyaya Philosophy : Epistemology -- Perception (Pratyakṣa), Inference (Anumāna), Comparison (Upamāna), Testimony (Sabda); Theory of Causation (Asatkāryavāda); Self and Liberation; The Concept of God		5L
Module 6	Mimamsa Philosophy: Epistemology -- Validity of Knowledge; Sources of Valid Knowledge (Pramāna) – Perception, Inference, Comparison, Verbal Testimony, Postulation (Arthapati), Non Apprehension (Anupalabdhi); Theories of Error (Khyativāda) – Akhyativāda, AnirvacaniyaKhyativāda, Viparitakhyativāda; Metaphysics -- Theory of Causation; Nature of Self; God and Liberation		4L
Module 7	Vaisesika Philosophy: Metaphysics and the Categories -- Substance (Dravya), Quality (Guṇa), Action (Karma), Generality (Sāmānya), Particularity (Vaiśeṣa), Inherence (Samavāya), Nonexistence (Abhāva); Epistemology; The Concept of God; Bondage and Liberation		3L
Module 8	Buddhist Philosophy: Epistemology -- Dependent Origination; Four Noble Truths; Eight Fold Paths; Ethics; Karma and Rebirth; Liberation		4L
Module 9	Jaina Philosophy: Syādvāda; Anekāntavāda; Ethics; Karma and Liberation		3L

CE(PC)693	Water Resource Engineering Laboratory	2P	1 Credits
Course Outcome	On completion of the course, the students will be able to: <ol style="list-style-type: none"> 1. Delineate the watershed of any reservoir using DEM. 2. Determine the average rainfall over a catchment. 3. Use the raingauge properly for a specified purpose. 4. Measure the rate of infiltration of water through the soil. 5. Measure the sunshine hours in a particular day. 		
Prerequisite	Engineering Hydrology CE(PC)502 & Water Resources Engineering CE(PC)603		
Experiment 1	Catchment area delineation (Manually and using DEM)		
Experiment 2	Calculation of average rainfall over a catchment area with arithmetic mean method, Thiessen polygon method and Isohyetal Method.		
Experiment 3	Use of different type of Rain gauges.		
Experiment 4	Measurement of infiltration rate using double ring infiltrometer.		
Experiment 5	Measurement of evaporation using evaporimeter.		
Experiment 6	Measurement of bright sunshine hours using sunshine recorder.		

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CE(PC)694	Steel Structure Design Sessional	2P	1 Credits
Course Outcome	After going through this course, the students will be able to: <ol style="list-style-type: none"> 1. Identify the material properties of structural steel. Moreover, the students will identify different bolted and welded connections, analyse and design them for axial and eccentric loads. 2. Design different steel sections subjected to axial compression and tension following Indian codes of practices. 3. Comprehend the differences between laterally supported and unsupported flexure members. Designing of the flexure members using Indian codes of practice. 4. Analyse and design rolled and built up compression members along with base connection subjected to axial compression, bending and tension. 5. Calculate shear force and bending moment on rolled and built up girders, dimension the section and finally design it following Indian standard design guidelines. 6. Identify different components of gantry system, calculate lateral and vertical loads acting on the system, dimension the components and design them. 7. Design different components of an industrial building. 		
Prerequisite	Design of Steel Structures (CE(PC)604)		
	Design of a factory shed including preparation of necessary working drawings and report in accordance with CE(PC)604		

CE(PC)695	Quantity Survey Estimation and Valuation Sessional	1T+2P	2 Credits
Course Outcome	The subject aims to provide the student with: <ol style="list-style-type: none"> 1. An introduction to quantity surveying 2. The capability to know analysis and schedule of rates 3. The ability to know specification of materials 4. An understanding about specification of works 5. The introduction to valuation 		
Prerequisite	Introduction to Civil Engineering [CE(HS)302], Construction Engineering & Management [CE(PC)601], Engineering Economics, Estimation & Costing [CE(PC)602]		
	<ol style="list-style-type: none"> 1. Quantity Surveying: Types of estimates, approximate estimates, items of work, unit of measurement, unit rate of payment. 2. Quantity estimate of a single storied building 3. Bar bending schedule. 4. Details of measurement and calculation of quantities with cost, bill of quantities, abstract of quantities. 5. Estimate of quantities of road, Underground reservoir, Surface drain, Septic tank. 6. Analysis and schedule of rates: Earthwork, brick flat soling, DPC, PCC and RCC, brick work, plastering, flooring and finishing, 7. Specification of materials: Brick, cement, fine and coarse aggregates 8. Specification of works: Plain cement concrete, reinforced cement concrete, first class brickwork, cement plastering, pointing, white washing, colour washing, distempering, lime punning, painting and varnishing 9. Valuation: Values and cost, gross income, outgoing, net income, scrap value, salvage value, market value, Book Value, sinking fund, capitalised value, Y. P., depreciation, obsolescence, deferred income, freehold and leasehold property, mortgage, rent fixation, valuation table 		

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Semester VII [Fourth year]

CE(OE)701A	Metro System and Engineering	2L + 0T	2 Credits
Module 1	Overview of Metro Systems; Need for Metros; Routing studies; Basic Planning and Financial.		4L
Module 2	CIVIL ENGINEERING Overview and construction methods for: Elevated and underground Stations; Viaduct spans and bridges; Underground tunnels; Depots; Commercial and Service buildings. Initial Surveys & Investigations; Basics of Construction Planning & Management, Construction Quality & Safety Systems. Traffic integration, multimodal transfers and pedestrian facilities; Environmental and social safeguards; Track systems-permanent way. Facilities Management		12L
Module 3:	ELECTRONICS AND COMMUNICATION ENGINEERING Signaling systems; Automatic fare collection; Operation Control Centre (OCC and BCC); SCADA and other control systems; Platform Screen Doors.		5L
Module 4:	MECHANICAL & TV + AC Rolling stock, vehicle dynamics and structure; Tunnel Ventilation systems; Air conditioning for stations and buildings; Fire control systems; Lifts and Escalators		5L
Module 5:	ELECTRICAL: OHE, Traction Power; Substations- TSS and ASS; Power SCADA; Standby and Back-up systems; Green buildings, Carbon credits and clear air mechanics		5L

CE(OE)701B	ICT for Development	2L + 0T	2 Credits
Module 1	Introduction to ICT: New media and ICT, Different types of ICT. Use of ICT for development; e-learning; Web commerce; Mobile telephony and Development: telecom industry in India. ICT Projects implemented in India and Northeast – Problems and Prospects		7L
Module 2	Digital Revolution and Digital Communication: Basics of New media theories – Information Society; Surveillance society; Digital Divide, Knowledge society; Network society. Works of Machlup, Bell, Negroponte and Castells		6L
Module 3:	Technology and Development: ICT for Development its societal implications; Evolution of ICT in Development Endeavour; ICT and Millennium Development Goals. Democratic and decentralized processes in development. Technology and culture: community and identity; participatory culture and ICT, community informatics		8L
Module 4:	Computer Mediated Communication and development: Different types of CMC; Important theoretical framework of CMC, cyber platform and communities, Social Networking Site; Convergent media, Multimedia platforms, Scope of convergent journalism for Development; Characteristics of convergent journalism; Different types of convergent journalism: precision journalism; annotative and open-source journalism; wiki journalism; open source journalism; citizen journalism; back-pack journalism, Convergent technologies and applications; Multimedia convergence and Interactivity		10L

CE(OE)701C	Cyber Law & Ethics	2L + 0T	2 Credits
Module 1	Introduction: Basics of Law, Understanding Cyber Space, Defining Cyber Laws, Scope and Jurisprudence, Concept of Jurisdiction, Cyber Jurisdiction, Overview of Indian Legal System, Introduction to IT Act 2000, Amendments in IT Act, Cyber Laws of EU – USA – Australia - Britain, other specific Cyber laws		6L
Module 2	Computer Ethics, Privacy and Legislation: Computer ethics, moral and legal issues, descriptive and normative claims, Professional Ethics, code of ethics and professional conduct. Privacy, Computers and privacy issue, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT, Legal Policies, legislative background		7L
Module 3:	Intellectual Property Rights Issues: Copyrights, Jurisdiction Issues and Copyright Infringement, Multimedia and Copyright issues, WIPO, Intellectual Property Rights, Understanding Patents, Understanding Trademarks, Trademarks in Internet, Domain name registration, Software Piracy, Legal Issues in Cyber Contracts, Authorship, Document Forgery		7L
Module 4:	Indian IT Act and Standards: Indian IT ACT, Adjudication under Indian IT ACT, IT Service Management Concept, IT Audit standards, ISO/IEC 27000 Series, COBIT, HIPPA, SOX, System audit, Information security audit, ISMS, SoA (Statement of Applicability), BCP (Business Continuity Plan), DR (Disaster		6L

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	Recovery), RA (Risk Analysis/Assessment)			
Module 5:	International Laws governing Cyber Space: Introduction to International Cyber Law, UNCITRAL, Cyber Laws: Legal Issues and Challenges in India, Net neutrality, Role of INTERPOL.			4L
Reference	Sl.	Book Name	Author	Publishing House
	1	Computer Ethics	Deborah G. Johnson	Pearsons Education
	2	Information Security and Cyber Laws	Gupta & Gupta	Khanna Publishing House
	3	Cyber Law Simplified	Vivek Sood	McGraw Hill Education
	4	Cyber frauds, cybercrimes & law in India	Pavan Duggal,	Saakshar Law Publications
	5	The Internet Law of India: Indian Law Series	Shubham Sinha	CreateSpace Independent Publishing Platform

CE(PE)701A	Computational Hydraulics		2L + 1T	3 Credits
Course Outcome	On successful completion of this course, student should be able to: 1. Identify the complexities involved in fluid flow problems. 2. Model the specific flow problem in terms of defining the governing equations, initial and boundary conditions and appropriate solution schemes to use. 3. Develop finite difference formulation of ordinary and partial differential equations of flow problems. 4. Develop finite volume formulation of ordinary and partial differential equations of flow problems.			
Prerequisite	Introduction to Civil Engineering CE(HS)302, Introduction to Fluid Mechanics CE(ES)401, Water Resources Engineering CE(PC)603,			
Module 1	Introduction: Modelling Theory - Physical modelling, analytical modelling, numerical modelling; classification of models based on i) Scale (space and time), ii) Solution (analytical and numerical); Concept of computational hydraulics; Processes involved in model development and application.			4L
Module 2	Modelling Fluid Flow Problems: Governing equations- Conservation of mass, conservation of momentum, conservation of energy; Mathematical classification of flow equations, solution of ordinary differential equations and partial differential equations, boundary conditions; Solution of Saint-Venant Equations - Kinematic wave solution, Diffusive wave solution and full dynamic solution; Characteristic form of Saint-Venant Equations.			8L
Module 3:	Numerical Solution Schemes: Discrete solution of governing equations, Space discretization - Structured grids and unstructured grids, grid generation, time discretization.			2L
	Finite Difference Method: General concept, approximation of derivatives; Finite difference formulation for ordinary differential equations - Explicit schemes, Implicit schemes, Mixed schemes and weighted average schemes; Finite difference formulation for partial differential equations - initial conditions, boundary conditions, explicit and implicit schemes; The Preissmann Scheme, The Abbott-Ionescu scheme.			8L
	Example Applications: Ordinary differential equation - Solution of linear reservoir problem; Partial differential equation - Solution of simple wave propagation, Solution of diffusion equation.			6L
Module 4:	Finite Volume Method: General concept, Steps in application of Finite Volume Method- Surface and volume integrals, Discretization of convective fluxes, Discretization of diffusive fluxes, evaluation of time derivative, boundary conditions.			8L
	Example Application: Solution of Advection-Diffusion Equation in 1-D.			4L
Reference	Sl.	Book Name	Author	Publishing House
	1	Computational Hydraulics	M. B. Abbott and A. W. Minns	Routledge, London, 2016
	2	Computational Hydraulics – An Introduction	C. B. Vreugdenhil,	Springer – Verlag, New York, 1989
	3	Computational Hydraulics	C. A. Brebbia and A. J. Ferrante,	Butterworth-Heinemann, 2013.
	4	Computational Methods for Fluid Dynamics,	J. H. Ferziger and M. Peric	Springer, London, 2002.

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CE(PE)701B	Disaster Preparedness and Planning		2L + 1T	3 Credits
Course Outcome	On completion of the course the students will be able to: 1. Define the basic concepts and terminologies disaster management 2. Understand and describe the categories of disaster 3. Realize the roles and responsibilities of a civil engineer towards society in time of a disaster 4. Analyze relationship between development and disasters 5. Apply different concepts of disaster management			
Prerequisite	Class-X level knowledge of Indian Geography and Class-XII level knowledge of Physics, Chemistry, Mathematics, Biology and Environmental Science; Undergraduate level introductory knowledge of Civil and Environmental Engineering			
Module 1	Introduction, Basic Concepts and Definitions Disaster, Hazard, Vulnerability, Risks, Severity, Frequency and details, Capacity, Impact, Prevention, Mitigation			3L+1T
Module 2	Disasters and their Classification Natural Disasters: Floods, Draught, Cyclones, Volcanoes, Earthquakes, Tsunami, Landslides, Coastal Erosion, Soil Erosion, Forest Fires Manmade Disasters: Industrial Pollution, Artificial Flooding in Urban Areas, Nuclear Radiation, Chemical Spills, Transportation Accidents, Terrorist Strikes Hazard and vulnerability profile of India, Mountain and coastal areas, Ecological fragility			5L+3T
Module 3:	Disaster Impacts Disaster Impacts: Environmental, Physical, Social, Ecological, Economic, Political Health, Psycho-social issues; Demographic aspects (gender, age, special needs); Hazard locations; Global and national disaster trends; Climate change and urban disasters.			7L+3T
Module 4:	Disaster Risk Reduction (DRR) Phases of disaster management cycle; Prevention, Mitigation, Preparedness, Relief and recovery; Structural and non-structural measures; Risk analysis, Vulnerability and capacity assessment; Early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority			7L+3T
Module 5:	Disasters, Environment and Development Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land use changes, urbanization etc.), Sustainable and environmental friendly recovery; Reconstruction and development methods			6L+4T
Reference	Sl.	Book Name	Author	Publishing House
	1	Disaster Management	S.C. Sharma	Khanna Publishing House
	2	Disaster Risk Reduction in South Asia	Pradeep Sahni	Prentice Hall
	3	Handbook of Disaster Management: Techniques & Guidelines	Singh B.K.	Rajat Publication
	4	Disaster Medical Systems Guidelines	Emergency Medical Services Authority	State of California, EMSA no.214, June 2003
	5	IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings	Inter Agency Standing Committee (IASC) (Feb. 2007).	
	6	http://ndma.gov.in/ (Home page of National Disaster Management Authority)		
7	http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)			

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CE(PE)701C	Hydraulic Structures		2L + 1T	3 Credits
Course Outcome	On successful completion of this course, student should be able to: 1. Identify the characteristics of various types of dams and their selection procedure. 2. Perform the reconnaissance survey and, geophysical investigations necessary for selection of suitable dam site 3. Estimate forces acting on a gravity dams and perform stability analysis. 4. Estimate the seepage loss through embankment dams and suggest necessary remedial measures. 5. Calculate the discharge through the overflow section and design the appropriate energy dissipation structures.			
Prerequisite	Introduction to Civil Engineering CE(HS)302, Water Resources Engineering CE(PC)603,			
Module 1	Storage Structures: Dams, Types of Dams – Embankment dams, gravity dams, various components and their functions			1L + 1T
Module 2	Selection of Dam Site: Site investigations, initial study, reconnaissance survey, geophysical investigations, preliminary selection, evaluation of selected site - various types of foundation testing, field testing and borrow pit investigations, detailed investigations; assessment of foundation characteristics and suitability; selection of type of dam.			4L + 2T
Module 3:	Gravity Dam: Definition, Features of some important gravity dams, Forces acting on a gravity dam, estimation of forces due to: self-weight, water pressure on upstream and downstream face, Uplift pressure, wave pressure, silt pressure, wind pressure, earthquake forces, hydrodynamic forces; Stability analysis - load combinations, codal provisions, modes of failures - overturning, sliding, tension and compression failures, factors of safeties, principal stresses; Elementary profile of a gravity dam - forces acting, minimum base width - no tension, no sliding basis, principal stresses.			8L + 4T
	Embankment Dams: Definitions, Features of some important embankment dams; Types of embankment dams and their sectional features; Design criteria; Freeboard - necessity, estimation procedure; Seepage analysis - Laplace's flow equations, drainage blanket and rock toe, phreatic line, graphical procedure of drawing phreatic line, estimation of seepage loss; Stability analysis of embankment dams – slip circle method; Seepage Control - cut-offs, slurry trench, sheet piling, grouting, slope protection.			6L + 2T
	Diversion headworks: Necessity and uses, different types, layout and different components; weirs on permeable foundation, Creep theories, Khosla's method; Different types of modules, Canal escapes, Silt control devices.			5L + 3T
Module 4:	Spillways and Energy Dissipation Structures: Necessity, types, selection, spillway gates; High overflow ogee spillway - profile, discharge computation, flow equations, factors affecting coefficient of discharge, codal provisions. stilling basins (USBR and BIS) types			4L + 2T
Reference	Sl.	Book Name	Author	Publishing House
	1	Hydraulic Structures	Novak, A. I. B. Moffat, C. Nalluri and R. Narayan P	E & FN Spon, UK, 2010.
	2	Hydraulic Structures	S. H. Chen	Springer Nature, USA, 2015.
	3	Irrigation Engineering and Hydraulic Structures	S. K. Sharma	S. Chand Publishing, New Delhi, 2017.
	4	Dams and Appurtenant Hydraulic Structures	A. Tanchev	CRC Press, USA, 2014.
	5	Fluid Mechanics & Hydraulic Machines	S.S. Rattna	Khanna Publishing House
	6	Fluid Mechanics and Hydraulic Machines	K. Subramanya	McGraw Hill Education (India) Private Limited, New Delhi, Chennai, 2019.

CE(PE)702A	Prestressed Concrete	2L + 1T	3 Credits
Course Outcome	After going through this course, the students will be able to: <ol style="list-style-type: none"> 1. Learn the introduction of prestressed concrete member and its deflection properties 2. Develop the design criteria of prestressed concrete section for flexure and shear properties 3. Analyze the anchorage zone stress for post-tensioned members 4. Impart knowledge regarding the methods of Analysis of Statically Indeterminate Structures. 5. Impart knowledge regarding the composite construction of Prestress and In-situ concrete. 6. Impart knowledge regarding Design of Prestressed concrete poles and sleepers and introduction of partial prestressing. 		

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Prerequisite	Introduction to Solid Mechanics (CE(ES)402), Structural Analysis – I (CE(PC)503), Design of RC Structures (CE(PC)501)		
Module 1	Introduction of Prestressed concrete: Materials, prestressing system, analysis of prestress and bending stress, losses Shear and torsional resistance: design of shear reinforcement, design of reinforcement for torsion shear and bending. Deflections of prestressed concrete members: Importance, factors, short term and long term deflection		8L+4T
Module 2	Shear and Torsional Resistance: Design of Shear Reinforcement, Design of Reinforcement for Torsion, Shear and Bending. Limit State Design Criteria: Inadequacy of Elastic and Ultimate Load Method, Criteria for Limit States, Strength and Serviceability. Design of Prestressed Concrete Section: for Flexure & methods by Lin and Magnel		8L+4T
Module 3	Anchorage Zone stresses in post tensioned members: Stress distribution in end block, anchorage zone reinforcement		3L+1T
Module 4	Statically Indeterminate Structures: Advantages of Continuous Member, Effect of Prestressing, Methods of Achieving Continuity and Method of Analysis of Secondary Moments		4L+2T
Module 5	Composite Construction of Prestressed and In-situ Concrete: Types, Analysis of Stresses		3L+1T
Module 6	Prestressed Concrete Poles and Sleepers: Design of Sections for Compression and Bending. Introduction to Partial Prestressing.		2L+2T
IS Codes	1 IS: 1343 : 2012		
Reference	Sl.	Book Name	Author
	1	Prestressed Concrete	N. KrishnaRaju
	2	Prestressed Concrete	Ramamuthram
	3	Prestressed Concrete	Srikant Vanakudre
	4	Fundamentals of Prestressed Concrete	N.C.Sinha and S.K.Roy
	5	Prestressed Concrete	Karuna Moy Ghosh
	6	Design of Prestressed Structures	T.Y.Lin and N.H.Burns

CE(PE)702B	Repair & Rehabilitation of Structures	2L + 1T	3 Credits
Course Outcome	By the end of this course students will have the capability/knowledge of <ol style="list-style-type: none"> 1. Various distress and damages to concrete and masonry structures 2. The importance of maintenance of structures, types and properties of repair materials etc 3. Assessing damage to structures and various repair techniques 		
Prerequisite	Introduction to Solid Mechanics (CE(ES)402), Structural Analysis – I (CE(PC)503), Design of RC Structures (CE(PC)501), Concrete Technology (CE(PC)405).		
Module 1	Introduction: Overview of distress, deterioration in concrete structures, Scenario of distressed structures world over, Need for repairs and upgrading of structures, General introduction to process (Road-map) to a durable concrete repair		3L+1T
Module 2	Deterioration of concrete structures: Types of deterioration – Signs, causes & symptoms, Mechanism of deterioration, contributing factors like permeability, inadequate durability & micro-structure of concrete. Physical deterioration due to moisture, temperature, shrinkage, freeze-thaw, abrasion, erosion, cavitation, crystallization of salts, Efflorescence, exposure to severe environment like marine exposure. Chemical deterioration due to corrosion of reinforcement (chloride induced, carbonation induced), Alkali-silica reaction, sulphate attack, Acid attack Deterioration due to water leakage, fire – detection & mitigation of the same. Deterioration due to ageing, inadequate maintenance, Design & construction deficiencies, overloading etc. Types of cracks, causes & characteristics of cracking in various structural components like beam, column, slab, masonry walls. Measurement of cracks, interpretation of the cause of particular type of crack.		6L+3T
Module 3	Conditional/damage assessment & Evaluation of structures: Structural assessment: Conditional evaluation / Structural Appraisal of the structure – Importance, objective & stages, Conditional/damage assessment procedure, Preliminary & Detailed investigation – Scope, Objectives, Methodology & Rapid visual inspection of structures Damage Assessment allied Tests (Destructive, Semi-destructive, Nondestructive): Field & laboratory testing procedures for evaluating the structure for strength, corrosion activity, performance & integrity, durability.		6L+3T

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	Interpretation of the findings of the tests			
Module 4	Repairs, rehabilitation & Retrofitting of concrete structures: Repair materials - Criteria for durable concrete repair, Methodology, performance requirements, repair options, selection of repair materials, Preparatory stage of repairs, Different types of repair materials & their application, types of repair techniques. Retrofitting/Strengthening: Need for retrofitting, Design philosophy of strengthening structures, Techniques available for strengthening including conventional and advanced techniques. Seismic retrofit of concrete structures: Deficiencies in structure requiring seismic retrofit, Design philosophy, Techniques to enhance the seismic resistance of structures, advanced techniques for making seismic resistant structures			9L+3T
Module 5	Protection & maintenance of structures - Importance of protection & maintenance, Categories of maintenance, Building maintenance. Corrosion mitigation techniques to protect the structure from corrosion. Long term health monitoring / Structural health monitoring (SHM) – Definition and motivation for SHM, Basic components of SHM and its working mechanism, SHM as a tool for proactive maintenance of structures.			4L+2T
Reference	Sl.	Book Name	Author	Publishing House
	1	Handbook on repair and rehabilitation of RCC buildings	CPWD, Government of India	
	2	Failures and repair of concrete structures	S. Champion	John Wiley and Sons
	3	Diagnosis and treatment of structures in distress	R.N.Raikar	R & D Centre of Structural Designers and Consultants Pvt.Ltd
	4	Handbook on seismic retrofit of buildings	A. Chakrabarti et.al	Narosa Publishing House
	5	Repair and protection of concrete structures	Noel P. Mailvaganam	CRC Press
	6	Concrete repair and maintenance	Peter.H.Emmons	Galgotia publications
	7	Maintenance, Repair & Rehabilitation and Minor works in Building	P.C. Varghese	PHI
	8	Concrete Structures Repair Rehabilitation and Retrofitting	J Bhattacharjee	CBS
	9	Repair & Rehabilitation of Concrete Structures	Modi and Patel	PHI

CE(PE)702C	Finite Element Method		2L + 1T	3 Credits
Course Outcome	After going through this course, the students will be able to: 1. Obtain an understanding of the fundamental theory of the FEA method. 2. Develop the ability to generate the governing FE equations for systems governed by partial differential equations. 3. Understand the use of the basic finite elements for structural applications using truss, beam, frame, and plane elements and			
Prerequisite	Basic Mathematics			
Module 1	Introduction to Finite Element Analysis: Basic Concepts of Finite Element Analysis and its necessity			2L
Module 2	Numerical tools for Finite Element Formulation: Variational Principle: Ritz method, Weighted residual method: Galerkin approach, Petrov-Galerkin approach.			5L+2T
Module 3	Finite element Formulation: Formulation of Euler-Bernoulli beam element and Timoshenko beam element, Imposition of boundary conditions.			7L+3T
Module 4	Elements and their properties: One dimensional and Two dimensional elements (Bar element, Beam element, Plate element), Interpolation functions, Numerical integration.			7L+3T
Module 5	Finite element solutions: Formulation of stiffness matrix and solution of beam, plate and truss problems, Problems on Plates with cutout. Introduction to the software SAP2000.			7L+4T
Reference	Sl.	Book Name	Author	Publishing House
	1	An Introduction to the Finite Element Method	Reddy J.N	McGraw Hill Publication
	2	Matrix and Finite Element Analyses of Structures	Mukhopadhyay	Oxford and IBH Publishing Co. Pvt. Ltd
	3	Concepts and Applications of Finite Elements Analysis	Cook R.D, Malkus, Plesha and Witt	Wiley

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	4	Finite Element Analysis: Theory and Programming	Krishnamoorthy C. S.	McGraw Hill Publication
	5	Introduction to Finite Elements in Engineering	Chandrupatla and Belegundu	PHI
	6	Finite Element Method with Applications in Engineering	Desai	Pearson
	7	Finite Element Procedures	Bathe	PHI

CE(PE)703A	Air and Noise Pollution and Control	2L + 1T	3 Credits	
Course Outcome	After going through this course, the students will be able to: 1. Define the basic concepts and terminologies regarding air pollution and noise pollution 2. Describe the physics of air pollution and noise pollution 3. Apply the methods of air pollution and noise pollution measurements 4. Analyze different concepts of air and noise pollution solving mathematical problems 5. Compare air and noise quality with allowable standards and limits 6. Choose and design proper techniques for air pollution control and noise pollution control			
Prerequisite	Class-XII level knowledge of Physics, Chemistry, Mathematics, Biology and Environmental Science; Undergraduate level knowledge of Statistics and Environmental Engineering			
Module 1	Air Pollutants Sources; Classification; Effects on Human, Vegetation, Material Effects of Air pollution on Atmosphere: Photochemical Smog, Ozone Layer Depletion, Acid Rain, Greenhouse Effect and Global Warming	4L+2T		
Module 2	Air Pollution Meteorology Lapse Rate; Atmospheric Stability; Inversion; Plume Pattern	3L+1T		
Module 3	Dispersion of Air Pollutants Point Source Gaussian Plume Model, Stability Classes, Stability Charts, Design of Stack Height	3L+1T		
Module 4	Air Quality Methods of Measurement: Gaseous pollutants, Particulate pollutants Air Quality Standards and Indices: Ambient Air Quality Standard, NAAQS, Emission Standard, Air Quality Indices	4L+2T		
Module 5	Air Pollution Control Control of Gaseous Pollutants: Adsorption, Absorption, Condensation Control of Particulate Pollutants: Settling chambers, Cyclone separators, Wet collectors, Fabric filters, Electrostatic precipitators Control of Pollution from Automobiles	5L+3T		
Module 6	Physics of Noise Basics of Acoustics; Sound Pressure, Power and Intensity and their Interrelations	1L+1T		
Module 7	Measurement of Noise Noise Level; Interrelation between Noise, Pressure, Power and Intensity Levels; Noise Meter; Noise Networks; Frequency Band Analysis; Decibel Addition Measurement of Community Noise: L_N , L_{eq} , L_{dn} , L_{NP}	4L+2T		
Module 8	Source and Effect of Noise Psychoacoustics and noise criteria; effects of noise on health; annoyance rating schemes	1L+1T		
Module 9	Noise Pollution Control Noise Standards and Limits; Methods of Noise Pollution Control	3L+1T		
Reference	Sl.	Book Name	Author	Publishing House
	1	Air Pollution and Control	Keshav Kant, Rajni Kant	Khanna Publishing House
	2	Environmental Engineering	S.C. Sharma	Khanna Publishing House
	3	Introduction to Environmental Engineering and Science	Masters, G.M., Ela, W.P.	Prentice Hall / Pearson
	4	Environmental Engineering: A Design Approach.	Sincero, A., Sincero, G.	Prentice Hall
	5	Environmental Engineering. Volume-1 and Volume-2.	Garg, S.K.	Khanna Publishers
	6	Air Pollution	Rao, M.N., Rao, H.V.N.	Tata McGraw Hill

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CE(PE)703B	Physico-Chemical Processes for Water and Wastewater Treatment		2L + 1T	3 Credits
Course Outcome	On completion of the course the students will be able to: 1. Define the basic concepts and terminologies regarding physico-chemical treatment of water and wastewater 2. Describe the physics, chemistry and hydraulics of different unit operations and processes for water and wastewater treatment 3. Analyze different physico-chemical water and wastewater treatment options solving mathematical problems 4. Design different physico-chemical treatment processes to treat water and wastewater			
Prerequisite	Class-XII level knowledge of Physics, Chemistry, Mathematics, Biology and Environmental Science; Undergraduate level knowledge of Engineering Physics, Engineering Chemistry, Fluid Mechanics and Hydraulics and Environmental Engineering			
Module 1	Introduction and Basic Concepts Water purification in natural systems, physical processes, chemical processes and biological processes; Primary, secondary and tertiary treatment; Unit operations, unit processes			2L+2T
Module 2	Aeration Aeration and Gas Transfer			2L
Module 3	Sedimentation Sedimentation, different types of settling; sedimentation tank design			3L+1T
Module 4	Clariflocculation Coagulation and flocculation; Coagulation processes, Stability of colloids; Destabilization of colloids; Destabilization in water and wastewater treatment; Transport of colloidal particles; Design aspects			4L+2T
Module 5	Filtration Filtration processes; Hydraulics of flow through porous media; Rate control patterns and methods; Filter effluent quality parameters; Mathematical model for deep granular filters; Slow sand filtration, Rapid sand filtration, Precoat filtration; design aspects			4L+2T
Module 6	Disinfection Types of disinfectants; Kinetics of disinfection; Chlorination and its theory; Design of Chlorinators			3L+1T
Module 7	Precipitation Hardness removal; Iron, Manganese, and Heavy metal removal			3L+1T
Module 8	Adsorption Adsorption equilibria and adsorption isotherm; Rates of adsorption; Sorption kinetics in batch reactors; Continuous reactors; Factors affecting adsorption			3L+1T
Module 9	Ion Exchange Processes Materials and reactions; Methods of operation; Application; Design aspects			3L+1T
Module 10	Membrane Processes Reverse osmosis, Ultrafiltration, Electrodialysis			3L+1T
Reference	Sl.	Book Name	Author	Publishing House
	1	Elements of Water Pollution Control Engineering	O.P. Gupta	Khanna Publishing House
	2	Environmental Engineering. Volume-1 and Volume-2.	Garg, S.K.	Khanna Publishers
	3	Environmental Engineering: A Design Approach.	Sincero, A., Sincero, G.	Prentice Hall
	4	Environmental Engineering	Peavy, H.S, Rowe, D.R, Tchobanoglous, G	Tata McGraw Hill Indian Edition
	5	Environmental Engineering	S.C. Sharma	Khanna Publishing House
	6	Manual on Water Supply and Treatment	CPHEEO	Govt. of India
	7	Manual on Sewerage and Sewage Treatment	CPHEEO	Govt. of India
	8	Manual on Municipal Solid Waste Management.	CPHEEO	Govt. of India
	9	Water Works Engineering: Planning, Design and Operation	Qasim, S.R., Motley, E.M., Zhu, G.	Prentice Hall
	10	Waste Water Treatment Plants: Planning, Design and Operation	Qasim, S.R.	CRC Press
	11	Water Engineering: Hydraulic, Distribution and Treatment.	Shammas, N.K., Wang, L.K.	Wiley

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	12	<i>Water Quality Engineering: Physical / Chemical Treatment Processes.</i>	Benjamin, M.M., Lawler, D.F.	Wiley
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CE(PE)703C	Water and Air Quality Modelling	2L + 1T	3 Credits	
Course Outcome	On completion of the course the students will be able to: 1. Define the basic concepts and terminologies regarding water and air quality modelling 2. Describe the background mechanisms in modeling water and air quality 3. Analyze different water and air quality models solving mathematical problems 4. Apply the concepts of air and water quality modeling in air and water pollution control and management			
Prerequisite	Class-XII level knowledge of Physics, Chemistry, Mathematics, Biology and Environmental Science; Undergraduate level knowledge of Engineering Statistics, Engineering Physics, Engineering Chemistry, Fluid Mechanics and Hydraulics and Environmental Engineering			
Module 1	Introduction to Water Quality Models Introduction to mathematical models; Water quality model development; Calibration and verification; Cost benefit analysis using models; Model requirements and limitations	4L+2T		
Module 2	Dissolved Oxygen Model for Streams Sources and sinks of dissolved oxygen; Estimation of system parameters; Streeter Phelps model, oxygen 'sag' curve, Determination of deoxygenation and re-aeration coefficients; Benthic oxygen demand; Mass transport mechanisms	6L+2T		
Module 3	Models for Estuary and Lakes Physical chemical and biological processes in estuaries and lakes	4L+2T		
Module 4	Introduction to Air Quality Models Micrometeorological processes, Wind rose, Dispersion, coefficients and Stability classes	4L+2T		
Module 5	Dispersion Models Point Source Gaussian Dispersion Model, Stack height computation; Line Source Models; Box Models	7L+3T		
Module 6	Air Quality Models Regional air quality models, Source inventories and significance	4L+2T		
Reference	Sl.	Book Name	Author	Publishing House
	1	Air Pollution and Control	Keshav Kant, Rajni Kant	Khanna Publishing House
	2	Elements of Water Pollution Control Engineering	O.P. Gupta	Khanna Publishing House
	3	Environmental Engineering	S.C. Sharma	Khanna Publishing House
	4	Environmental Engineering. Volume-1 and Volume-2.	Garg, S.K.	Khanna Publishers
	5	Environmental Engineering	Peavy, H.S, Rowe, D.R, Tchobanoglous, G	Tata McGraw Hill Indian Edition
	6	Introduction to Environmental Engineering and Science.	Masters, G.M., Ela, W.P.	Prentice Hall / Pearson

CE(PE)704A	Structural Dynamics	2L + 1T	3 Credits
Course Outcome	At the conclusion of this course, the students will have an understanding of: 1. Fundamental theory of dynamic equation of motion 2. Fundamental analysis methods for dynamic systems 3. Dynamic properties and behaviour of civil structures 4. Modelling approach of dynamic response in civil engineering applications		
Prerequisite	Introduction to Solid Mechanics (CE(ES)402), Structural Analysis – I (CE(PC)503), Structural Analysis – II (CE(PE)602B), and Engineering Mathematics (Differential Equation)		
Module 1	Basics of Structural Dynamics: Introduction of Structural Dynamics, Differential Equations in Civil Engineering, Types of Analysis/Static and Dynamic load, Degrees of Freedom (Ex: Generation of Stiffness matrix), Dynamic Equilibrium Equation.	3L+2T	
Module 2	Free Vibration of SDOF: Undamped free Vibration, Natural Period/Frequency, Energy in Free Vibration, Damped Free Vibration, Types of	8L+4T	

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	damping, Logarithmic decrement equation Forced Vibration of SDOF: Undamped Forced vibration, Amplitude & Phase Angle, Dynamic amplification factor for deflection (Rd), Damped Forced vibration, Relationship between Rd, Rv and Ra			
Module 3	Force Transmission, Vibration Measurement: Resonant frequency and Half power band width, Force Transmission and Isolation, Design of Vibration Measuring Instruments		3L+1T	
Module 4	Response to Arbitrary Motions: Response to Unit Impulse, : Response to Arbitrary Force (Duhamel's Integral), Response to Step and Ramp Forces, Response to Rectangular Pulse, Half Sinusoidal wave		2L	
Module 5	Numerical Methods of Solution: Time Stepping Methods, Central Difference Method, Newmark's Method		2L	
Module 6	Response Spectrum: Concept of Response Spectrum, Uses of Response Spectrum, Special Cases in Spectrum, Development of Tripartite Plot, :Example: Base Shear and Base Moment, Response of Structure in Frequency Domain		3L+2T	
Module 7	Multi-Degree of Freedom Systems: Equation of Motion for MDOF System, Solution of Equation, Natural Frequencies and mode Shapes (60), Modal Orthogonality, Approximate Method for finding Natural frequency.		2L+1T	
Module 8	Earthquake Response of MDOF Systems: Time History Analysis, Response Spectrum Analysis, 3D Dynamic Analysis		2L	
Module 9	Dynamic Response of Continuous Systems: Vibration of Continuous systems, Shear behaviour and bending behaviour, Generalized SDOF		2L	
Module 10	Dynamics of Rigid Blocks: Dynamics of Rigid Blocks, Non Structural Elements, : Floor Response Spectrum		2L	
Module 11	Vibration Control: : Introduction to Vibration Control, Active Control, Passive Control, Design of Tuned Mass Damper		2L+1T	
Reference	Sl.	Book Name	Author	Publishing House
	1	Structural Dynamics (Theory and Computation)	Mario Paz.	CBS Publishers
	2	Dynamics of Structure (Theory and Application to Earthquake Engineering)	A.K.Chopra	Pearson Education
	3	Dynamics of Structures	Ashok K. Jain	Pearson Education

CE(PE)704B	Advanced Structural Analysis		2L + 1T	3 Credits
Course Outcome	After going through this course, the students will be able to: 1. Basic Knowledge of the student will increase. 2. Student will be able to apply stiffness and flexibility method using system approach. 3. Student will understand the yield conditions from their knowledge of stress-strain relations. 4. Student will be able to solve simple plate and shell problems			
Prerequisite	Introduction to Solid Mechanics (CE(ES)402), Structural Analysis – I (CE(PC)503), Structural Analysis – II (CE(PE)602B)			
Module 1	Matrix methods of structural analysis: Application of matrix methods to plane truss, beams, continuous frames			9L+5T
Module 2	Finite difference and relaxation technique -application to simple problems.			6L+3T
Module 3	Theory of plate bending: Navier's Sol utions. Levy's solution. Plate buckling problem. Membrane theory of domes and cylindrical shells.			7L+3T
Module 4	Theory of Elasticity: Three dimensional stress and strain analysis, stress strain transformation, stress invariants, equilibrium and compatibility equations. Two dimensional problems in Cartesian and polar coordinates. Plane stress, plane stain problems, St. Venant's principle			6L+1T
Reference	Sl.	Book Name	Author	Publishing House
	1	Matrix, finite element, computer and structural analysis,	Mukhopadhyay	ANE Books
	2	Intermediate Structural analysis	Wang	McGrawHill
	3	Theory of Plates and Shells	Timoshenko & Krieger	McGrawHill
	4	Structural Analysis	R Agor	Khanna Publishing House
	5	Theory of Elasticity	Timoshenko & Goodier	McGrawHill
	6	Analysis of Structures	T.S. Thandavamoorthy	Oxford University Press

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CE(PE)704C	Coastal Hydraulics and Sediment Transport		2L + 1T	3 Credits
Course Outcome	On successful completion of this course, student should be able to: <div><div>1.</div><div>Explain and quantify coastal wave processes including wave generation, propagation, refraction, shoaling, diffraction, and breaking.</div></div> <div><div>2.</div><div>Explain and quantify coastal wave properties important to coastal engineering, including wave heights, speeds, induced water velocities, pressures, making appropriate approximations for deep and shallow waters.</div></div> <div><div>3.</div><div>Characterize and quantify basic coastal sediment transport processes and rates</div></div> <div><div>4.</div><div>Analyse coastal sites to determine design waves by utilizing historical and bathymetric data. Estimate hydrodynamic forces on coastal structures</div></div>			
Prerequisite	Introduction to Civil Engineering CE(HS)302, Introduction to Fluid Mechanics CE(ES)401, Water Resources Engineering CE(PC)603,			
Module 1	Introduction: Basic understanding of wave mechanics including wave generation, propagation, form and assessment in the coastal zone. Statistical and spectral analysis of recorded wave data and prediction in coastal zone.			6L
Module 2	Tides and currents: The equilibrium tide, Dynamic modifications of the equilibrium tide, Modification of tidal pattern, Tidal streams, Tidal bores.			6L
Module 3:	Waves: The linear theory of waves, Waves of finite height, Wind waves, Waves in shoaling water, Refraction of waves, Reflection of waves, Diffraction of waves, Oscillations in a harbour, Ship waves.			8L
Module 4:	Sediment Transport: Basic concepts, Transport modes, Material in suspension, Bed-Load, Turbidity and density currents, Banks and channels in river estuaries, Regime of the sea-bed; Vertical distribution of suspended sediment in waves and current over a plane bed.			8L
Module 5:	Littoral drift: Definition of limit for littoral drift, The effect of grain size, The beach profile, Longshore transport of material, Coastal features.			8L
Module 6:	Coastal Structures: Types and use; Effect of construction of coastal structures on stability of shoreline/ beaches, shoreline configuration.			6L
Reference	Sl.	Book Name	Author	Publishing House
	1	Coastal hydrodynamics	J. S. Mani	Prentice-Hall of India Ltd, 2012
	2	Advances in Coastal Hydraulics	V. Panchang, J. Kaihatu	World Scientific Publishing Company, 2018
	3	Basic Coastal Engineering	R. M. Sorensen	Springer, 2010
	4	Computational Modeling in Hydraulic and Costal Engineering	C. Kouttias and P. D. Scarlatos	CRC Press, 2016.

CE(PE)705A	Railway and Airport Engineering	2L + 0T	2 Credits
Course Outcome	Students will be able to <ol style="list-style-type: none"> 6. Explain the basics in planning functional components of Railway and Airport. 7. Illustrate the engineering concepts of construction, operation and maintenance of Railway and Airport components. 8. Interpret the geometric design parameters of Railway 9. Decide the runway orientation of proposed runway on the basis of previous wind data analysis 10. Assess the basic runway length parameters. 		
Prerequisite	Class-XII level knowledge of Physics, Mathematics.; Undergraduate level knowledge of Strength of Materials.		
Module 1	Railway Engineering Introduction to Railway Engineering: Socio-economic impact of Indian Railways; Zonal classification of Indian Railways; Railway track gauge; Classification of Indian Railways based on Speed Criteria. Permanent Way (P-way): Components – Rails, Rail joints, Sleepers, Ballast, Fastenings, Sub-grade. Track Alignment and Engineering Survey: Basic requirement of good alignment; Factors in selection of good alignment; Engineering Survey. Track Stresses; Geometric Design: Gradient, Speed, Degree of Curve, Super-elevation, Transition curve, Widening of gauge on curves, Shift. Points and Crossings; Station and Yards; Signalling and Control Systems.		20L

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Module 2	Airport Engineering Airport Site Selection; Airport layout; Functions and planning of the Airfield components – runway, taxiway and Aprons, hanger, terminal building and control tower; Design of Runway and Taxiway; Runway orientation: Windrose diagrams.			10L
Reference	Sl.	Book Name	Author	Publishing House
	1	A Textbook of Railway Engineering	Saxena S.P. & Arora S.P	Dhanpat Rai & Sons
	2	Indian Railway Track	Agarwal M.M	Sachdeva Press
	3	Airport Planning & Design	Khanna S.K , Arora M.G & Jain S.S	Nemchand Brothers
	4	Planning & Design of Airports	Horonjeff R & Mckelvey F	Mc. Graw Hill.

CE(PE)705B	Pavement Design		2L + 0T	2 Credits
Course Outcome	At the end of the course, the student will be able to: 1. Differentiate between different types of pavements, both structurally and functionally. 2. Conduct Axle Load Survey and Estimate Design Traffic. 3. Analyze and design bituminous and cement concrete pavement using. 4. Understand the principles of Pavement Maintenance and identify various pavement distresses.			
Prerequisite	Transportation Engineering (CE(PC)506)			
Module 1	Pavement Design Flexible Pavement Design: Stresses and Deflections in homogeneous masses.; Burmister's two layer theory; Three layer and multi-layer theories; wheel load stresses, various factors in traffic wheel loads; ESWL of multiple wheels; McLeod method of design; AASTHO method of flexible pavement design. Low Volume Rigid Pavement: Criteria of Load, Scope and Specifications as per different Govt policies in India, Design Criteria.			13L
Module 2	Pavement Construction and Management Flexible Pavement Construction: Earthwork (Method of Alignment-wise marking using chainage), compaction of embankments, construction methods and field control checks for various types of flexible pavement materials in sub-base, base, binder and surface course layers; Construction procedure of Low Volume Rigid Pavement.			9L
Module 3	Pavement Evaluation - Pavement Distress Functional condition evaluation of pavements- Roughness, Skid Resistance, Serviceability Index; Structural evaluation of pavements –Benkelman beam and Falling Weight Deflectometer; Pavement strengthening; Design of bituminous and concrete overlays as per IRC			8L
Reference	Sl.	Book Name	Author	Publishing House
	1	Principles of Pavement Design	E. J. Yoder & M.W. Witzack	John Wiley and Sons
	2	Pavement Analysis and Design	Yang H. Huang	Pearson
	3	Principles of Transportation Engineering	P. Chakraborty & A. Das	PHI
	4	Highway Engineering	L.R. Kadiyali	Khanna Book Publishing (www.khannabooks.com)
	5	Highway Engineering	Khanna& Justo	Nemchand& Brothers
	6	Relevant latest IRC Codes (IRC-37 – 2001, IRC-37 – 2012, IRC 58 – 2015, IRC 81 -1997- Indian Road Congress		

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CE(PE)705C	Transportation System Planning		2L + 0T	2 Credits
Prerequisite	Transportation Engineering (CE(PC)506)			
Module 1	Introduction Importance of transportation, transportation planning methodology, hierarchical levels of planning and its relation to rural, urban areas. Long range planning, Passenger and goods transportation, General concept and process of transport planning, Land-use transport interactions, Socio-economic characteristics of Land use			5L
Module 2	Transportation System Multi modal transportation system; Characteristics of Mass Transit systems including technical, demand operational and economic problems, fixed Track Facility, Mass Rapid Transit System Elevated, Surface and Underground construction , integrated Operating Characteristics of Terminal and Transfer facilities			10L
Module 3	Transport planning Studies: Urban Travel Characteristics, Private and Public Behaviour analysis, Transportation demand Surveys, Delineation of the urban area, zoning, Origin-Destination Studies, Home Interviews, trip Classification. Methodology: Study of existing network-trip generation techniques, Category analysis, multiple regression techniques, Modal split analysis, Trip distribution techniques, Growth Factor model, Gravity models, Opportunity models and multiple regression models.			15L
Reference	Sl.	Book Name	Author	Publishing House
	1	Highway Engineering	L.R. Kadiyali	Khanna Book Publishing (www.khannabooks.com)
	2	Transportation Engineering	L.R. Kadiyali	Khanna Book Publishing (www.khannabooks.com)

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Semester VIII [Fourth year]

CE(HS)801A	Professional Practice, law & Ethics	2L	2 Credits	
Module 1	<p>Professional Practice – Respective roles of various stakeholders: Government(constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC)(formulating standards of practice);professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction);Clients/ owners (role governed by contracts); Developers (role governed by regulations such asRERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/ Service agencies (rolegoverned by contracts and regulatory Acts and Standards)</p> <p>Professional Ethics – Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistleblowing, protected disclosures.</p>	4L		
Module 2	General Principles of Contracts Management: Indian Contract Act, 1972 and amendments covering General principles of contracting; Contract Formation & Law; Privacy of contract; Various types of contract and their features; Valid & Voidable Contracts; Prime and subcontracts; Joint Ventures & Consortium; Complex contract terminology; Tenders, Request For Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions & Specifications; Critical “Red Flag” conditions; Contract award & Notice To Proceed; Variations & Changes in Contracts; Differing site conditions; Cost escalation; Delays, Suspensions & Terminations; Time extensions &Force Majeure; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Non-performance; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bid fixing, Cartels); Reverse auction; Case Studies; Build-Own-Operate & variations; Public- Private Partnerships; International Commercial Terms;	18L		
Module 3:	Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law –Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.	5L		
Module 4:	Engagement of Labour and Labour & other construction-related Laws: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act,1946; Workmen’s Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017	2L		
Module 5:	Law relating to Intellectual property: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies;	1L		
Reference	Sl.	Book Name	Author	Publishing House
	1	Professional Ethics & Human Values	Premvir Kapoor	Khanna Publishing House

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	2	Legal Aspects of Building and Engineering Contracts	B.S. Patil	
	3	The National Building Code	BIS	
	4	Indian Contract Act	Dutta	Eastern Law House
	5	The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration	Kwatra G.K.	Indian Council of Arbitration

CE(PE)801A	GIS & Remote Sensing		2L	2 Credits
Course Outcome	<p>Upon completing the course, the students will be able to:</p> <ol style="list-style-type: none"> 1. Define and state the scope GIS & remote sensing in civil engineering 2. Understand the basic principles of remote sensing and GIS 3. Apply the various methods of remote sensing and GIS to different geospatial datasets 4. Analyze the different results obtained from different remote sensing data sources 5. Evaluate the different results in solving real world problems. 6. Design and construct optimum solutions for real world problems that can be resolved by GIS & remote sensing 			
Prerequisite	<p>Knowledge of Class-XII level physics, computer science Knowledge of CE(PC)404 and CE(PC)494</p>			
Module 1	<p>Fundamentals of Remote Sensing: Energy sources and radiation principles; Electromagnetic Spectrum; Energy interactions in the atmosphere and with earth surface features; Atmospheric windows; Spectral response patterns and spectral signatures</p>			3L
Module 2	<p>Digital Image Processing: Image rectification and restoration; Image enhancement; Image classification; Accuracy assessment; Digital change detection; Spatial, spectral, radiometric and temporal resolution characteristics of IRS, Landsat and Sentinel data.</p>			6L
Module 3:	<p>Advanced Remote Sensing: Microwave remote sensing: Frequency and wavelengths, polarization, range and azimuth resolution, relief displacement, foreshortening, layover, shadows and speckles; Synthetic Aperture Radar (SAR); Indian microwave sensors; Working principles of LiDAR remote sensing</p>			3L
Module 4:	<p>Advanced Digital Image Processing: Principal Component Analysis (PCA); Colour Space Transformation; Fourier Transformation; Image fusion; Hybrid classification system</p>			3L
Module 5:	<p>GIS: Definition, components and applications of GIS; Spatial and attribute data; Raster vs. Vector GIS; Concept of topology; Non-topological data structures</p>			3L
Module 6	<p>Database and Coordinate System: Concepts of Relational Data Base Management System (RDBMS) and geodatabase; Spatial and attribute query; Datum and projection; Universal Transverse Mercator (UTM) grid system; On-the-fly projection</p>			3L
Module 7	<p>Spatial Data Analysis: Concepts of local, focal, zonal and global analysis; Proximity analysis; Distance measurement; Raster and vector overlay; Spatial interpolation; DEM and TIN, Cost surface analysis</p>			6L
Module 8	<p>Applications of GIS & Remote Sensing: Watershed analysis; Runoff and erosion modelling; Location and allocation analysis; Atmospheric pollution monitoring; Urban growth modelling; Carbon sequestration and climate change</p>			5L
Reference	Sl.	Book Name	Author	Publishing House
	1	Principles of Geoinformatics	P.K. Garg	Khanna Publishing House
	2	Remote Sensing and Image Interpretation	Thomas M. Lillesand Ralph W. Kiefer Jonathan W. Chipman	Wiley India Edition
	3	Introduction to Geographic Information Systems	Kang-tsung Chang	Tata McGraw-Hill Publishing Company Limited
	4	Remote Sensing and GIS	Basudeb Bhatta	Oxford University Press
	5	Remote Sensing of Environment: An Earth Resource Perspective	J. R. Jensen	Pearson
	6	Applications of Geomatics in Civil Engineering	J. K. Ghosh I. de Silva (Eds.)	Springer
	7	Introductory Digital Image Processing: A Remote Sensing	J. R. Jensen	Pearson

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	Perspective		
8	Concepts and Techniques of Geographic Information Systems	C. P. Lo A. K. W. Yeung	Pearson

CE(PE)801B	Rock Mechanics		2L	2 Credits
Module 1	Composition of rocks, Engineering classification and Limitation of Geologic classification of rocks			4L
Module 2	Rock coming, various methods of obtaining rock cores, Engineering Properties of rock, stress -strain relations, elastic theory application to design in rock.			6L
Module 3:	Strength and failure of rocks, Uniaxial and triaxial strength of rocks, failure theories of rocks and propagation of cracks, Griffith Chack theory -Water in rock, Structural feature of mass rocks and their effects on engineering properties.			8L
Module 4:	Measurement of stresses -rock mass, various types of measuring devices, evaluation of properties of rocks in the field.			6L
Module 5:	Strain and displacement of the rock mass, rock reinforcement and support, subsidence.			6L
Reference	Sl.	Book Name	Author	Publishing House
	1	Engineering Rock Mechanics: An Introduction to the Principles	J. A. Hudson and J. P. Harrison	
	2	Rock Mechanics: For Underground Mining	Barry H.G.	
	3	Empirical Rock Failure Criteria	P.R. Sheorey, Balkema, Rotterdam	
	4	Rock Mechanics in Engineering Practice	K.G.Stagg and O.C.Zienkiewicz,	John Wiley and Sons
	5	Hand Book on Mechanical Properties of Rocks	V.S. Vutukuri and R D Lama	
	6	Rock Mechanics for Engineers	B.P Verma	
	7	Engineering Behavior of Rocks	W. Farmer,	Chapman and Hall Ltd

CE(PE)801C	Environmental Laws and Policy		2L	2 Credits
Course Outcome	Upon completing the course, the students will be able to: 1. To apply the relevant measures to mitigate pollution from different sources. 2. To understand the effects of the various pollutants on the environment as a whole according to the formulated guidelines 3. To be able to give recommendations for alternatives to reduce pollution 4. To formulate standards of the various parameters corresponding to their impact on the environment with changing time			
Prerequisite	Basic Science, Biology, Environmental Sciences and Environmental Engineering (Including Air Quality Dispersion, Meteorology, Solid Waste Management, EIA)			
Module 1	Introduction: Environment, Nature, Ecosystem, Origin of Environmental laws, Concept of laws and policies, Environment and Governance			3L
Module 2	Sustainable Development and Environment: Understanding of Climate change Concept of Carbon Footprint, Carbon Credit, Carbon Offsetting Use of Hybrid Energy (Conventional +Non Conventional) Use of Clean Development Mechanism			6L
Module 3:	Environmental Laws (Indian Perspective) : Indian Environmental Laws and Policies			8L
Module 4:	Environmental Laws (International Perspective) : Fundamental Principles and Application of International Environmental Law, Introduction to Trade and Environment Right to Environment as Human Right International Humanitarian Law and Environment Environment and Conflict Management Focus on International Protocols- UNFCCC & Kyoto Protocol, Treaty on Antarctic & Polar Regions, UN Conventions of Law of the Sea and Regional Sea Convention, Law on International Water Courses			11L
Reference	Sl.	Book Name	Author	Publishing House

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	1	Environmental Law and Policy	Aruna Venkat.	PHI Publication.
	2	Environmental Law and Policy	James Salzman & Burton H. Thompson (Jr.),	Foundation Press.
	3	Environmental Law	Gurdip Singh	Eastern Book Company
	4	Climate Change, Law, Policy and Governance	Usha Tandon	Eastern Book Company.

CE(PE)801D	Pavement Materials	2L	2 Credits	
Module 1	Introduction Basic road construction materials : Types of basic materials, Suitability of different materials depends on their availability and characteristics, Economic, Environmental, and Social issues of material usage, Life cycle analysis and its use in design		3L	
Module 2	Soil Classification; Index & Engineering properties of soil, Properties of sub-grade; Suitability of different type of soil for the construction of highway embankments and pavement layers; Field compaction and control. Introduction to Soil Stabilization: Physical and Chemical modification: Stabilization with admixtures like cement, lime, calcium chloride, fly ash and bitumen. A critical look at the different laboratory and in-situ procedures for evaluating the mechanical properties of soils viz. CBR, Plate Load test, resilient modulus, DCPT		7L	
Module 3:	Aggregate Characterization: Origin, classification, properties. Tests and specifications on road aggregates for flexible and rigid pavements. Importance of aggregate gradation problems on Rothfutch’s and Critical sieve methods and Shape factor in mix design		6L	
Module 4:	Bitumen Binders Different types, properties and uses, Tests on bitumen, Rheological and pavement performance related properties, Criteria for selection of different binders. Marshall Method of mix design, Additives & Modifiers in Bituminous mixes, problems on mix design		6L	
Module 5:	Cement Requirements, design of mix for CC pavement, use of additives, IRC specifications & Tests, joint filler and sealer materials.		3L	
Module 6:	Modern trend of using Modified, Sustainable and Environment friendly materials Geo-Synthetics: Geo-synthetic clay liner – Construction details – Geo Synthetic Materials – Functions – Property characterization Modified bitumen: Crumb Rubber Modified bitumen, Natural rubber modified bitumen, polymer modified bitumen; Long term and short term ageing and its effect on bitumen performance Plastic waste: Types of polymer, applicability of polymer based waste product in different layers of pavement		4L	
Reference	Sl.	Book Name	Author	Publishing House
	1	Highway Engineering	L.R. Kadiyali	Khanna Book Publishing Co.
	2	Highway Engineering	Khanna and Justo	Nem Chand and Bros.
IS and IRC codes	1	IS 73, revised 2006, IS 2720, IS 2386, IS 1201 to 1220, IS 8887- 1995, IS 217- 1986		
	2	IRC: 51-1992, 63-1976, 74 –1979, 88-1984,		
	3	IRC SP: 53 – 2002, IRC SP: 58 – 2000,		
	4	“Guidelines for use of Geotextiles in Road Pavements and Associated works”- 2002; IRC		
	5	State of art, special report 3 – “compaction of earthwork and subgrade”- IRC, HRB, 1999		
	6	MoRTH ‘Specifications for Roads and Bridges Works’- Indian Roads Congress		

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CE(OE)801A	Human Resource Development and Organizational Behaviour		2L	2 Credits
Module 1	Organizational Behaviour: Definition, Importance, Historical Background, Fundamental Concepts of OB, Challenges and Opportunities for OB			2L
Module 2	Personality and Attitudes: Meaning of personality, Personality Determinants and Traits, Development of Personality, Types of Attitudes, Job Satisfaction			2L
Module 3:	Perception: Definition, Nature and Importance, Factors influencing Perception, Perceptual Selectivity, Link between Perception and Decision Making.			2L
Module 4:	Motivation: Definition, Theories of Motivation - Maslow's Hierarchy of Needs Theory, McGregor's Theory X & Y, Herzberg's Motivation-Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory.			4L
Module 5	Group Behaviour: Characteristics of Group, Types of Groups, Stages of Group Development, Group Decision Making.			2L
Module 6	Communication: Communication Process, Direction of Communication, Barriers to Effective Communication			2L
Module 7:	Leadership: Definition, Importance, Theories of Leadership Styles			2L
Module 8:	Organizational Politics: Definition, Factors contributing to Political Behaviour.			2L
Module 9:	Conflict Management: Traditional vis-a-vis Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation – Bargaining Strategies, Negotiation Process.			3L
Module 10:	Organizational Design: Various Organizational Structures and their Effects on Human Behaviour, Concepts of Organizational Climate and Organizational Culture.			4L
Reference	Sl.	Book Name	Author	Publishing House
	1	Organizational Behavior	Robbins, S. P. & Judge, T.A	Pearson
	2	Organizational Behavior	Luthans, Fred	McGraw Hil
	3	Understanding Organizations – Organizational Theory & Practice in India	Shukla, Madhuka	PHI
	4	Principles of Organizational Behaviour	Fincham, R. & Rhodes, P	Oxford University Press

CE(OE)801B	Bridge Engineering	2L	2 Credits
Course Outcome	After going through this course, the students will be able to: 1. Discuss basic definitions, types, and components of bridges. 2. Discuss sub-surface investigations required for bridge construction. 3. Understand standard specification and loads for bridge design. 4. Perform design of different types bearings and joints for bridges. 5. Perform design of various reinforced concrete and steel bridges.		
Prerequisite	Design of RC Structures (CE(PC)501), Structural Analysis – I (CE(PC)503), Design of Steel Structures (CE(PC)604).		
Module 1	Introduction: Definition and basic forms, components of a typical bridge, classification of bridges, site investigation, bridge hydrology and hydraulics. Loads: I.R.C loads, impact factors, wind loads, longitudinal forces, lateral forces and centrifugal forces. Bearings: Types of bearings, details of bearing, joints, design examples	3L	
Module 2	Design of reinforced concrete solid slab bridge: Introduction, general design features, economic span, effective width method, simply supported and cantilever slab bridges, analysis and design.	7L	
Module 3	Design of box culvert bridge: Introduction, design method and design example.	4L	
Module 4	Design of a T beam bridge: Introduction, components, design of interior panel of slab, longitudinal and cross girders, Pigeaud's method, design example.	6L	
Module 5	Design of composite bridge: General aspects, method of construction, analysis of composite section, shear connectors, design of composite beam.	4L	

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Module 6	Design of steel bridges: General features, types of stress, design of railway truss bridge and plate girder bridge			6L
Module 7	Design of cable stayed bridge: General features, Philosophy of design.			2L
IS Codes	1	All relevant IRC and IS codes		
Reference	Sl.	Book Name	Author	Publishing House
	1	Prestressed Concrete	Shrikant Vanakudre	Khanna Book Publishing Co.
	2	Prestressed Concrete Bridges	N. Krishnaraju	CBS Publisher
	3	Design of Bridge Structures	Jagadish and Jayaram	PHI
	4	Essential Bridge Engineering	Jhonson Victor D.	Oxford, IBH Publishing Co.
	5	Design of Bridges	N. Krishnaraju	Oxford, IBH Publishing Co.
	6	Concrete Structures	Vazirani & Ratwani	Khanna Publishers
	7	Design of concrete bridges	Aswani, Vazirani & Ratwani	Khanna Publishers
	8	Bridge engineering	Ponnuswamy	McGrawHill
	9	Principle & Practice of Bridge Engineering	Bindra	Dhanpat Rai Publishing House

CE(OE)801C	Deep Foundations	2L + 0T	2 Credits	
Course Outcome	On successful completion of this course, student should be able to: 1. Explain the concept of bearing capacity for deep foundation. 2. Estimate the safe bearing capacity including settlement consideration for deep foundations. 3. Select a suitable deep foundation system for various site conditions and also analysis of that. 4. Explain in what circumstances pile is needed and how to estimate pile and pile group capacity under various soil conditions Characterize.			
Prerequisite	Introduction to Civil Engineering CE(HS)302, CE(PE)601 Foundation Engineering, Soil Mechanics – II CE(PC)504, Soil Mechanics – I CE(PC)401.			
Module 1	Piles: types - load carrying capacity of pile - static and dynamic formula - pile load test - penetration test - pile groups - Efficiency - Feld's rule –Converse Labarre formula, Settlement of piles and pile groups - Negative skin friction – under-reamed piles, pile cap	10L		
Module 2	Drilled Pier: Introduction, uses, types, bearing capacity, settlement, construction procedures.	6L		
Module 3:	Cassion foundations: Types & selections, forces & moments, depth determination.	4L		
Module 4:	Well foundations: The Types, components, design of well foundations – grip, size, steining, curb, cutting edge, top & bottom plug, well cap; stability analysis of well foundation, construction, shift & tilts.	8L		
Reference	Sl.	Book Name	Author	Publishing House
	1	Principles of Foundation Engineering	Braja M. Das	Thomson Asia Pvt. Ltd., Singapore, 2005.
	2	Geotechnical Engineering, Principles and Practices,	Donald P. Coduto, Man-Chu Ronald Yeung and William A. Kitch,	PHI Learning Private limited, 2011.
	3	Soil Mechanics and Foundation Engineering	P. Purushothama Raj	Pearson publication

CE(OE)801D	Groundwater Contamination	2L + 0T	2 Credits
Course Outcome	On successful completion of this course, student should be able to: 1. To be able to understand the principles and theories regarding groundwater contamination with 2. To be able to formulate the various remedial measures for groundwater contamination		
Prerequisite	Basic Sciences, Hydrology, Meteorology and Groundwater Hydrology		
Module 1	Introduction: Definition of groundwater, hydrological properties of various water bearing strata, vertical distribution of subsurface water, groundwater in hydrologic cycle	2L	
Module 2	Groundwater Hydraulics: Darcy's Law, Dupuit's assumption, Application of Darcy's Law for simple flow systems, Governing differential equations for confined and unconfined aquifers, steady and unsteady flow solutions for fully penetrating wells, partially	7L	

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	penetrating wells, Interference of wells, Test pumping analysis with steady and unsteady flows, Delayed yield, method of images			
Module 3:	Groundwater quality: Indian & International standards		3L	
Module 4:	Groundwater pollution: Sources, Remedial and preventive measures		3L	
Module 5:	Groundwater conservation: Groundwater budget, seepage from surface water, artificial recharge with reclamation		3L	
Module 6:	Models for Groundwater flow: Sampling & Monitoring methods, transport mechanisms, modeling (advective and dispersive transport), (adsorption and chemical reaction), biodegradation kinetics, numerical flow and transport modeling, waste site characterization/investigation, groundwater remediation, legal issues in groundwater contamination		10L	
Reference	Sl.	Book Name	Author	Publishing House
	1	Elements of Hydrology and Groundwater	R.N. Saxena & D.C. Gupta	PHI
	2	Groundwater Contamination, Performance, Limitations and Impacts	Anna L Powell	Nova Science Publishers
	3	Groundwater Contamination and Remediation	Edited by Timothy D. Scheibe & David C. Mays	MDPI

CE(OE)802A	Soft Skills and Personality Development	2L	2 Credits																
Module 1	Self-Growth i) Self Growth- Maslow's Hierarchy of Needs Theory ii) Anger, Stress & Time Management- Theories and application iii) SWOT Analysis		6L																
Module 2	Stepping Up i) Growth & Environment ii) Competitive Spirit iii) Responsibility Factor		7L																
Module 3:	Professional Communication i) Impression Management- theory on social psychology ii) Employability Quotient iii) Cross-cultural communication		6L																
Module 4:	Leadership & Team Playing i) Leadership & Team Playing: Theories, Styles, Stages ii) Motivation, Negotiation Skills, Conflict Management iii) Planning & Envisioning: Initiative and Innovation in the Work Environment- De Bono's Six Thinking Hats		6L																
Reference	<table border="1"> <thead> <tr> <th>Sl.</th><th>Book Name</th><th>Author</th><th>Publishing House</th></tr> </thead> <tbody> <tr> <td>1</td><td>Personality Development and Soft Skills</td><td>Barun K. Mitra</td><td>Oxford University</td></tr> <tr> <td>2</td><td>Soft Skills: An Integrated Approach to Maximize Personality</td><td>Gajendra Singh Chauhan and Sangeeta Sharma</td><td>Wiley</td></tr> <tr> <td>3</td><td>The Ace of Soft Skills: Attitude, Communication and Etiquette for Success</td><td>Gopalaswamy Ramesh and Mahadevan Ramesh</td><td>Pearson</td></tr> </tbody> </table>	Sl.	Book Name	Author	Publishing House	1	Personality Development and Soft Skills	Barun K. Mitra	Oxford University	2	Soft Skills: An Integrated Approach to Maximize Personality	Gajendra Singh Chauhan and Sangeeta Sharma	Wiley	3	The Ace of Soft Skills: Attitude, Communication and Etiquette for Success	Gopalaswamy Ramesh and Mahadevan Ramesh	Pearson		
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CE(OE)802B	Earthquake Engineering	2L	2 Credits
Course Outcome	After going through this course, the students will be able to: 1.To provide a coherent development to the students for the courses in sector of earthquake engineering. 2.To present the foundations of many basic engineering concepts related earthquake Engineering 3.To give an experience in the implementation of engineering concepts which are applied in field of earthquake engineering 4.To involve the application of scientific and technological principles of planning, analysis, design of buildings according to earthquake design philosophy.		
Prerequisite	Introduction to Solid Mechanics (CE(ES)402), Structural Analysis – I (CE(PC)503), Structural Analysis – II (CE(PE)602B), Design of RC Structures (CE(PC)501), Structural Dynamics (CE(PE)704A).		
Module 1	Seismology: Earth's Interior and Plate Tectonics; Causes of Earthquakes and Seismic Waves; Measurement of Earthquakes and Measurement parameters;		4L

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	Modification of Earthquake due to the Nature of Soil; Seismic Hazard Analysis	
Module 2	Earthquake Inputs: Time History Records and Frequency Contents of Ground Motion; Power Spectral Density Function of Ground Motion; Concept of Response Spectrums of Earthquake; Combined D ² V ² A Spectrum and Construction of Design Spectrum; Site Specific, Probabilistic and Uniform Hazard Spectrums; Predictive Relationships for earthquake parameters;	4L
Module 3	Dynamics for Earthquake Analysis: Equations of Motion for SDOF and MDOF Systems; Undamped Free Vibration of SDOF and MDOF Systems; Mode Shapes and Frequencies of MDOF System; Rayleigh Damping Matrix; Direct Time Domain Analysis of MDOF System; Direct Frequency Domain Analysis of MDOF System; Modal Analysis in Time and Frequency Domain	4L
Module 4	Response Analysis for Specific Ground Motion: Equations of Motion for Single and Multi ² Support Excitations and Solutions; Equations of Motion in State Space and Solutions; Computational Steps for the Solutions using MATLAB; Time History Analysis of 3D Tall Buildings.	4L
Module 5	Response Spectrum Method of Analysis: Concept of Equivalent Lateral Force for Earthquake; Modal Combination Rules; Response Spectrum Method of Analysis of Structures and Codal Provisions; Response Spectrum Method of Analysis for Torsionally Coupled Systems; Response Spectrum Method of Analysis for Non ² Classically Damped Systems;	4L
Module 6	Seismic Soil - Structure Interaction: Fundamentals of Seismic Soil ² Structure Interaction; Direct Method of Analysis of Soil ² Structure 6 Interaction using FEM and Use of ABAQUS, Substructuring Method of Analysis of Soil ² Structure Interaction Problem	4L
Module 7	Inelastic Response of Structures for Earthquake Forces: Fundamental Concepts of Inelastic Response Analysis for Earthquake Forces; Solutions of Incremental Equations of Motions for SDOF Systems; Solutions of Incremental Equations of Motions for MDOF Systems; Push over Analysis; Concepts of Ductility and Inelastic Spectrum;	5L
Module 8	Base isolation for earthquake resistant design of structures: Base isolation concept, isolation systems and their modelling; linear theory of base isolation; stability of elastomeric bearings; codal provisions for seismic isolation, practical applications.	5L
IS Codes	1 IS1893: Part I (2016), 2 IS 13920: 2016 3 IS 4326	
Reference	Sl. Book Name Author Publishing House 1 Earthquake resistant design of Structures Agarwal and Shrikhande PHI 2 Earthquake-resistant design of structures S.K. Duggal, Oxford University Press. 3 Elements of Earthquake Engineering Jai Krishna, A. R. Chandrashekhar and Brijesh Chandra South Asian Publishers 4 Earthquake Resistant Design D. J. Dowrick John Wiley & Sons	

CE(OE)802C	Urban Transport Planning	2L	2 Credits
Module 1	Introduction Urban morphology - Urbanization and travel demand – Urban activity systems and travel patterns – Systems approach – Trip based and Activity based approach		4L
Module 2	Urban Transportation Planning Goals, Objectives and Constraints - Inventory, Model building, Forecasting and Evaluation - Study area delineation – Zoning - UTP survey. Trip generation models – Trip classification - productions and attractions – Trip rate analysis - Multiple regression models - Category analysis. Trip distribution models – Growth factor models, Gravity model and Opportunity modes. Modal split models – Mode choice behavior – Trip end and trip interchange models - Probabilistic models – Utility functions - Logit models - Two stage model. Traffic assignment – Transportation networks – Minimum Path Algorithms - Assignment methods – All or Nothing assignment, Capacity restrained assignment and Multi path assignment - Route-choice behavior.		21L
Module 3	Scope of UTP in present scenario		5L

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	Financing of Project – urban development planning policy - Case studies.		
Reference	Sl.	Book Name	Author
	1	Transportation Engineering	L.R. Kadiyali
	2	Traffic Engineering and Transport Planning	L R Kadiyali
	3	Urban Transportation: Planning, Operation and Management	S Ponnuswamy and Johnson Victor
	4	Transportation Planning: Principles, Practices and Policies	Pradeep Kumar Sarkar and Vinay Maitri

CE(OE)802D	Environmental Impact Assessment and Life Cycle Analyses		2L	2 Credits
Course Outcome	After going through this course, the students will be able to: <ol style="list-style-type: none"> 1. To understand and evaluate the impact of any activity (large or small scale) on the surrounding environment 2. To be able to formulate mitigation strategies to protect the environment leading to sustainability 3. To be able to understand the intricacies of Life Cycle Analysis and apply basic knowledge for coherent existence 			
Prerequisite	Basic Sciences, Biology, Environmental Science and Environmental Engineering			
Module 1	Introduction Definition, Objective with legal aspect of Environmental Impact Assessment (EIA)			2L
Module 2	Methodology for EIA with Base Line Studies, Screening , Scoping and Public Consultation			4L
Module 3	EIA Analysis Data Collection & Environmental Impact Analysis, preparation of EIA report			5L
Module 4	EIA Mitigation and Audit- Mitigation and Impact Management with various case studies, Environmental Audit			5L
Module 5	Introduction to Life Cycle Analysis (LCA): History, Definition, Standards and structure of LCA Goal and Scope of LCA: System of a product with boundary, unit process and functional unit			2L
Module 6	Life Cycle Interpretation and Inventory: Limitation of LCA, Identification of significant issues, Evaluation, Reporting, Critical Review. Inventory: Data Collection, Data Bases, Allocation, Validation			3L
Module 7	LCA Impact Assessment and Practice: Categories, Classification, Normalization, LCA Management, Life Cycle thinking, Sustainability			4L
Module 8	Introduction: Definition, Objective with legal aspect of Environmental Impact Assessment (EIA)			2L
Reference	Sl.	Book Name	Author	Publishing House
	1	Environmental Impact Assessment	R. R. Barthwal,	New Age International Publication
	2	Environmental Impact Assessment	Canter	McGraw Hill Publications
	3	Environmental Impact Assessment: Theory and Practice	M. Anji Reddy	B. S. Publication
	4	Environmental Impact Assessment: Theory and Practice	Peter Wathern	CRC Press
	5	Life Cycle Assessment (LCA): A Guide to Best Practice	Walter Klöpffer , Birgit Grahl	Wiley Publishers
	6	Environmental Life Cycle Assessment	Olivier Jolliet, Myriam Saade-Sbeih, Shanna Shaked, Alexandre Jolliet, Pierre Crettaz,	CRC Press
	7	Life Cycle Student Handbook	Mary Ann Curran,	Scrivener Publishing, Wiley

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Curriculum Structure

Semester III (Second year)							
Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				L	T	P	
Theory							
1	Engineering Science Course	ESC 301	Analog and Digital Electronics	3	0	0	3
2	Professional Core Courses	PCC-CS301	Data Structure & Algorithms	3	0	0	3
3	Professional Core Courses	PCC-CS302	Computer Organisation	3	0	0	3
4	Basic Science course	BSC 301	Mathematics-III (Differential Calculus)	2	0	0	2
5	Humanities & Social Sciences including Management courses	HSMC 301	Economics for Engineers (Humanities-II)	3	0	0	3
Practical							
6	Professional Core Courses	PCC-CS393	IT Workshop (Sci Lab/MATLAB/Python/R)	0	0	4	2
7	Engineering Science Course	ESC 391	Analog and Digital Electronics	0	0	4	2
8	Professional Core Courses	PCC-CS391	Data Structure & Algorithms	0	0	4	2
9	Professional Core Courses	PCC-CS392	Computer Organisation	0	0	4	2
			Total credits				22
Semester IV (Second year)							
Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				L	T	P	
Theory							
1	Professional Core Courses	PCC-CS401	Discrete Mathematics	3	1	0	4
2	Professional Core Courses	PCC-CS 402	Computer Architecture	3	0	0	3
3	Professional Core Courses	PCC-CS403	Formal Language & Automata Theory	3	0	0	3

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4	Professional Core Courses	PCC-CS404	Design & Analysis of Algorithms	3	0	0	3
5	Basic Science courses	BSC 401	Biology	2	1	0	3
6	Mandatory Courses	MC401	Environmental Sciences	1	-	-	0
Practical							
7	Engineering Science Course	PCC-CS 492	Computer Architecture	0	0	4	2
8	Professional Core Courses	PCC-CS494	Design & Analysis of Algorithms	0	0	4	2
						Total credits	20

Semester V (Third year)							
Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				L	T	P	
1	Engineering Science Course	ESC501	Software Engineering	3	0	0	3
2	Professional Core Courses	PCC-CS501	Compiler Design	3	0	0	3
3	Professional Core Courses	PCC-CS502	Operating Systems	3	0	0	3
4	Professional Core Courses	PCC-CS503	Object Oriented Programming	3	0	0	3
5	Humanities & Social Sciences including Management courses	HSMC-501	Introduction to Industrial Management (Humanities III)	3	0	0	3
6	Professional Elective	PEC-IT 501A/B/C/D	(Elective-I) Theory of	3	0	0	3

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	courses		Computation/Artificial Intelligence/Advanced Computer Architecture/Computer Graphics				
7	Mandatory Courses	MC- CS501	Constitution of India/ Essence of Indian Knowledge Tradition	-	-	-	0
Practical							
8	Professional Core Courses	ESC- 591	Software Engineering		0	4	2
9	Professional Core Courses	PCC- CS592	Operating Systems		0	4	2
10	Professional Core Courses	PCC- CS593	Object Oriented Programming		0	4	2
Total credits							24

Semester VI (Third year)							
Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				L	T	P	
1	Professional Core Courses	PCC- CS601	Database Management Systems	3	0	0	3
2	Professional Core Courses	PCC- CS602	Computer Networks	3	0	0	3
3	Professional Elective courses	PEC- IT601A/B/C/D	(Elective-II) Advanced Algorithms/ Distributed Systems/ Signals & Systems / Image Processing	3	0	0	3
4	Professional Elective courses	PEC- IT602A/B/C/D	(Elective-III) Parallel and Distributed Algorithms/ Data Warehousing & Data Mining/Human Computer Interaction/Pattern Recognition	3	0	0	3

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5	Open Elective courses	OEC-IT601A/B	(Open Elective-) Numerical Methods/ Human Resource Development and Organizational Behavior	3	0	0	3
6	Project	PROJ-CS601	Research Methodology	3	0	0	3
Practical							
7	Professional Core Courses	PCC-CS691	Database Management Systems	0	0	4	2
8	Professional Core Courses	PCC-CS692	Computer Networks	0	0	4	2
			Total credits				22

Semester VII (Fourth year)							
Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				L	T	P	
1	Professional Elective courses	PEC-CS701A/B/C/D/E	(Elective-IV) Quantum Computing/ Cloud Computing/ Digital Signal Processing/Multi-agent Intelligent Systems/Machine learning	3	0	0	3
2	Professional Elective courses	PEC-CS702A/B/C/D/E	(Elective-V) Neural Networks and Deep Learning/ Soft Computing/ Ad-Hoc and Sensor Networks/Information Theory and Coding/Cyber Security	3	0	0	3
3	Open Elective courses	OEC-CS701A/B/C	(Open Elective-II) Operations Research/Multimedia Systems/Introduction to Philosophical Thoughts	3	0	0	3
4	Humanities & Social	HSM	Project Management and	2	1	0	3

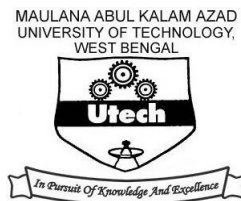
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	Sciences including Management courses	C 701	Entrepreneurship				
5	Project	PROJ-CS781	Project-II	0	0	12	6
			Total credits				18

Semester VIII (Fourth year)							
[Summer Industry Internship]							
Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				L	T	P	
1	Professional Elective courses	PEC-CS801A/B/C/D/E	(Elective-VI) Signals and Networks/Cryptography & Network Security/ Speech and Natural Language Processing/ Web and Internet Technology/Internet of Things	3	0	0	3
2	Open Elective courses	OEC-CS801A/B/C/D/E	Open Elective-III Big Data Analysis/Cyber Law and Ethics/ Mobile Computing/Robotics/Soft Skill & Interpersonal Communication	3	0	0	3
3	Open Elective courses	OEC-CS802A/B/C	(Open Elective-IV) E-Commerce and ERP/Micro-electronics and VLSI Design/Economic Policies in India	3	0	0	3
4	Project	PROJ-CS881	Project-III	0	0	12	6
			Total credits				15

1st Year Curriculum for B.Tech courses in Engineering & Technology

(Applicable from the academic session 2018-2019)



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(Formerly West Bengal University of Technology)
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits

B. Range of credits :

A range of credits from 150 to 160 for a student to be eligible to get B.Tech Degree in Engineering. A student will be eligible to get B.Tech Degree *with Honours*, if he/she completes an additional 20 credits. These could be acquired through Massive Open Online Courses (MOOCs).

C. MOOCs for B. Tech Honours

The additional 20 credits (for obtaining B. Tech with Honours) are to be gained through MOOCs. The complete description of the MOOCs relevant for the first year course are given in *Annexure-I*. The courses for subsequent years of study will be posted subsequently.

D. Guidelines regarding Mandatory Induction Program for the new students

All concerned are requested to follow the guidelines given in *Annexure-II* (Notice dt.06/12/2017) concerning Mandatory Induction Program. The colleges/ Institute may also refer to the AICTE Model Curriculum for Undergraduate Degree Courses in Engineering & Technology (January 2018) -Volume I (Page No.31-38), if necessary.

E. Mandatory Additional Requirement for earning B. Tech Degree

All concerned are requested to follow the guidelines in *Annexure-III* concerning Mandatory Additional Requirements.

F. Group division:

Group-A:

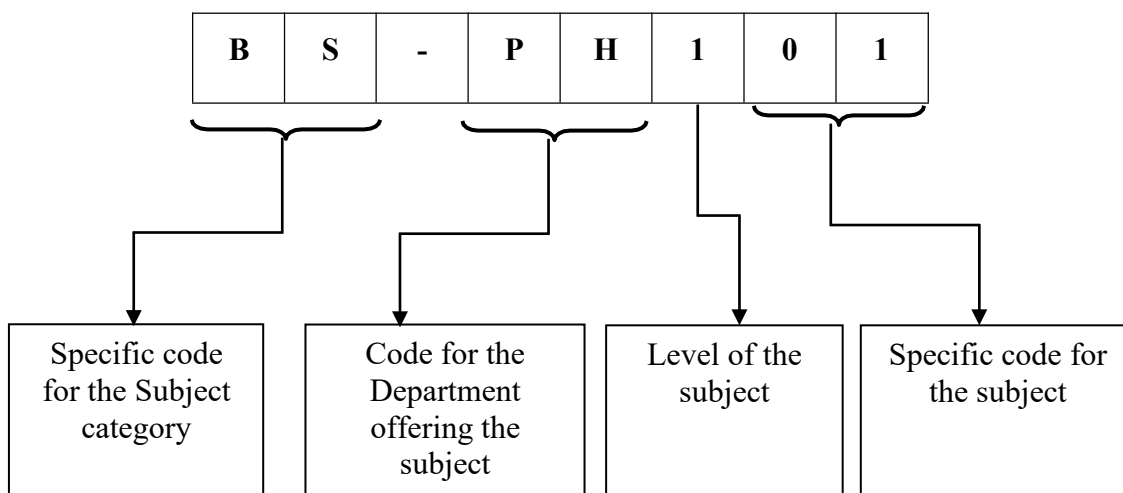
Chemistry based subjects: [Bio-Technology, Food Technology, Leather Technology, Textile Technology, Ceramic Technology, Chemical Engineering and any other Engineering that chooses to be Chemistry based] + Physics based subjects: [Mechanical Engineering, Production Engineering, Civil Engineering, Automobile Engineering, Marine Engineering, Apparel Production Engineering, Computer Science & Engineering, Information Technology.]

Group-B:

All Physics based subjects which are also Electrical & Electronics based [Electrical Engineering, Electronics & Communication Engineering, Applied Electronics & Instrumentation Engineering, Power Engineering, Electrical & Electronics Engineering, Bio-Medical Engineering, Instrumentation & Control Engineering]

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G. Subject Numbering Scheme:



List of Codes for Subject Category	
Code	Category Name
BS	Basic Science Courses
ES	Engineering Science Courses
HM	Humanities and Social Sciences including Management courses
PC	Professional core courses
PE	Professional Elective courses
OE	Open Elective courses
MC	Mandatory courses
PW	Project

List of Codes for Departments			
Code	Name of the Department	Code	Name of the Department
APM	Apparel Production Engineering	ECE	Electronics & Communication Engineering
AEIE	Applied Electronics & Instrumentation Engineering	FT	Food Technology
AUE	Automobile Engineering	IT	Information Technology
BME	Bio-Medical Engineering	ICE	Instrumentation & Control Engineering
BT	Bio-Technology	LT	Leather Technology
CT	Ceramic Technology	MRE	Marine Engineering
CHE	Chemical Engineering	ME	Mechanical Engineering
CE	Civil Engineering	PWE	Power Engineering
CSE	Computer Science & Engineering	PE	Production Engineering
EEE	Electrical & Electronics Engineering	TT	Textile Technology
EE	Electrical Engineering		

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First Year First Semester							
Mandatory Induction Program- 3 weeks duration							
Sl No.	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science course	BS-PH101/ BS-CH101	Physics-I (Gr-A)/ Chemistry-I(Gr-B)	3	1	0	4
2	Basic Science course	BS-M101/ BS-M102	Mathematics –IA*/ Mathematics –IB *	3	1	0	4
3	Engineering Science Courses	ES-EE101	Basic Electrical Engineering	3	1	0	4
	Total Theory			9	3	0	12
Practical							
1	Basic Science course	BS-PH191/ BS-CH191	Physics-I Laboratory (Gr-A)/ Chemistry-I Laboratory (Gr-B)	0	0	3	1.5
2	Engineering Science Courses	ES-EE191	Basic Electrical Engineering Laboratory	0	0	2	1
3	Engineering Science Courses	ES-ME191/ ES-ME192	Engineering Graphics & Design(Gr-B)/ Workshop/Manufacturing Practices(Gr-A)	1	0	4	3
	Total Practical			1		9	5.5
	Total of First Semester			10	3	9	17.5

* Mathematics –IA (BS-M101) - CSE & IT
 Mathematics –IB (BS-M102) - All stream except CSE & IT

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First Year Second Semester							
Sl No.	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science courses	BS-PH201/ BS-CH201	Physics-I (Gr-B)/ Chemistry-I (Gr-A)	3	1	0	4
2	Basic Science courses	BS-M201/ BS-M202	Mathematics –IIA [#] / Mathematics –IIB [#]	3	1	0	4
3	Engineering Science Courses	ES-CS201	Programming for Problem Solving	3	0	0	3
4	Humanities and Social Sciences including Management courses	HM-HU201	English	2	0	0	2
	Total Theory			11	2	0	13
Practical							
1	Basic Science courses	BS-PH291/ BS-CH291	Physics-I Laboratory (Gr-B)/ Chemistry-I Laboratory (Gr-A)	0	0	3	1.5
2	Engineering Science Courses	ES-CS291	Programming for Problem Solving	0	0	4	2
3	Engineering Science Courses	ES-ME291/ ES-ME292	Engineering Graphics & Design(Gr-A)/ Workshop/Manufacturing Practices(Gr-B)	1	0	4	3
4	Humanities and Social Sciences including Management courses	HM-HU291	Language Laboratory	0	0	2	1
	Total Practical			1	0	13	7.5
	Total of Second Semester			12	2	13	20.5

Mathematics –II (BS-M201) - CSE & IT
 Mathematics –II (BS-M202) - All stream except CSE & IT

	Group-A	Group-B
1 st Year 1 st Semester	Physics-I (BS-PH101); Workshop/Manufacturing Practices (ES-ME192)	Chemistry-I (BS-CH101); Engineering Graphics & Design (ES-ME191)
1 st Year 2 nd Semester	Chemistry-I (BS-CH201); Engineering Graphics & Design (ES-ME291)	Physics-I (BS-PH201); Workshop/Manufacturing Practices (ES-ME292)

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Course Code : BS-PH101/ BS-PH201	Category : Basic Science Courses
Course Title : Physics-I	Semester : First/ Second
L-T-P : 3-1-0	Credit:4
Pre-Requisites:	

Course objectives :

Basic concepts of mechanics, optics and its applications, electricity, magnetism and qualitative understanding of concepts of quantum physics and statistical mechanics.

1. Mechanics (7L)

Problems including constraints & friction. Basic ideas of vector calculus and partial differential equations. Potential energy function $F = -\text{grad } V$, equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy & momentum. Non-inertial frames of reference. Harmonic oscillator; Damped harmonic motion forced oscillations and resonance. Motion of a rigid body in a plane and in 3D. Angular velocity vector. Moment of inertia.

2. Optics (5L)

- Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits (only the expressions for max;min, & intensity and qualitative discussion of fringes); diffraction grating(resolution formulac only), characteristics of diffraction grating and its applications.
- Polarisation : Introduction, polarisation by reflection, polarisation by double reflection, scattering of light, circular and elliptical polarisation, optical activity.
- Lasers : Principles and working of laser : population inversion, pumping, various modes, threshold population inversion with examples .

3. Electromagnetism and Dielectric Magnetic Properties of Materials (8L)

- Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielecrrics, internal fields in a solid, Clausius- Mossotti equation(expression only), applications of dielectrics.
- Magnetisation , permeability and susceptibility, classificationof magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.

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4. Quantum Mechanics (16L)

- Introduction to quantum physics, black body radiation, explanation using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.

5. Statistical Mechanics (8L)

- Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics.

Course outcomes:

Students will be familiar with

- Basic concepts of mechanics
- Bragg's Law and introduction to the principles of lasers, types of lasers and applications.
- Various terms related to properties of materials such as, permeability, polarization, etc.
- Some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials.
- Simple quantum mechanics calculations.
-

Learning Resources:

1. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited
2. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker, Wiley
3. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press
4. Engineering Mechanics (In SI Units) (SIE), S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati, McGraw Hill Education
5. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education
6. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education
7. Engineering Mechanics, M.K. Harbola, Cengage India
8. An Introduction to Mechanics (SIE), David Kleppner, Robert Kolenkow, McGraw Hill Education
9. Principles of mechanics, John L. Synge and Byron A. Griffith, New York, McGraw-Hill
10. Mechanics (Dover Books on Physics), J. P. Den Hartog, Dover Publications Inc.
11. Engineering Mechanics: Dynamics, L.G. Kraige J.L. Meriam, Wiley
12. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, Robert Eisberg, Robert Resnick, Wiley
13. Introduction to Quantum Mechanics, J. Griffiths David, Pearson Education
14. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press
15. Optics, Hecht, Pearson Education
16. Optics, Ghatak, McGraw Hill Education India Private Limited
17. Fundamentals of Statistical and Thermal Physics, Reif, Sarat Book Distributors
18. Statistical Mechanics, Pathria, Elsevier
19. Statistical Physics, L.D. Landau, E.M. Lifshitz, Butterworth-Heinemann

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Course Code : BS-CH101/ BS-CH201	Category : Basic Science Courses
Course Title : Chemistry-I	Semester : First/ Second
L-T-P : 3-1-0	Credit:4
Pre-Requisites:	

Detailed contents

i) Atomic and molecular structure (10 lectures)

Schrodinger equation. Particle in a box solutions and their applications for simple sample. Molecular orbitals of diatomic molecules (e.g.H₂). Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

ii) Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

iii) Intermolecular forces and potential energy surfaces (4 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena.

iv) Use of free energy in chemical equilibria (8 lectures)

First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

v) Periodic properties (4 Lectures)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

vi) Stereochemistry (4 lectures)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

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vii) Organic reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

Learning Resources:

1. Engineering Chemistry, Satyaprakash, Khanna Book Publishing, Delhi
2. University chemistry, by B. H. Mahan
3. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
4. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
5. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
6. Physical Chemistry, by P. W. Atkins
7. Spectroscopy of Organic Compounds, by P.S.Kalsi, New Age International Pvt Ltd Publishers
8. Physical Chemistry, P. C. Rakshit, Sarat Book House
9. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition
<http://bcs.whfreeman.com/vollhardtschore5e/default.asp>

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Course Code : BS-M101	Category : Basic Science Course
Course Title : Mathematics – I A	Semester : First (CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic	Lectures Hours
1	<i>Calculus (Integration):</i> Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	<i>Calculus (Differentiation):</i> Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	<i>Matrices:</i> Matrices, Vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.	7
4	<i>Vector Spaces:</i> Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem, composition of linear maps, Matrix associated with a linear map.	9
5	<i>Vector Spaces (Continued):</i> Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.	10

Course Outcomes:

The students will be able to:

- Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.
- Understand the domain of applications of mean value theorems to engineering problems.
- Learn different types of matrices, concept of rank, methods of matrix inversion and their applications.
- Understand linear spaces, its basis and dimension with corresponding applications in the field of computer science.
- Learn and apply the concept of eigen values, eigen vectors, diagonalisation of matrices and orthogonalization in inner product spaces for understanding physical and engineering problems

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Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. S.K. Mapa, Higher Algebra: Abstract and Linear, Sarat Book House Pvt.Ltd.
8. Hoffman and Kunze: Linear algebra, PHI.

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Course Code : BS-M102	Category : Basic Science Course
Course Title : Mathematics –I B	Semester : First (All stream except CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic	Lectures Hours
1	<i>Calculus (Integration):</i> Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	<i>Calculus (Differentiation):</i> Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	<i>Sequence and Series:</i> Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.	11
4	<i>Multivariate Calculus:</i> Limit, continuity and partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, Curl and Divergence.	9
5	<i>Matrices:</i> Inverse and rank of a matrix, Rank-nullity theorem; System of linear equations; Symmetric, Skew-symmetric and Orthogonal matrices; Determinants; Eigenvalues and Eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.	8

Course Outcomes:

After completing the course the student will be able to

Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

Understand the domain of applications of mean value theorems to engineering problems.

Learn the tools of power series and Fourier series to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.

Apply the knowledge for addressing the real life problems which comprises of several variables or attributes and identify extremum points of different surfaces of higher dimensions.

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Understand different types of matrices, their eigen values, eigen vectors, rank and also their orthogonal transformations which are essential for understanding physical and engineering problems.

Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.

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Course Code : ES-EE101	Category : Engineering Science Courses
Course Title : Basic Electrical Engineering	Semester : First
L-T-P : 3-1-0	Credit: 4
Pre-Requisites:	

Detailed contents:

Module 1: DC Circuits (8 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers (6 hours)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 hours)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters (6 hours)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

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Course Outcomes

To understand and analyze basic electric and magnetic circuits

To study the working principles of electrical machines and power converters.

To introduce the components of low voltage electrical installations

Learning Recourses:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Book Publishing Co. (P) Ltd., Delhi.
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
4. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
5. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
6. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

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Course Code : BS-PH191/ BS-PH291	Category : Basic Science course
Course Title : Physics-I Laboratory	Semester : First/ Second
L-T-P : 0-0-3	Credit:1.5
Pre-Requisites:	

Choose 10 experiments including at least one from Optics, Electricity and Magnetism and Quantum Mechanics and at least a total of six from these three groups.

Experiments in Optics

1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of a monochromatic light by Newton's ring
3. Determination of wavelength of a monochromatic light by Fresnel's bi-prism
4. Determination of wavelength of the given laser source by diffraction method

Electricity & Magnetism experiments

1. Determination of thermo electric power of a given thermocouple.
2. Determination of specific charge (e/m) of electron by J.J. Thompson's method.
3. Determination of dielectric constant of a given dielectric material.
4. Determination of Hall coefficient of a semiconductor by four probe method.
5. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.
6. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
7. Determination of unknown resistance using Carey Foster's bridge
8. Study of Transient Response in LR, RC and LCR circuits using expeyes
9. Generating sound from electrical energy using expeyes

Experiments in Quantum Physics

1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Lande-g factor using Electron spin resonance spectrometer.
4. Determination of Rydberg constant by studying Hydrogen spectrum.
5. Determination of Band gap of semiconductor.
6. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

Miscellaneous experiments

1. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure
2. Determination of bending moment and shear force of a rectangular beam of uniform cross-section
3. Determination of modulus of rigidity of the material of a rod by static method
4. Determination of rigidity modulus of the material of a wire by dynamic method
5. To determine the moment of inertia of a body about an axis passing through its centre of gravity and to determine the modulus of rigidity of the material of the suspended wire
6. Determination of coefficient of viscosity by Poiseuille's capillary flow method

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Course Code : BS-CH191/ BS-CH291	Category : Basic Science Courses
Course Title : Chemistry-I Laboratory	Semester : First/ Second
L-T-P : 0-0-3	Credit:1.5
Pre-Requisites:	

Choose 10 experiments from the following:

1. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
2. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
3. Determination of dissolved oxygen present in a given water sample.
4. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution)
5. Determination of surface tension and viscosity
6. Thin layer chromatography
7. Ion exchange column for removal of hardness of water
8. Determination of the rate constant of a reaction
9. Determination of cell constant and conductance of solutions
10. Potentiometry - determination of redox potentials and emfs
11. Saponification/acid value of an oil
12. Chemical analysis of a salt
13. Determination of the partition coefficient of a substance between two immiscible liquids
14. Adsorption of acetic acid by charcoal
15. Use of the capillary viscosimeters to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

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Course Code : ES-EE191	Category : Engineering Science Courses
Course Title : Basic Electrical Engineering Laboratory	Semester : First
L-T-P : 0-0-2	Credit: 1
Pre-Requisites:	

Choose 10 experiments from the following:

1. First activity: Introduction to basic safety precautions and mentioning of the do's and Don'ts. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about the modalities of evaluation.
2. Introduction and uses of following instruments :
 - (a) Voltmeter
 - (b) Ammeter
 - (c) Multimeter
 - (d) Oscilloscope

Demonstration of real life resistors, capacitors with color code , inductors and autotransformer.

3. Demonstration of cut-out sections of machines: DC machine, Induction machine, Synchronous machine and single phase induction machine.
4. Calibration of ammeter and Wattmeter.
5. Determination of steady state and transient response of R-L, R-C and R-L-C circuit to a step change in voltage.
6. Determination of steady state response of R-L and R-C and R-L-C circuit and calculation of impedance and power factor.
7. Determination of resonance frequency and quality factor of series and parallel R-L-C circuit.
8. (a) Open circuit and short circuit test of a single-phase transformer
(b) Load test of the transformer and determination of efficiency and regulation
9. Demonstration of three phase transformer connections. Voltage and current relationship, phase shifts between the primary and secondary side.
10. Measurement of power in a three phase unbalanced circuit by two wattmeter method.
11. Determination of Torque –Speed characteristics of separately excited DC motor.
12. Determination of Torque speed characteristics and observation of direction reversal by change of phase sequence of connection of Induction motor.
13. Determination of operating characteristics of Synchronous generator.
14. Demonstration of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter for speed control of an Induction motor
15. Demonstration of components of LT switchgear.

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Course Code : ES-ME191/ ES-ME 291	Category : Engineering Science Courses
Course Title : Engineering Graphics & Design	Semester : First/ Second
L-T-P : 1-0-4	Credit: 3
Pre-Requisites:	

Sl. No.	Content	Lecture (L)	Practical (P)
1	INTRODUCTION TO ENGINEERING DRAWING Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes.	1	4
2	LETTERING, DIMENSIONING, SCALES Plain scale, Diagonal scale and Vernier Scales.	1	4
3	GEOMETRICAL CONSTRUCTION AND CURVES Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Archimedian Spiral.	1	4
4	PROJECTION OF POINTS, LINES, SURFACES Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle, pentagon, Hexagon etc.) inclined Planes - Auxiliary Planes.	1	4
5	PROJECTION OF REGULAR SOLIDS Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).	1	4
6	COMBINATION OF REGULAR SOLIDS, FLOOR PLANS Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.	1	4
7	ISOMETRIC PROJECTIONS Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;	1	4

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8	SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)	1	4
9	OVERVIEW OF COMPUTER GRAPHICS, CUSTOMISATION & CAD DRAWING listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;	1	4
	ANNOTATIONS, LAYERING & OTHER FUNCTIONS applying dimensions to objects, applying annotations to drawings;		
10	Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;	2	8

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11	DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).	2	8
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Course Outcomes

The student will learn:

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling

General Instructions

1. In every topic some problems are to be done in the class and some are to be given to students as home assignment.
2. The problems for class work are to be prepared on drawing sheet of A1 size in the class/ using AutoCAD software.
3. The problems for home assignments are to be prepared on drawing copy/ using AutoCAD software.
4. Print out of every assignment is to be taken for CAD Drawings on Drawing sheets (A4 Sheets).
5. A title block must be prepared in each sheet/ assignment.

Following is the list of drawing instruments that required for making engineering drawings on paper with perfection.

1. Drawing Board
2. Mini drafter/ Set-squares (45°–45° & 60°–90°), T-square
3. Protractor (180°, 360°)
4. Scales (Plain, Diagonal)
5. Compass (Small and Large)
6. Divider (Small and Large)

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7. French Curves
8. Drawing paper (A1 Size)
9. Drawing pencil (H, HB, B)
10. Sharpener
11. Eraser
12. Drawing pins & clips
13. Duster or handkerchief etc.

Learning Resources:

1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House
2. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
5. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
6. Corresponding set of CAD Software Theory and User Manuals

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Course Code : ES-ME192/ ES-ME 292	Category : Engineering Science Courses
Course Title : Workshop/ Manufacturing Practices	Semester : First/ Second
L-T-P : 1-0-4	Credit:3
Pre-Requisites:	

(i) Lectures & videos:

Detailed contents:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Electrical & Electronics
5. Carpentry
6. Plastic moulding, glass cutting
7. Metal casting
8. Welding (arc welding & gas welding), brazing

(ii) Workshop Practice:

Machine shop (8 hours)

Typical jobs that may be made in this practice module:

To make a pin from a mild steel rod in a lathe.

To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Fitting shop (8 hours)

Typical jobs that may be made in this practice module:

To make a Gauge from MS plate.

Carpentry (8 hours)

Typical jobs that may be made in this practice module:

To make wooden joints and/or a pattern or like.

Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs))

Typical jobs that may be made in this practice module:

ARC WELDING (4 hours): To join two thick (approx 6mm) MS plates by manual metal arc welding.

GAS WELDING (4 hours): To join two thin mild steel plates or sheets by gas welding.

Casting (8 hours)

Typical jobs that may be made in this practice module:

One/ two green sand moulds to prepare, and a casting be demonstrated.

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Smithy (4 hours) ~ 4 hours

Typical jobs that may be made in this practice module:

A simple job of making a square rod from a round bar or like.

Plastic moulding & Glass cutting (4 hours)

Typical jobs that may be made in this practice module:

For plastic moulding, making at least one simple plastic component should be made.

For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made.

Electrical & Electronics (8 hours)

Familiarization with LT switchgear elements, making its sketches and noting down its specification. Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable.

Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point.

Simple wiring exercise to be executed to understand the basic electrical circuit.

Simple soldering exercises to be executed to understand the basic process of soldering.

Fabrication of a single-phase full wave rectifier with a step down transformer using four diodes and electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes

Upon completion of this laboratory course, students will be able to fabricate components with their own hands.

They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

By assembling different components, they will be able to produce small devices of their interest.

Learning Resources:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. and Steven S. Schmid, “Manufacturing Engineering and Technology”, 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu, “Manufacturing Technology – I” Pearson Education, 2008.
4. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4th edition, Prentice Hall India, 1998.
5. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGrawHill House, 2017.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

Course Code : BS-M201	Category : Basic Science Course
Course Title : Mathematics – II A	Semester : Second (CSE &IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics and BS-M101	

Module No.	Description of Topic	Lectures Hours
1	Basic Probability: Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the Multinomial distribution, Poisson approximation to the Binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.	11
2	Continuous Probability Distributions: Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities.	4
3	Bivariate Distributions: Bivariate distributions and their properties, distribution of sums and quotients, Conditional densities, Bayes' rule.	5
4	Basic Statistics: Measures of Central tendency, Moments, Skewness and Kurtosis, Probability distributions: Binomial, Poisson and Normal and evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.	8
5	Applied Statistics: Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	8
6	Small samples: Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	4

Course Outcomes:

The students will be able to:

Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.

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Understand the basic ideas of statistics with different characterisation of a univariate and bivariate data set.

Apply statistical tools for analysing data samples and drawing inference on a given data set.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
3. S. Ross, A First Course in Probability, Pearson Education India
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.
5. John E. Freund, Ronald E. Walpole, Mathematical Statistics, Prentice Hall.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
7. N.G. Das, Statistical Methods (Combined Volume), Tata-McGraw Hill.

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

Course Code : BS-M202	Category : Basic Science Course
Course Title : Mathematics – II B	Semester : Second (All stream except CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics and BS-M102	

Module No.	Description of Topic	Lectures Hours
1	<i>Multivariate Calculus (Integration):</i> Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, change of variables (Cartesian to Polar), Applications: Areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.	11
2	<i>First order ordinary differential equations:</i> Exact, linear and Bernoulli's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.	5
3	<i>Ordinary differential equations of higher orders:</i> Second order linear differential equations with constant coefficients, Use of D-operators, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.	9
4	<i>Complex Variable – Differentiation</i> Differentiation of complex functions, Cauchy-Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithmic) and their properties; Conformal mappings, Mobius transformations and their properties.	6
5	<i>Complex Variable – Integration</i> Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, Zeros of analytic functions, Singularities, Laurent's series; Residues, Cauchy residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.	9

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Course Outcomes:

The students will be able to:

Learn the methods for evaluating multiple integrals and their applications to different physical problems.

Understand different techniques to solve first and second order ordinary differential equations with its formulation to address the modelling of systems and problems of engineering sciences.

Learn different tools of differentiation and integration of functions of a complex variable that are used with various other techniques for solving engineering problems.

Apply different types of transformations between two 2- dimensional planes for analysis of physical or engineering problems.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. E. L. Ince, Ordinary Differential Equations, Dover Publications.
8. J. W. Brown and R. V. Churchill, Complex Variables and Applications, Mc-Graw Hill.

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

Course Code : ES-CS201	Category : Engineering Science Courses
Course Title : Programming for Problem Solving	Semester : Second
L-T-P : 3-0-0	Credit :3
Pre-Requisites:	

Detailed contents

Unit 1: Introduction to Programming (4 lectures)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - **(1 lecture)**.

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. **(1 lecture)**

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- **(2 lectures)**

Unit 2: Arithmetic expressions and precedence (2 lectures)

Unit 3: Conditional Branching and Loops (6 lectures)

Writing and evaluation of conditionals and consequent branching **(3 lectures)**

Iteration and loops **(3 lectures)**

Unit 4: Arrays (6 lectures)

Arrays (1-D, 2-D), Character arrays and Strings

Unit 5: Basic Algorithms (6 lectures)

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 6: Function (5 lectures)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Unit 7: Recursion (4 -5 lectures)

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 8: Structure (4 lectures)

Structures, Defining structures and Array of Structures

Unit 9: Pointers (2 lectures)

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Unit 10: File handling (only if time is available, otherwise should be done as part of the lab)

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

Course Outcomes

The student will learn

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical errors.
- To implement conditional branching, iteration and recursion.
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- To apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.

Learning Resources:

1. R. S. Salaria, Computer Concepts and Programming in C, Khanna Publishers
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

Course Code : ES-CS291	Category : Engineering Science Courses
Course Title : Programming for Problem Solving	Semester : Second
L-T-P : 0-0-4	Credit:2
Pre-Requisites:	

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

Tutorial 12: File handling:

Lab 12: File operations

Laboratory Outcomes

To formulate the algorithms for simple problems

To translate given algorithms to a working and correct program

To be able to correct syntax errors as reported by the compilers

To be able to identify and correct logical errors encountered at run time

To be able to write iterative as well as recursive programs

To be able to represent data in arrays, strings and structures and manipulate them through a program

To be able to declare pointers of different types and use them in defining self-referential structures.

To be able to create, read and write to and from simple text files.

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

Course Code : HM-HU201	Category : Humanities and Social Sciences including Management courses
Course Title : English	Semester : Second
L-T-P : 2-0-0	Credit:2
Pre-Requisites:	

Detailed contents

1. Vocabulary Building

- 1.1 The concept of Word Formation: Compounding, Backformation, Clipping, Blending.
- 1.2 Root words from foreign languages and their use in English
- 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
- 1.4 Synonyms, antonyms, and standard abbreviations: Acronyms

2. Basic Writing Skills

- 2.1 Sentence Structures & Types: Simple, Compound, Complex
- 2.2 Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration
- 2.3 Importance of proper punctuation
- 2.4 Creating coherence: Arranging paragraphs & Sentences in logical order
- 2.5 Creating Cohesion: Organizing principles of paragraphs in documents
- 2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

- 3.1 Subject-verb agreement
- 3.2 Noun-pronoun agreement
- 3.3 Misplaced modifiers
- 3.4 Articles
- 3.5 Prepositions
- 3.6 Redundancies
- 3.7 Clichés

4. Nature and Style of sensible Writing

- 4.1 Describing
- 4.2 Defining
- 4.3 Classifying
- 4.4 Providing examples or evidence
- 4.5 Writing introduction and conclusion

5. Writing Practices

- 5.1 Comprehension
- 5.2 Précis Writing
- 5.3 Essay Writing
- 5.4 Business Letter, Cover Letter & CV; E-mail

Addendum

Some examples of English words with foreign roots

Greek Root/Affix	Examples
Anti	Antisocial, antiseptic

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Auto	Automatic, autograph
Anthropos	Anthropology, philanthropy
Bio	Biography
Chronos	Time
Di	Dilemma
Bio	Biology
Biblio	Bibliography
Chron	Chronology
Cracy	Contradiction
Geo	Geology
Hyper	Hyperactive
Mania	Kleptomania
Mega	Megaserial
Eu	Eulogy, euphoria
Geo	Geology
Graph	autograph, photograph
Hetero	Heterogeneous
Hyper	Hyperactive
Hypo	hypodermic, hypoglycemia
Macro	Macrocosm
Mega	megalomania
Micro	microcosm

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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Mono	Monarch
Pan	Panorama
Pathos	Pathetic
Phobia	Hydrophobia
Pod (Gk), ped (Latin)	Pseudopodia
Poly	polyglot
Tele	Telephone
Theo	Theology, theist
Latin Root	Examples
Aud	Audible
Bene	Beneficial
Brev	abbreviate, brief
circum	Circulate
Contra	Contradict
Cred	Credible
Dict	Diction
Femina	Feminine
Inter	Internet, interval
Magna	Magnificent
Mal	Malnutrition
Multi	multinational
Nova	Novel
Multi	Multiple, multiplex
Non	Nonstop

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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Pre	Previous, predicate
Re	Redo, rewind
Scrib	Scripture
Spect	Spectator
Trans	Transport
Uni	Unity
Omni	Omnipotent
Semi	Semicircle
Sub	Subway
somnus	Insomnia,
Super	Superman
Sym	Sympathy
scribe	Describe, scribble(write illegibly), inscribe
Trans	Transform
Un	Unnecessary
Uni	Universal

Learning Resources:

- (i) Kulbushan Kumar, R S Salaria, Effective Communication Skills, Khanna Publishing House, Delhi.
- (ii) Practical English Usage. Michael Swan. OUP. 1995.
- (iii) Remedial English Grammar. F.T. Wood. Macmillan. 2007
- (iv) On Writing Well. William Zinsser. Harper Resource Book. 2001
- (v) Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- (vi) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
- (vii) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
- (viii) Universal English Prof. Prasad Kataria Publications, 2019.
- (ix) "Communication Skills for Professionals"-Nira Konar, Prentice Hall of India 2nd edition, New Delhi, 2011
- (x) Gajendra Singh Chauhan, Smita Kashiramka and L. Thimmesha. Functional English. Cengage, 2019.

Course Outcomes

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Course Code : HM-HU291	Category : Humanities and Social Sciences including Management courses
Course Title : Language Laboratory	Semester : Second
L-T-P : 0-0-2	Credit:1
Pre-Requisites:	

- | | |
|---|----|
| 1) Honing 'Listening Skill' and its sub skills through Language Lab Audio device; | 3P |
| 2) Honing 'Speaking Skill' and its sub skills | 2P |
| 3) Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/
Voice modulation/ Stress/ Intonation/ Pitch & Accent) of connected speech | 2P |
| 4) Honing 'Conversation Skill' using Language Lab Audio –Visual input;
Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone &
Role Play Mode) | 2P |
| 5) Introducing 'Group Discussion' through audio –Visual input and acquainting them
with key strategies for success | 2P |
| 6) G D Practice Sessions for helping them internalize basic Principles
(turn- taking, creative intervention, by using correct body language, courtesies &
other soft skills) of GD | 4P |
| 7) Honing 'Reading Skills' and its sub skills using Visual / Graphics/
Diagrams /Chart Display/Technical/Non Technical Passages
Learning Global / Contextual / Inferential Comprehension; | 2P |
| 8) Honing 'Writing Skill' and its sub skills by using
Language Lab Audio –Visual input; Practice Sessions | 2P |

Course Outcomes

- The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

MOOCs for B. Tech Honours



Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal

Notice

1st May, 2018

MOOCs for B.Tech Honours (Applicable from the session 2018-2019)

Preamble

All India Council for Technical Education (AICTE) has introduced Model Curriculum for Bachelor of Technology programme with 160 credits in the entire programme of 4 years, and additional 20 credits will be required to be done for the degree of Bachelor of Technology with Honours. These additional 20 credits will have to be acquired with online courses (MOOCs) as per AICTE. So students will have to complete additional 20 credits through MOOCs within 4 years of time. This creates an excellent opportunity for students to acquire the necessary skill set for employability through massive online courses where the rare expertise of world famous experts from academics and industry are available. Maulana Abul Kalam Azad University of Technology, West Bengal (MAKAUT,WB) has thus decided to introduce AICTE model curriculum for its B.Tech Programmes and suggest baskets for MOOCs available year wise for the four-year long B.Tech programme from the sessions 2018-2019. The basket for MOOCs will be a dynamic one, as courses keep on updating with time. Few essential skill sets required for employability are also identified year wise by MAKAUT,WB. For MOOCs platforms where examination or assessment is absent (like SWAYAM) or where certification is costly (like Coursera or edX), faculty members of the Institutes are to audit the courses and prepare the examination question papers, for the courses undertaken by the students of respective Institutes, so that MAKAUT,WB can conduct examination for the course. The total of 20 credits that is required to be attained for B.Tech Honours degree are distributed over four years in the following way:

For first year	:	8 credits
For second year	:	4 credits
For third year	:	4 credits
For fourth year	:	4 credits

A student of first year has to cover courses from at least three skills :

1. Computer Programing with Python / R
2. Soft skill
3. Ethics

Courses are * marked in the above areas

If a student is unable to cover the credits assigned for the first year, he/she can do these courses in either of the subsequent years, but he/she has to choose the courses from the basket of MOOCs announced by MAKAUT,WB from time to time. The same rule will be applicable for the other years of the programme.

The basket for MOOCs for the 1st year B. Tech for the session 2018-2019 are made available herewith.

By order.

MOOCs for First Year, Engineering and Technology

Sl. No	Course	Provider	Duration	Credits	Name of University / Institution
1.	Presentation Skills: Designing Presentation Slides	Coursera *	4 weeks	1	Tomsk State University
2.	Effective Problem-Solving and Decision-Making	Coursera	4 weeks	1	University of California
3.	Communication in the 21st Century Workplace	Coursera *	4 weeks	1	University of California
4.	Psychology at Work	Coursera *	6 weeks	2	University of Western Australia
5.	Critical Thinking & Problem Solving	EdX *	3 weeks	3	Rochester Institute of Technology
6.	Successful Career Development	Coursera	7 weeks	2	University System of Georgia
7.	Working in Teams: A Practical Guide	edX	4 weeks	1	University of Queensland
8.	Communication theory: bridging academia and practice	Coursera	9 weeks	3	Higher School of Economics
9.	Speaking Effectively	NPTEL *	8 weeks	3	Indian Institute of Technology, Kharagpur
10.	Introduction to Philosophy	Coursera	5 weeks	1	University of Edinburgh
11.	Moralities of Everyday Life	Coursera	6 weeks	2	Yale University
12.	Introduction to Logic	Coursera *	10 weeks	3	Stanford University
13	Write Professional Emails in English	Coursera *	5 weeks	2	Georgia Institute of Technology
14	Technical Writing	Coursera	5 weeks	1	Moscow Institute of Physics and Technology
15	Learn to Program: The Fundamentals	Coursera	7 weeks	2	University of Toronto
16	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
17	Introduction to Problem Solving and Programming	NPTEL	12 weeks	4	NPTEL
18	The Science of Well Being	Coursera	6 weeks	2	Yale University
19	Developing Soft Skills and Personality	NPTEL	8 weeks	3	
20	Programming Basics	edX	9 weeks	3	IIT Bombay
21	Introduction to Python: Absolute Beginner	EdX *	5 weeks	2	Microsoft
22	Inferential Statistics	Coursera *	7 weeks	2	University of Amsterdam
23	Linear Regression and Modelling	Coursera	4 weeks	1	Duke University
24	Foundation of Data Structures	edX	6 weeks	2	IIT Bombay
25	Introduction to Logic	NPTEL	12 weeks	4	NPTEL
26	Introduction to Probability and Data	Coursera *	5 weeks	1	Duke University
27	Ethics	NPTEL *	12 weeks	4	
28	Science, Technology and Society	NPTEL	12 weeks	4	
29	Creating Innovation	Coursera	6 weeks	2	Macquarie University
30	Ethical Leadership Through Giving Voice to Values	Coursera *	4 weeks	2	University of Virginia
31	Creativity, Innovation, and Change	Coursera *	6 weeks	2	Pennsylvania State University
32	Interpersonal Communication for Engineering Leaders	Coursera	4 weeks	1	Rice University

33	Learn to Program: The Fundamentals	Coursera *	7 weeks	3	University of Toronto
34	Introduction to Mathematical Thinking	Coursera *	9 weeks	3	Stanford University
35	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
36	A Life of Happiness and Fulfillment	Coursera	6 weeks	2	Indian School of Business
37	Model Thinking	Coursera	12 weeks	4	University of Michigan
38	Introduction to Philosophy: God, Knowledge, and Consciousness	edX	12 weeks	4	MIT
39	Soft skills	NPTEL *	12 Weeks	4	IIT Roorkee
40	Developing Soft Skills and Personality	NPTEL *	8 weeks	3	IIT Kanpur
41	Indian Fiction in English	NPTEL	12 Weeks	4	IIT Madras
42	Development of Sociology in India	NPTEL	4 Weeks	1	IIT Kanpur
43	Intellectual Property	NPTEL	12 Weeks	4	IIT Madras
44	Essential Statistics for Data Analysis using Excel	EdX *	Self Paced	3	Microsoft
45	Ethics and Law in Data and Analytics	edX	Self Paced	4	Microsoft
46	Climate Change Mitigation in Developing Countries	Coursera *	6 weeks	3	University of Cape town
47	Web Design for Everybody (Basics of Web Development and Coding) Specialization	Coursera	15weeks	4	University of Michigan
48	Ecology: Ecosystem Dynamics and Conservation	Coursera	5 weeks	1	American Museum of Natural History, Howard Hughes Medical Institute
49	Environmental Studies: A Global Perspective	EdX *	Self Paced	4	Curtin University
50	Introduction to Computer Science and Programming Using Python	edX *	Self Paced	4	MIT, USA
51	Statistics and R	edX *	Self Paced	4	Harvard University
52	Introduction to Programming in C	Coursera *	4 weeks	4	Duke University
53	Java Programming: Solving Problems with Software	Coursera	4 weeks	4	Duke University
54	Grammar and Punctuation	Coursera	4 weeks	1	University of California
55	How to Write an Essay	Coursera *	5 weeks	1	University of California, Berkeley
56	Conversational English Skills	EdX *	10 weeks	3	Tsinghua University
57	Advanced Writing	Coursera *	4 weeks	1	University of California, Irvine
58	Speak English Professionally: In Person, Online & On the Phone	Coursera *	5 weeks	1	Georgia Institute of Technology
59	English for Science, Technology, Engineering, and Mathematics	Coursera	5 weeks	1	University of Pennsylvania
60	English Composition	edX	8 weeks	3	Arizona State University
61	Take Your English Communication Skills to the Next Level	Coursera *	4 weeks	1	Georgia Institute of Technology

**Guidelines regarding
Mandatory Induction Program for
the new students**



Maulana Abul Kalam Azad University of Technology, West Bengal
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BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Date: 06.12.2017

Maulana Abul Kalam Azad University of Technology, West Bengal

Guidelines regarding Induction Programme for the new students

(As per Model Curriculum for 1st Year UG degrees courses in Engineering & Technology, November 2017)

To be followed from the 2018-19 academic session

Preamble: Engineering education has evolved globally in a continuous manner to address the twin needs of industry and society. It is now an accepted fact that the institutions imparting technical education should aspire to create manpower who will possess strong technical knowledge and skill, have leadership qualities and be a team player, capable of coming up with innovative solutions and be alive to societal and community concerns.

The aim of the Induction Programme is to acclimatize the students to the environment of their engineering institution, give them a flavour of the exciting new world of education that they are entering, provide them with mentoring schemes, and make them aware of their neighbourhood, society and people. This will allow them to evolve as well rounded individuals.

The following schedule is laid down by the University to implement the three week long Induction Programme:

Week 1	1 st Half	Day 1	Overall introduction of the new students to the Institution, its different Departments & Faculty Members
	2 nd Half	Day 1	(a) Assignment of faculty mentors to the new students (b) Assessment and allotment for mentoring by senior students preferably from the second year
	2 hrs	Day 2, 3, 4, 5	Lectures by eminent personalities on different areas such as (a) Introduction to Engineering (b) Various topics of science and technology (c) Innovation and entrepreneurship (d) Creative and performing arts (e) Social issues
	2 hrs.	Day 2, 3, 4, 5	Participation in Games, Yoga, Meditation etc.
	2 hrs	Day 2, 3, 4, 5	Visit to the different Departments of the Institute
Week 2 (All Days)	2hrs		Scheduled class lectures as per time table.
	2hrs		Students to be conducted through proficiency modules to be prepared by respective Colleges for ascertaining English skills & Computer knowledge of the students

			and to prepare a report on the same
	2hrs		Participation in Games, Sports, Yoga, Creative arts etc.
Week 3	2hrs		Scheduled class lectures as per time table
		Day 1	Visits to neighbourhood locations
		Day 2	Visits to natural spots in adjoining areas to understand the effect of nature on society
		Day 3	Visits to Science Museum / laboratories
		Day 4	Visits to NGOs
		Day 5	

Any other activity, as deemed fit by the Director/Principal of the affiliated Colleges, may be proposed and discussed with the Academic Coordinator of the University, by sending email to the following address: academics.makaut@gmail.com.

Note: 1) If necessary, networking may be established with NGOs to facilitate the different components and aspects of the Induction Programme.

Mandatory Additional Requirement for earning B. Tech Degree



Maulana Abul Kalam Azad University of Technology, West Bengal
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Maulana Abul Kalam Azad University of Technology, West Bengal
BF-142, Sector-I, Saltlake

Notice

Mandatory Additional Requirement for earning B.Tech Degree

Addressing the needs of the industry and the society: Globally, engineering education systems have continuously evolved, in order to address the needs of the industry and the society. It is becoming imperative that every University should create opportunities for the students to inculcate attributes, which are not restricted only to engineering knowledge and acumen. Industry needs professionals who can work successfully in teams, who have leadership qualities, who are alive to social and community needs and who can bring innovation and creativity to their work and who are also digitally proficient. Hence, in order to prepare its students to match these multiple requirements, MAKAUT, WB has created a unique mechanism of awarding 100 Activity Points over and above the academic grades. It is planned that the students at MAKAUT, WB will be able to reap benefits from these activities at their own pace and comfort. It is expected that by the time MAKAUT, WB's students reach their Final Year, they would have developed themselves so well both through their studies in the respective technological field and through their active participation in the co-curricular and extra-curricular activities as also through SAWYAM based learning activities that they would be well-prepared for contributing to building the India and the world of their dreams.

The additional requirement applies to: Every student, who is admitted to the 4 years B.Tech program from the academic year 2018-19 onwards, is required to earn minimum 100 Activity Points in addition to the required academic grades, for getting MAKAUT, WB's B.Tech degree. Similarly, it is mandatory to earn 75 Activity Points, in addition to the academic grades, for getting B.Tech degree by a student (Lateral Entry) who is admitted to the B.Tech program from the academic year 2018-19 onwards. *(Please see Table 1 for details.)* [Lateral Entry students will have a multiplying factor of 1.33 to bring uniformity in score].

Level of Entry in B.Tech Course	Total duration for earning Points	Minimum Points
1 st Year from the academic year 2018-19 onwards	1 st to 4 th Year	100
2 nd Year from the academic year 2018-19 onwards (Lateral Entry)	2 nd to 4 th Year	75

Table – I

For existing Students (except students in the 4th year): Every student, who is admitted to the 4 years B.Tech program prior to the academic year 2018-19, is required to earn minimum number of Activity Points as per Table II in addition to the required academic grades, for getting MAKAUT, WB's B.Tech degree.

Current Semester	Total Points to be earned During the full course
2 nd	100
4 th	75
6 th	50

Table –II

These points must be earned on the basis of active participation in co-curricular and extracurricular activities spanning through all the semesters of study. Every student may choose, as per his/her liking, activities in order to achieve the mandatory points (as per Table-III, depending on his/her entry level), before becoming eligible for award of the Degree. These activities can be spread over the years, as per convenience of the student.

Notes:

- **Current 4th year students who are going to sit for Final Semester examination in May-June, 2018 are outside the preview of this Mandatory Additional Requirement**
- Every student shall participate in the co-curricular and extra-curricular activities and produce documentary proof to the designated Faculty Members appointed by the Head of Department / Principal / Director in the respective college. Thereby the student should earn the required Points before *her* she appears for his/ her Final Examinations.
- A student's result of his/her Final Examinations will be withheld until he/she completes the minimum Activity Points by the end of his/her B.Tech Program.
- In every semester, every student is required to prepare a file containing documentary proofs of activities, done by him / her. This file will be duly verified and Activity Points will be assigned by the teachers as appointed above, at the end of every semester.
- The college will form a 3 members committee and finalize the Activity Points for each student before entering them into the Online Point Entry System (at the URL, as specified by the COE of the University).
- Every student has to earn at least 100 activity points. The points students has earned will be reflected in the student's marksheet.
- Activity points earned by Lateral Entry students will be multiplied by 1.33.

Table III provides a List of Activity Heads and Sub-Activity Heads along with their capping of the Activity Points that can be earned by the students during the entire B.Tech duration.

Sl. No.	Name of the Activity	Points	Maximum Points Allowed
1.	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) (per course)	20	40
2.	Tech Fest/Teachers Day/Freshers Welcome		
	Organizer	5	10
	Participants	3	6
5.	Rural Reporting	5	10
6.	Tree Plantation (per tree)	1	10
7.	Participation in Relief Camps	20	40
8.	Participation in Debate/Group Discussion/ Tech quiz	10	20
9.	Publication of Wall magazine in institutional level (magazine/article/internet)	10	20
10.	Publication in News Paper, Magazine & Blogs	10	20
11.	Research Publication (per publication)	15	30
12.	Innovative Projects (other than course curriculum)	30	60
13.	Blood donation	8	16
	Blood donation camp Organization	10	20
15.	Participation in Sports/Games		
	College level	5	10
	University Level	10	20
	District Level	12	24
	State Level	15	30
	National/International Level	20	20
21.	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20
22.	Member of Professional Society	10	20
23.	Student Chapter	10	20
24.	Relevant Industry Visit & Report	10	20
25.	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	5	10
26.	Participation in Yoga Camp (Certificate to be submitted)	5	10
27.	Self-Entrepreneurship Programme	20	20
28.	Adventure Sports with Certification	10	20
29.	Training to under privileged/Physically challenged	15	30
30.	Community Service & Allied Activities	10	20

Suggestions from the College Principals will be considered to append in the above Table-III.

Sd/-

Registrar(Acting)
MAKAUT,WB

Maulana Abul Kalam Azad University of Technology, West Bengal
Record of Activities for Mandatory Additional Requirement

Annexure-I
Rev:00

College Name (College Code):						Department:						
Student Name:				University Roll No:			Registration No:					
Sl No	Activity	Points	Max. Points Allowed	Points Earned								
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	Total
1	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) per course											
	For 12 weeks duration	20	40									
	For 8 weeks duration	16										
2	Tech Fest/Teachers Day/Freshers Welcome											
	Organizer	5	10									
	Participants	3	6									
3	Rural Reporting	5	10									
4	Tree Plantation and up keeping (per tree)	1	10									
5	Participation in Relief Camps	20	40									
6	Participation in Debate/Group Discussion/ Tech quiz	10	20									
7	Publication of Wall magazine in institutional level (magazine/article/internet)											
	Editor	10	20									
	Writer	6	12									
8	Publication in News Paper, Magazine & Blogs	10	20									
9	Research Publication (per publication)	15	30									
10	Innovative Projects (other than course curriculum)	30	60									
11	Blood donation	8	16									
	Blood donation camp Organization	10	20									

Maulana Abul Kalam Azad University of Technology, West Bengal
Record of Activities for Mandatory Additional Requirement

Annexure-I
Rev:00

Sl No	Activity	Points	Max. Points Allowed	Points Earned								Total
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	
12	Participation in Sports/Games											
	College level	5	10									
	University Level	10	20									
	District Level	12	24									
	State Level	15	30									
	National/International Level	20	20									
13	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20									
14	Member of Professional Society	10	20									
15	Student Chapter	10	20									
16	Relevant Industry Visit & Report	10	20									
17	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	5	10									
18	Participation in Yoga Camp (Certificate to be submitted)	5	10									
19	Self-Entrepreneurship Programme	20	20									
20	Adventure Sports with Certification	10	20									
21	Training to under privileged / Differently abled	15	30									
22	Community Service & Allied Activities	10	20									
Total Points												
Signature of Mentor												
Signature of HOD												
*Please abide strictly to the Notes at the end of the Notice by Registrar, MAKAUT, WB regarding Mandatory Additional Requirement for earning B.Tech Degree												
* <i>Annexure-I</i> is to be retained in the Institute records with all documentary proofs of activities <i>(to be verified by the University as and when required)</i> .												

1st Year Curriculum for B.Tech courses in Engineering & Technology

(Applicable from the academic session 2018-2019)



Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits

B. Range of credits :

A range of credits from 150 to 160 for a student to be eligible to get B.Tech Degree in Engineering. A student will be eligible to get B.Tech Degree *with Honours*, if he/she completes an additional 20 credits. These could be acquired through Massive Open Online Courses (MOOCs).

C. MOOCs for B. Tech Honours

The additional 20 credits (for obtaining B. Tech with Honours) are to be gained through MOOCs. The complete description of the MOOCs relevant for the first year course are given in *Annexure-I*. The courses for subsequent years of study will be posted subsequently.

D. Guidelines regarding Mandatory Induction Program for the new students

All concerned are requested to follow the guidelines given in *Annexure-II* (Notice dt.06/12/2017) concerning Mandatory Induction Program. The colleges/ Institute may also refer to the AICTE Model Curriculum for Undergraduate Degree Courses in Engineering & Technology (January 2018) -Volume I (Page No.31-38), if necessary.

E. Mandatory Additional Requirement for earning B. Tech Degree

All concerned are requested to follow the guidelines in *Annexure-III* concerning Mandatory Additional Requirements.

F. Group division:

Group-A:

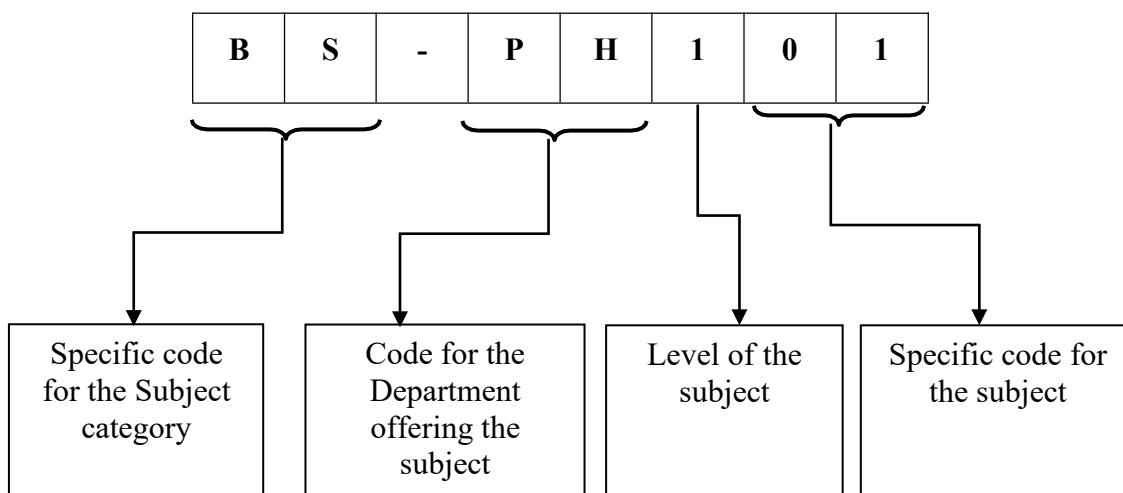
Chemistry based subjects: [Bio-Technology, Food Technology, Leather Technology, Textile Technology, Ceramic Technology, Chemical Engineering and any other Engineering that chooses to be Chemistry based] + Physics based subjects: [Mechanical Engineering, Production Engineering, Civil Engineering, Automobile Engineering, Marine Engineering, Apparel Production Engineering, Computer Science & Engineering, Information Technology.]

Group-B:

All Physics based subjects which are also Electrical & Electronics based [Electrical Engineering, Electronics & Communication Engineering, Applied Electronics & Instrumentation Engineering, Power Engineering, Electrical & Electronics Engineering, Bio-Medical Engineering, Instrumentation & Control Engineering]

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G. Subject Numbering Scheme:



List of Codes for Subject Category	
Code	Category Name
BS	Basic Science Courses
ES	Engineering Science Courses
HM	Humanities and Social Sciences including Management courses
PC	Professional core courses
PE	Professional Elective courses
OE	Open Elective courses
MC	Mandatory courses
PW	Project

List of Codes for Departments			
Code	Name of the Department	Code	Name of the Department
APM	Apparel Production Engineering	ECE	Electronics & Communication Engineering
AEIE	Applied Electronics & Instrumentation Engineering	FT	Food Technology
AUE	Automobile Engineering	IT	Information Technology
BME	Bio-Medical Engineering	ICE	Instrumentation & Control Engineering
BT	Bio-Technology	LT	Leather Technology
CT	Ceramic Technology	MRE	Marine Engineering
CHE	Chemical Engineering	ME	Mechanical Engineering
CE	Civil Engineering	PWE	Power Engineering
CSE	Computer Science & Engineering	PE	Production Engineering
EEE	Electrical & Electronics Engineering	TT	Textile Technology
EE	Electrical Engineering		

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First Year First Semester							
Mandatory Induction Program- 3 weeks duration							
Sl No.	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science course	BS-PH101/ BS-CH101	Physics-I (Gr-A)/ Chemistry-I(Gr-B)	3	1	0	4
2	Basic Science course	BS-M101/ BS-M102	Mathematics –IA*/ Mathematics –IB *	3	1	0	4
3	Engineering Science Courses	ES-EE101	Basic Electrical Engineering	3	1	0	4
	Total Theory			9	3	0	12
Practical							
1	Basic Science course	BS-PH191/ BS-CH191	Physics-I Laboratory (Gr-A)/ Chemistry-I Laboratory (Gr-B)	0	0	3	1.5
2	Engineering Science Courses	ES-EE191	Basic Electrical Engineering Laboratory	0	0	2	1
3	Engineering Science Courses	ES-ME191/ ES-ME192	Engineering Graphics & Design(Gr-B)/ Workshop/Manufacturing Practices(Gr-A)	1	0	4	3
	Total Practical			1		9	5.5
	Total of First Semester			10	3	9	17.5

* Mathematics –IA (BS-M101) - CSE & IT
 Mathematics –IB (BS-M102) - All stream except CSE & IT

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First Year Second Semester							
Sl No.	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science courses	BS-PH201/ BS-CH201	Physics-I (Gr-B)/ Chemistry-I (Gr-A)	3	1	0	4
2	Basic Science courses	BS-M201/ BS-M202	Mathematics –IIA [#] / Mathematics –IIB [#]	3	1	0	4
3	Engineering Science Courses	ES-CS201	Programming for Problem Solving	3	0	0	3
4	Humanities and Social Sciences including Management courses	HM-HU201	English	2	0	0	2
	Total Theory			11	2	0	13
Practical							
1	Basic Science courses	BS-PH291/ BS-CH291	Physics-I Laboratory (Gr-B)/ Chemistry-I Laboratory (Gr-A)	0	0	3	1.5
2	Engineering Science Courses	ES-CS291	Programming for Problem Solving	0	0	4	2
3	Engineering Science Courses	ES-ME291/ ES-ME292	Engineering Graphics & Design(Gr-A)/ Workshop/Manufacturing Practices(Gr-B)	1	0	4	3
4	Humanities and Social Sciences including Management courses	HM-HU291	Language Laboratory	0	0	2	1
	Total Practical			1	0	13	7.5
	Total of Second Semester			12	2	13	20.5

Mathematics –II (BS-M201) - CSE & IT
 Mathematics –II (BS-M202) - All stream except CSE & IT

	Group-A	Group-B
1 st Year 1 st Semester	Physics-I (BS-PH101); Workshop/Manufacturing Practices (ES-ME192)	Chemistry-I (BS-CH101); Engineering Graphics & Design (ES-ME191)
1 st Year 2 nd Semester	Chemistry-I (BS-CH201); Engineering Graphics & Design (ES-ME291)	Physics-I (BS-PH201); Workshop/Manufacturing Practices (ES-ME292)

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Course Code : BS-PH101/ BS-PH201	Category : Basic Science Courses
Course Title : Physics-I	Semester : First/ Second
L-T-P : 3-1-0	Credit:4
Pre-Requisites:	

Course objectives :

Basic concepts of mechanics, optics and its applications, electricity, magnetism and qualitative understanding of concepts of quantum physics and statistical mechanics.

1. Mechanics (7L)

Problems including constraints & friction. Basic ideas of vector calculus and partial differential equations. Potential energy function $F = -\text{grad } V$, equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy & momentum. Non-inertial frames of reference. Harmonic oscillator; Damped harmonic motion forced oscillations and resonance. Motion of a rigid body in a plane and in 3D. Angular velocity vector. Moment of inertia.

2. Optics (5L)

- Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits (only the expressions for max;min, & intensity and qualitative discussion of fringes); diffraction grating(resolution formulac only), characteristics of diffraction grating and its applications.
- Polarisation : Introduction, polarisation by reflection, polarisation by double reflection, scattering of light, circular and elliptical polarisation, optical activity.
- Lasers : Principles and working of laser : population inversion, pumping, various modes, threshold population inversion with examples .

3. Electromagnetism and Dielectric Magnetic Properties of Materials (8L)

- Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielectrics, internal fields in a solid, Clausius- Mossotti equation(expression only), applications of dielectrics.
- Magnetisation , permeability and susceptibility, classificationof magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.

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4. Quantum Mechanics (16L)

- Introduction to quantum physics, black body radiation, explanation using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.

5. Statistical Mechanics (8L)

- Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics.

Course outcomes:

Students will be familiar with

- Basic concepts of mechanics
- Bragg's Law and introduction to the principles of lasers, types of lasers and applications.
- Various terms related to properties of materials such as, permeability, polarization, etc.
- Some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials.
- Simple quantum mechanics calculations.
-

Learning Resources:

1. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited
2. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker, Wiley
3. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press
4. Engineering Mechanics (In SI Units) (SIE), S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati, McGraw Hill Education
5. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education
6. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education
7. Engineering Mechanics, M.K. Harbola, Cengage India
8. An Introduction to Mechanics (SIE), David Kleppner, Robert Kolenkow, McGraw Hill Education
9. Principles of mechanics, John L. Synge and Byron A. Griffith, New York, McGraw-Hill
10. Mechanics (Dover Books on Physics), J. P. Den Hartog, Dover Publications Inc.
11. Engineering Mechanics: Dynamics, L.G. Kraige J.L. Meriam, Wiley
12. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, Robert Eisberg, Robert Resnick, Wiley
13. Introduction to Quantum Mechanics, J. Griffiths David, Pearson Education
14. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press
15. Optics, Hecht, Pearson Education
16. Optics, Ghatak, McGraw Hill Education India Private Limited
17. Fundamentals of Statistical and Thermal Physics, Reif, Sarat Book Distributors
18. Statistical Mechanics, Pathria, Elsevier
19. Statistical Physics, L.D. Landau, E.M. Lifshitz, Butterworth-Heinemann

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Course Code : BS-CH101/ BS-CH201	Category : Basic Science Courses
Course Title : Chemistry-I	Semester : First/ Second
L-T-P : 3-1-0	Credit:4
Pre-Requisites:	

Detailed contents

i) Atomic and molecular structure (10 lectures)

Schrodinger equation. Particle in a box solutions and their applications for simple sample. Molecular orbitals of diatomic molecules (e.g.H₂). Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

ii) Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

iii) Inter-molecular forces and potential energy surfaces (4 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena.

iv) Use of free energy in chemical equilibria (8 lectures)

First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

v) Periodic properties (4 Lectures)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

vi) Stereochemistry (4 lectures)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

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vii) Organic reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

Learning Resources:

1. Engineering Chemistry, Satyaprakash, Khanna Book Publishing, Delhi
2. University chemistry, by B. H. Mahan
3. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
4. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
5. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
6. Physical Chemistry, by P. W. Atkins
7. Spectroscopy of Organic Compounds, by P.S.Kalsi, New Age International Pvt Ltd Publishers
8. Physical Chemistry, P. C. Rakshit, Sarat Book House
9. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition
<http://bcs.whfreeman.com/vollhardtschore5e/default.asp>

Maulana Abul Kalam Azad University of Technology, West Bengal
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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
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Course Code : BS-M101	Category : Basic Science Course
Course Title : Mathematics – I A	Semester : First (CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic	Lectures Hours
1	<i>Calculus (Integration):</i> Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	<i>Calculus (Differentiation):</i> Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	<i>Matrices:</i> Matrices, Vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.	7
4	<i>Vector Spaces:</i> Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem, composition of linear maps, Matrix associated with a linear map.	9
5	<i>Vector Spaces (Continued):</i> Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.	10

Course Outcomes:

The students will be able to:

Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

Understand the domain of applications of mean value theorems to engineering problems.

Learn different types of matrices, concept of rank, methods of matrix inversion and their applications.

Understand linear spaces, its basis and dimension with corresponding applications in the field of computer science.

Learn and apply the concept of eigen values, eigen vectors, diagonalisation of matrices and orthogonalization in inner product spaces for understanding physical and engineering problems

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Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. S.K. Mapa, Higher Algebra: Abstract and Linear, Sarat Book House Pvt.Ltd.
8. Hoffman and Kunze: Linear algebra, PHI.

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Course Code : BS-M102	Category : Basic Science Course
Course Title : Mathematics –I B	Semester : First (All stream except CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic	Lectures Hours
1	<i>Calculus (Integration):</i> Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	<i>Calculus (Differentiation):</i> Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	<i>Sequence and Series:</i> Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.	11
4	<i>Multivariate Calculus:</i> Limit, continuity and partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, Curl and Divergence.	9
5	<i>Matrices:</i> Inverse and rank of a matrix, Rank-nullity theorem; System of linear equations; Symmetric, Skew-symmetric and Orthogonal matrices; Determinants; Eigenvalues and Eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.	8

Course Outcomes:

After completing the course the student will be able to

Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

Understand the domain of applications of mean value theorems to engineering problems.

Learn the tools of power series and Fourier series to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.

Apply the knowledge for addressing the real life problems which comprises of several variables or attributes and identify extremum points of different surfaces of higher dimensions.

1st Year Curriculum Structure for B.Tech courses in Engineering & Technology

(Applicable from the academic session 2018-2019)

Understand different types of matrices, their eigen values, eigen vectors, rank and also their orthogonal transformations which are essential for understanding physical and engineering problems.

Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.

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1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
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Course Code : ES-EE101	Category : Engineering Science Courses
Course Title : Basic Electrical Engineering	Semester : First
L-T-P : 3-1-0	Credit: 4
Pre-Requisites:	

Detailed contents:

Module 1: DC Circuits (8 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers (6 hours)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 hours)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters (6 hours)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

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Course Outcomes

To understand and analyze basic electric and magnetic circuits

To study the working principles of electrical machines and power converters.

To introduce the components of low voltage electrical installations

Learning Recourses:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Book Publishing Co. (P) Ltd., Delhi.
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
4. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
5. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
6. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

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Course Code : BS-PH191/ BS-PH291	Category : Basic Science course
Course Title : Physics-I Laboratory	Semester : First/ Second
L-T-P : 0-0-3	Credit:1.5
Pre-Requisites:	

Choose 10 experiments including at least one from Optics, Electricity and Magnetism and Quantum Mechanics and at least a total of six from these three groups.

Experiments in Optics

1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of a monochromatic light by Newton's ring
3. Determination of wavelength of a monochromatic light by Fresnel's bi-prism
4. Determination of wavelength of the given laser source by diffraction method

Electricity & Magnetism experiments

1. Determination of thermo electric power of a given thermocouple.
2. Determination of specific charge (e/m) of electron by J.J. Thompson's method.
3. Determination of dielectric constant of a given dielectric material.
4. Determination of Hall coefficient of a semiconductor by four probe method.
5. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.
6. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
7. Determination of unknown resistance using Carey Foster's bridge
8. Study of Transient Response in LR, RC and LCR circuits using expeyes
9. Generating sound from electrical energy using expeyes

Experiments in Quantum Physics

1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Lande-g factor using Electron spin resonance spectrometer.
4. Determination of Rydberg constant by studying Hydrogen spectrum.
5. Determination of Band gap of semiconductor.
6. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

Miscellaneous experiments

1. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure
2. Determination of bending moment and shear force of a rectangular beam of uniform cross-section
3. Determination of modulus of rigidity of the material of a rod by static method
4. Determination of rigidity modulus of the material of a wire by dynamic method
5. To determine the moment of inertia of a body about an axis passing through its centre of gravity and to determine the modulus of rigidity of the material of the suspended wire
6. Determination of coefficient of viscosity by Poiseuille's capillary flow method

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Course Code : BS-CH191/ BS-CH291	Category : Basic Science Courses
Course Title : Chemistry-I Laboratory	Semester : First/ Second
L-T-P : 0-0-3	Credit:1.5
Pre-Requisites:	

Choose 10 experiments from the following:

1. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
2. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
3. Determination of dissolved oxygen present in a given water sample.
4. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution)
5. Determination of surface tension and viscosity
6. Thin layer chromatography
7. Ion exchange column for removal of hardness of water
8. Determination of the rate constant of a reaction
9. Determination of cell constant and conductance of solutions
10. Potentiometry - determination of redox potentials and emfs
11. Saponification/acid value of an oil
12. Chemical analysis of a salt
13. Determination of the partition coefficient of a substance between two immiscible liquids
14. Adsorption of acetic acid by charcoal
15. Use of the capillary viscosimeters to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

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Course Code : ES-EE191	Category : Engineering Science Courses
Course Title : Basic Electrical Engineering Laboratory	Semester : First
L-T-P : 0-0-2	Credit: 1
Pre-Requisites:	

Choose 10 experiments from the following:

1. First activity: Introduction to basic safety precautions and mentioning of the do's and Don'ts. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about the modalities of evaluation.
2. Introduction and uses of following instruments :
 - (a) Voltmeter
 - (b) Ammeter
 - (c) Multimeter
 - (d) Oscilloscope

Demonstration of real life resistors, capacitors with color code , inductors and autotransformer.

3. Demonstration of cut-out sections of machines: DC machine, Induction machine, Synchronous machine and single phase induction machine.
4. Calibration of ammeter and Wattmeter.
5. Determination of steady state and transient response of R-L, R-C and R-L-C circuit to a step change in voltage.
6. Determination of steady state response of R-L and R-C and R-L-C circuit and calculation of impedance and power factor.
7. Determination of resonance frequency and quality factor of series and parallel R-L-C circuit.
8. (a) Open circuit and short circuit test of a single-phase transformer
(b) Load test of the transformer and determination of efficiency and regulation
9. Demonstration of three phase transformer connections. Voltage and current relationship, phase shifts between the primary and secondary side.
10. Measurement of power in a three phase unbalanced circuit by two wattmeter method.
11. Determination of Torque –Speed characteristics of separately excited DC motor.
12. Determination of Torque speed characteristics and observation of direction reversal by change of phase sequence of connection of Induction motor.
13. Determination of operating characteristics of Synchronous generator.
14. Demonstration of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter for speed control of an Induction motor
15. Demonstration of components of LT switchgear.

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Course Code : ES-ME191/ ES-ME 291	Category : Engineering Science Courses
Course Title : Engineering Graphics & Design	Semester : First/ Second
L-T-P : 1-0-4	Credit: 3
Pre-Requisites:	

Sl. No.	Content	Lecture (L)	Practical (P)
1	INTRODUCTION TO ENGINEERING DRAWING Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes.	1	4
2	LETTERING, DIMENSIONING, SCALES Plain scale, Diagonal scale and Vernier Scales.	1	4
3	GEOMETRICAL CONSTRUCTION AND CURVES Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Archimedian Spiral.	1	4
4	PROJECTION OF POINTS, LINES, SURFACES Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle, pentagon, Hexagon etc.) inclined Planes - Auxiliary Planes.	1	4
5	PROJECTION OF REGULAR SOLIDS Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).	1	4
6	COMBINATION OF REGULAR SOLIDS, FLOOR PLANS Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.	1	4
7	ISOMETRIC PROJECTIONS Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;	1	4

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8	SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)	1	4
9	OVERVIEW OF COMPUTER GRAPHICS, CUSTOMISATION & CAD DRAWING listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;	1	4
	ANNOTATIONS, LAYERING & OTHER FUNCTIONS applying dimensions to objects, applying annotations to drawings;		
10	Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;	2	8

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11	DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).	2	8
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Course Outcomes

The student will learn:

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling

General Instructions

1. In every topic some problems are to be done in the class and some are to be given to students as home assignment.
2. The problems for class work are to be prepared on drawing sheet of A1 size in the class/ using AutoCAD software.
3. The problems for home assignments are to be prepared on drawing copy/ using AutoCAD software.
4. Print out of every assignment is to be taken for CAD Drawings on Drawing sheets (A4 Sheets).
5. A title block must be prepared in each sheet/ assignment.

Following is the list of drawing instruments that required for making engineering drawings on paper with perfection.

1. Drawing Board
2. Mini drafter/ Set-squares (45°–45° & 60°–90°), T-square
3. Protractor (180°, 360°)
4. Scales (Plain, Diagonal)
5. Compass (Small and Large)
6. Divider (Small and Large)

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7. French Curves
8. Drawing paper (A1 Size)
9. Drawing pencil (H, HB, B)
10. Sharpener
11. Eraser
12. Drawing pins & clips
13. Duster or handkerchief etc.

Learning Resources:

1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House
2. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
5. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
6. Corresponding set of CAD Software Theory and User Manuals

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Course Code : ES-ME192/ ES-ME 292	Category : Engineering Science Courses
Course Title : Workshop/ Manufacturing Practices	Semester : First/ Second
L-T-P : 1-0-4	Credit:3
Pre-Requisites:	

(i) Lectures & videos:

Detailed contents:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Electrical & Electronics
5. Carpentry
6. Plastic moulding, glass cutting
7. Metal casting
8. Welding (arc welding & gas welding), brazing

(ii) Workshop Practice:

Machine shop (8 hours)

Typical jobs that may be made in this practice module:

To make a pin from a mild steel rod in a lathe.

To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Fitting shop (8 hours)

Typical jobs that may be made in this practice module:

To make a Gauge from MS plate.

Carpentry (8 hours)

Typical jobs that may be made in this practice module:

To make wooden joints and/or a pattern or like.

Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs))

Typical jobs that may be made in this practice module:

ARC WELDING (4 hours): To join two thick (approx 6mm) MS plates by manual metal arc welding.

GAS WELDING (4 hours): To join two thin mild steel plates or sheets by gas welding.

Casting (8 hours)

Typical jobs that may be made in this practice module:

One/ two green sand moulds to prepare, and a casting be demonstrated.

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Smithy (4 hours) ~ 4 hours

Typical jobs that may be made in this practice module:

A simple job of making a square rod from a round bar or like.

Plastic moulding & Glass cutting (4 hours)

Typical jobs that may be made in this practice module:

For plastic moulding, making at least one simple plastic component should be made.

For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made.

Electrical & Electronics (8 hours)

Familiarization with LT switchgear elements, making its sketches and noting down its specification. Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable.

Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point.

Simple wiring exercise to be executed to understand the basic electrical circuit.

Simple soldering exercises to be executed to understand the basic process of soldering.

Fabrication of a single-phase full wave rectifier with a step down transformer using four diodes and electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes

Upon completion of this laboratory course, students will be able to fabricate components with their own hands.

They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

By assembling different components, they will be able to produce small devices of their interest.

Learning Resources:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. and Steven S. Schmid, “Manufacturing Engineering and Technology”, 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu, “Manufacturing Technology – I” Pearson Education, 2008.
4. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4th edition, Prentice Hall India, 1998.
5. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGrawHill House, 2017.

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Course Code : BS-M201	Category : Basic Science Course
Course Title : Mathematics – II A	Semester : Second (CSE &IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics and BS-M101	

Module No.	Description of Topic	Lectures Hours
1	Basic Probability: Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the Multinomial distribution, Poisson approximation to the Binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.	11
2	Continuous Probability Distributions: Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities.	4
3	Bivariate Distributions: Bivariate distributions and their properties, distribution of sums and quotients, Conditional densities, Bayes' rule.	5
4	Basic Statistics: Measures of Central tendency, Moments, Skewness and Kurtosis, Probability distributions: Binomial, Poisson and Normal and evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.	8
5	Applied Statistics: Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	8
6	Small samples: Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	4

Course Outcomes:

The students will be able to:

Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.

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Understand the basic ideas of statistics with different characterisation of a univariate and bivariate data set.

Apply statistical tools for analysing data samples and drawing inference on a given data set.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
3. S. Ross, A First Course in Probability, Pearson Education India
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.
5. John E. Freund, Ronald E. Walpole, Mathematical Statistics, Prentice Hall.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
7. N.G. Das, Statistical Methods (Combined Volume), Tata-McGraw Hill.

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Course Code : BS-M202	Category : Basic Science Course
Course Title : Mathematics – II B	Semester : Second (All stream except CSE & IT)
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: High School Mathematics and BS-M102	

Module No.	Description of Topic	Lectures Hours
1	<i>Multivariate Calculus (Integration):</i> Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, change of variables (Cartesian to Polar), Applications: Areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.	11
2	<i>First order ordinary differential equations:</i> Exact, linear and Bernoulli's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.	5
3	<i>Ordinary differential equations of higher orders:</i> Second order linear differential equations with constant coefficients, Use of D-operators, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.	9
4	<i>Complex Variable – Differentiation</i> Differentiation of complex functions, Cauchy-Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithmic) and their properties; Conformal mappings, Mobius transformations and their properties.	6
5	<i>Complex Variable – Integration</i> Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, Zeros of analytic functions, Singularities, Laurent's series; Residues, Cauchy residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.	9

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Course Outcomes:

The students will be able to:

Learn the methods for evaluating multiple integrals and their applications to different physical problems.

Understand different techniques to solve first and second order ordinary differential equations with its formulation to address the modelling of systems and problems of engineering sciences.

Learn different tools of differentiation and integration of functions of a complex variable that are used with various other techniques for solving engineering problems.

Apply different types of transformations between two 2- dimensional planes for analysis of physical or engineering problems.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. E. L. Ince, Ordinary Differential Equations, Dover Publications.
8. J. W. Brown and R. V. Churchill, Complex Variables and Applications, Mc-Graw Hill.

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Course Code : ES-CS201	Category : Engineering Science Courses
Course Title : Programming for Problem Solving	Semester : Second
L-T-P : 3-0-0	Credit :3
Pre-Requisites:	

Detailed contents

Unit 1: Introduction to Programming (4 lectures)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - **(1 lecture)**.

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. **(1 lecture)**

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- **(2 lectures)**

Unit 2: Arithmetic expressions and precedence (2 lectures)

Unit 3: Conditional Branching and Loops (6 lectures)

Writing and evaluation of conditionals and consequent branching **(3 lectures)**

Iteration and loops **(3 lectures)**

Unit 4: Arrays (6 lectures)

Arrays (1-D, 2-D), Character arrays and Strings

Unit 5: Basic Algorithms (6 lectures)

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 6: Function (5 lectures)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Unit 7: Recursion (4 -5 lectures)

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 8: Structure (4 lectures)

Structures, Defining structures and Array of Structures

Unit 9: Pointers (2 lectures)

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Unit 10: File handling (only if time is available, otherwise should be done as part of the lab)

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Course Outcomes

The student will learn

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical errors.
- To implement conditional branching, iteration and recursion.
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- To apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.

Learning Resources:

1. R. S. Salaria, Computer Concepts and Programming in C, Khanna Publishers
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

Course Code : ES-CS291	Category : Engineering Science Courses
Course Title : Programming for Problem Solving	Semester : Second
L-T-P : 0-0-4	Credit:2
Pre-Requisites:	

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

Tutorial 12: File handling:

Lab 12: File operations

Laboratory Outcomes

To formulate the algorithms for simple problems

To translate given algorithms to a working and correct program

To be able to correct syntax errors as reported by the compilers

To be able to identify and correct logical errors encountered at run time

To be able to write iterative as well as recursive programs

To be able to represent data in arrays, strings and structures and manipulate them through a program

To be able to declare pointers of different types and use them in defining self-referential structures.

To be able to create, read and write to and from simple text files.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Course Code : HM-HU201	Category : Humanities and Social Sciences including Management courses
Course Title : English	Semester : Second
L-T-P : 2-0-0	Credit:2
Pre-Requisites:	

Detailed contents

1. Vocabulary Building

- 1.1 The concept of Word Formation: Compounding, Backformation, Clipping, Blending.
- 1.2 Root words from foreign languages and their use in English
- 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
- 1.4 Synonyms, antonyms, and standard abbreviations: Acronyms

2. Basic Writing Skills

- 2.1 Sentence Structures & Types: Simple, Compound, Complex
- 2.2 Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration
- 2.3 Importance of proper punctuation
- 2.4 Creating coherence: Arranging paragraphs & Sentences in logical order
- 2.5 Creating Cohesion: Organizing principles of paragraphs in documents
- 2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

- 3.1 Subject-verb agreement
- 3.2 Noun-pronoun agreement
- 3.3 Misplaced modifiers
- 3.4 Articles
- 3.5 Prepositions
- 3.6 Redundancies
- 3.7 Clichés

4. Nature and Style of sensible Writing

- 4.1 Describing
- 4.2 Defining
- 4.3 Classifying
- 4.4 Providing examples or evidence
- 4.5 Writing introduction and conclusion

5. Writing Practices

- 5.1 Comprehension
- 5.2 Précis Writing
- 5.3 Essay Writing
- 5.4 Business Letter, Cover Letter & CV; E-mail

Addendum

Some examples of English words with foreign roots

Greek Root/Affix	Examples
Anti	Antisocial, antiseptic

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Auto	Automatic, autograph
Anthropos	Anthropology, philanthropy
Bio	Biography
Chronos	Time
Di	Dilemma
Bio	Biology
Biblio	Bibliography
Chron	Chronology
Cracy	Contradiction
Geo	Geology
Hyper	Hyperactive
Mania	Kleptomania
Mega	Megaserial
Eu	Eulogy, euphoria
Geo	Geology
Graph	autograph, photograph
Hetero	Heterogeneous
Hyper	Hyperactive
Hypo	hypodermic, hypoglycemia
Macro	Macrocosm
Mega	megalomania
Micro	microcosm

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Mono	Monarch
Pan	Panorama
Pathos	Pathetic
Phobia	Hydrophobia
Pod (Gk), ped (Latin)	Pseudopodia
Poly	polyglot
Tele	Telephone
Theo	Theology, theist
Latin Root	Examples
Aud	Audible
Bene	Beneficial
Brev	abbreviate, brief
circum	Circulate
Contra	Contradict
Cred	Credible
Dict	Diction
Femina	Feminine
Inter	Internet, interval
Magna	Magnificent
Mal	Malnutrition
Multi	multinational
Nova	Novel
Multi	Multiple, multiplex
Non	Nonstop

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Pre	Previous, predicate
Re	Redo, rewind
Scrib	Scripture
Spect	Spectator
Trans	Transport
Uni	Unity
Omni	Omnipotent
Semi	Semicircle
Sub	Subway
somnus	Insomnia,
Super	Superman
Sym	Sympathy
scribe	Describe, scribble(write illegibly), inscribe
Trans	Transform
Un	Unnecessary
Uni	Universal

Learning Resources:

- (i) Kulbushan Kumar, R S Salaria, Effective Communication Skills, Khanna Publishing House, Delhi.
- (ii) Practical English Usage. Michael Swan. OUP. 1995.
- (iii) Remedial English Grammar. F.T. Wood. Macmillan. 2007
- (iv) On Writing Well. William Zinsser. Harper Resource Book. 2001
- (v) Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- (vi) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
- (vii) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
- (viii) Universal English Prof. Prasad Kataria Publications, 2019.
- (ix) "Communication Skills for Professionals"-Nira Konar, Prentice Hall of India 2nd edition, New Delhi, 2011
- (x) Gajendra Singh Chauhan, Smita Kashiramka and L. Thimmesha. Functional English. Cengage, 2019.

Course Outcomes

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
 (Applicable from the academic session 2018-2019)

Course Code : HM-HU291	Category : Humanities and Social Sciences including Management courses
Course Title : Language Laboratory	Semester : Second
L-T-P : 0-0-2	Credit:1
Pre-Requisites:	

- | | |
|---|----|
| 1) Honing 'Listening Skill' and its sub skills through Language Lab Audio device; | 3P |
| 2) Honing 'Speaking Skill' and its sub skills | 2P |
| 3) Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/
Voice modulation/ Stress/ Intonation/ Pitch & Accent) of connected speech | 2P |
| 4) Honing 'Conversation Skill' using Language Lab Audio –Visual input;
Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone &
Role Play Mode) | 2P |
| 5) Introducing 'Group Discussion' through audio –Visual input and acquainting them
with key strategies for success | 2P |
| 6) G D Practice Sessions for helping them internalize basic Principles
(turn- taking, creative intervention, by using correct body language, courtesies &
other soft skills) of GD | 4P |
| 7) Honing 'Reading Skills' and its sub skills using Visual / Graphics/
Diagrams /Chart Display/Technical/Non Technical Passages
Learning Global / Contextual / Inferential Comprehension; | 2P |
| 8) Honing 'Writing Skill' and its sub skills by using
Language Lab Audio –Visual input; Practice Sessions | 2P |

Course Outcomes

- The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

MOOCs for B. Tech Honours



Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal

Notice

1st May, 2018

MOOCs for B.Tech Honours (Applicable from the session 2018-2019)

Preamble

All India Council for Technical Education (AICTE) has introduced Model Curriculum for Bachelor of Technology programme with 160 credits in the entire programme of 4 years, and additional 20 credits will be required to be done for the degree of Bachelor of Technology with Honours. These additional 20 credits will have to be acquired with online courses (MOOCs) as per AICTE. So students will have to complete additional 20 credits through MOOCs within 4 years of time. This creates an excellent opportunity for students to acquire the necessary skill set for employability through massive online courses where the rare expertise of world famous experts from academics and industry are available. Maulana Abul Kalam Azad University of Technology, West Bengal (MAKAUT,WB) has thus decided to introduce AICTE model curriculum for its B.Tech Programmes and suggest baskets for MOOCs available year wise for the four-year long B.Tech programme from the sessions 2018-2019. The basket for MOOCs will be a dynamic one, as courses keep on updating with time. Few essential skill sets required for employability are also identified year wise by MAKAUT,WB. For MOOCs platforms where examination or assessment is absent (like SWAYAM) or where certification is costly (like Coursera or edX), faculty members of the Institutes are to audit the courses and prepare the examination question papers, for the courses undertaken by the students of respective Institutes, so that MAKAUT,WB can conduct examination for the course. The total of 20 credits that is required to be attained for B.Tech Honours degree are distributed over four years in the following way:

For first year	:	8 credits
For second year	:	4 credits
For third year	:	4 credits
For fourth year	:	4 credits

A student of first year has to cover courses from at least three skills :

1. Computer Programing with Python / R
2. Soft skill
3. Ethics

Courses are * marked in the above areas

If a student is unable to cover the credits assigned for the first year, he/she can do these courses in either of the subsequent years, but he/she has to choose the courses from the basket of MOOCs announced by MAKAUT,WB from time to time. The same rule will be applicable for the other years of the programme.

The basket for MOOCs for the 1st year B. Tech for the session 2018-2019 are made available herewith.

By order.

MOOCs for First Year, Engineering and Technology

Sl. No	Course	Provider	Duration	Credits	Name of University / Institution
1.	Presentation Skills: Designing Presentation Slides	Coursera *	4 weeks	1	Tomsk State University
2.	Effective Problem-Solving and Decision-Making	Coursera	4 weeks	1	University of California
3.	Communication in the 21st Century Workplace	Coursera *	4 weeks	1	University of California
4.	Psychology at Work	Coursera *	6 weeks	2	University of Western Australia
5.	Critical Thinking & Problem Solving	EdX *	3 weeks	3	Rochester Institute of Technology
6.	Successful Career Development	Coursera	7 weeks	2	University System of Georgia
7.	Working in Teams: A Practical Guide	edX	4 weeks	1	University of Queensland
8.	Communication theory: bridging academia and practice	Coursera	9 weeks	3	Higher School of Economics
9.	Speaking Effectively	NPTEL *	8 weeks	3	Indian Institute of Technology, Kharagpur
10.	Introduction to Philosophy	Coursera	5 weeks	1	University of Edinburgh
11.	Moralities of Everyday Life	Coursera	6 weeks	2	Yale University
12.	Introduction to Logic	Coursera *	10 weeks	3	Stanford University
13	Write Professional Emails in English	Coursera *	5 weeks	2	Georgia Institute of Technology
14	Technical Writing	Coursera	5 weeks	1	Moscow Institute of Physics and Technology
15	Learn to Program: The Fundamentals	Coursera	7 weeks	2	University of Toronto
16	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
17	Introduction to Problem Solving and Programming	NPTEL	12 weeks	4	NPTEL
18	The Science of Well Being	Coursera	6 weeks	2	Yale University
19	Developing Soft Skills and Personality	NPTEL	8 weeks	3	
20	Programming Basics	edX	9 weeks	3	IIT Bombay
21	Introduction to Python: Absolute Beginner	EdX *	5 weeks	2	Microsoft
22	Inferential Statistics	Coursera *	7 weeks	2	University of Amsterdam
23	Linear Regression and Modelling	Coursera	4 weeks	1	Duke University
24	Foundation of Data Structures	edX	6 weeks	2	IIT Bombay
25	Introduction to Logic	NPTEL	12 weeks	4	NPTEL
26	Introduction to Probability and Data	Coursera *	5 weeks	1	Duke University
27	Ethics	NPTEL *	12 weeks	4	
28	Science, Technology and Society	NPTEL	12 weeks	4	
29	Creating Innovation	Coursera	6 weeks	2	Macquarie University
30	Ethical Leadership Through Giving Voice to Values	Coursera *	4 weeks	2	University of Virginia
31	Creativity, Innovation, and Change	Coursera *	6 weeks	2	Pennsylvania State University
32	Interpersonal Communication for Engineering Leaders	Coursera	4 weeks	1	Rice University

33	Learn to Program: The Fundamentals	Coursera *	7 weeks	3	University of Toronto
34	Introduction to Mathematical Thinking	Coursera *	9 weeks	3	Stanford University
35	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
36	A Life of Happiness and Fulfillment	Coursera	6 weeks	2	Indian School of Business
37	Model Thinking	Coursera	12 weeks	4	University of Michigan
38	Introduction to Philosophy: God, Knowledge, and Consciousness	edX	12 weeks	4	MIT
39	Soft skills	NPTEL *	12 Weeks	4	IIT Roorkee
40	Developing Soft Skills and Personality	NPTEL *	8 weeks	3	IIT Kanpur
41	Indian Fiction in English	NPTEL	12 Weeks	4	IIT Madras
42	Development of Sociology in India	NPTEL	4 Weeks	1	IIT Kanpur
43	Intellectual Property	NPTEL	12 Weeks	4	IIT Madras
44	Essential Statistics for Data Analysis using Excel	EdX *	Self Paced	3	Microsoft
45	Ethics and Law in Data and Analytics	edX	Self Paced	4	Microsoft
46	Climate Change Mitigation in Developing Countries	Coursera *	6 weeks	3	University of Cape town
47	Web Design for Everybody (Basics of Web Development and Coding) Specialization	Coursera	15weeks	4	University of Michigan
48	Ecology: Ecosystem Dynamics and Conservation	Coursera	5 weeks	1	American Museum of Natural History, Howard Hughes Medical Institute
49	Environmental Studies: A Global Perspective	EdX *	Self Paced	4	Curtin University
50	Introduction to Computer Science and Programming Using Python	edX *	Self Paced	4	MIT, USA
51	Statistics and R	edX *	Self Paced	4	Harvard University
52	Introduction to Programming in C	Coursera *	4 weeks	4	Duke University
53	Java Programming: Solving Problems with Software	Coursera	4 weeks	4	Duke University
54	Grammar and Punctuation	Coursera	4 weeks	1	University of California
55	How to Write an Essay	Coursera *	5 weeks	1	University of California, Berkeley
56	Conversational English Skills	EdX *	10 weeks	3	Tsinghua University
57	Advanced Writing	Coursera *	4 weeks	1	University of California, Irvine
58	Speak English Professionally: In Person, Online & On the Phone	Coursera *	5 weeks	1	Georgia Institute of Technology
59	English for Science, Technology, Engineering, and Mathematics	Coursera	5 weeks	1	University of Pennsylvania
60	English Composition	edX	8 weeks	3	Arizona State University
61	Take Your English Communication Skills to the Next Level	Coursera *	4 weeks	1	Georgia Institute of Technology

**Guidelines regarding
Mandatory Induction Program for
the new students**



Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Date: 06.12.2017

Maulana Abul Kalam Azad University of Technology, West Bengal

Guidelines regarding Induction Programme for the new students

(As per Model Curriculum for 1st Year UG degrees courses in Engineering & Technology, November 2017)

To be followed from the 2018-19 academic session

Preamble: Engineering education has evolved globally in a continuous manner to address the twin needs of industry and society. It is now an accepted fact that the institutions imparting technical education should aspire to create manpower who will possess strong technical knowledge and skill, have leadership qualities and be a team player, capable of coming up with innovative solutions and be alive to societal and community concerns.

The aim of the Induction Programme is to acclimatize the students to the environment of their engineering institution, give them a flavour of the exciting new world of education that they are entering, provide them with mentoring schemes, and make them aware of their neighbourhood, society and people. This will allow them to evolve as well rounded individuals.

The following schedule is laid down by the University to implement the three week long Induction Programme:

Week 1	1 st Half	Day 1	Overall introduction of the new students to the Institution, its different Departments & Faculty Members
	2 nd Half	Day 1	(a) Assignment of faculty mentors to the new students (b) Assessment and allotment for mentoring by senior students preferably from the second year
	2 hrs	Day 2, 3, 4, 5	Lectures by eminent personalities on different areas such as (a) Introduction to Engineering (b) Various topics of science and technology (c) Innovation and entrepreneurship (d) Creative and performing arts (e) Social issues
	2 hrs.	Day 2, 3, 4, 5	Participation in Games, Yoga, Meditation etc.
	2 hrs	Day 2, 3, 4, 5	Visit to the different Departments of the Institute
Week 2 (All Days)	2hrs		Scheduled class lectures as per time table.
	2hrs		Students to be conducted through proficiency modules to be prepared by respective Colleges for ascertaining English skills & Computer knowledge of the students

			and to prepare a report on the same
	2hrs		Participation in Games, Sports, Yoga, Creative arts etc.
Week 3	2hrs		Scheduled class lectures as per time table
		Day 1	Visits to neighbourhood locations
		Day 2	Visits to natural spots in adjoining areas to understand the effect of nature on society
		Day 3	Visits to Science Museum / laboratories
		Day 4	Visits to NGOs
		Day 5	

Any other activity, as deemed fit by the Director/Principal of the affiliated Colleges, may be proposed and discussed with the Academic Coordinator of the University, by sending email to the following address: academics.makaut@gmail.com.

Note: 1) If necessary, networking may be established with NGOs to facilitate the different components and aspects of the Induction Programme.

Mandatory Additional Requirement for earning B. Tech Degree



Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal
BF-142, Sector-I, Saltlake

Notice

Mandatory Additional Requirement for earning B.Tech Degree

Addressing the needs of the industry and the society: Globally, engineering education systems have continuously evolved, in order to address the needs of the industry and the society. It is becoming imperative that every University should create opportunities for the students to inculcate attributes, which are not restricted only to engineering knowledge and acumen. Industry needs professionals who can work successfully in teams, who have leadership qualities, who are alive to social and community needs and who can bring innovation and creativity to their work and who are also digitally proficient. Hence, in order to prepare its students to match these multiple requirements, MAKAUT, WB has created a unique mechanism of awarding 100 Activity Points over and above the academic grades. It is planned that the students at MAKAUT, WB will be able to reap benefits from these activities at their own pace and comfort. It is expected that by the time MAKAUT, WB's students reach their Final Year, they would have developed themselves so well both through their studies in the respective technological field and through their active participation in the co-curricular and extra-curricular activities as also through SAWYAM based learning activities that they would be well-prepared for contributing to building the India and the world of their dreams.

The additional requirement applies to: Every student, who is admitted to the 4 years B.Tech program from the academic year 2018-19 onwards, is required to earn minimum 100 Activity Points in addition to the required academic grades, for getting MAKAUT, WB's B.Tech degree. Similarly, it is mandatory to earn 75 Activity Points, in addition to the academic grades, for getting B.Tech degree by a student (Lateral Entry) who is admitted to the B.Tech program from the academic year 2018-19 onwards. *(Please see Table 1 for details.)* [Lateral Entry students will have a multiplying factor of 1.33 to bring uniformity in score].

Level of Entry in B.Tech Course	Total duration for earning Points	Minimum Points
1 st Year from the academic year 2018-19 onwards	1 st to 4 th Year	100
2 nd Year from the academic year 2018-19 onwards (Lateral Entry)	2 nd to 4 th Year	75

Table – I

For existing Students (except students in the 4th year): Every student, who is admitted to the 4 years B.Tech program prior to the academic year 2018-19, is required to earn minimum number of Activity Points as per Table II in addition to the required academic grades, for getting MAKAUT, WB's B.Tech degree.

Current Semester	Total Points to be earned During the full course
2 nd	100
4 th	75
6 th	50

Table –II

These points must be earned on the basis of active participation in co-curricular and extracurricular activities spanning through all the semesters of study. Every student may choose, as per his/her liking, activities in order to achieve the mandatory points (as per Table-III, depending on his/her entry level), before becoming eligible for award of the Degree. These activities can be spread over the years, as per convenience of the student.

Notes:

- **Current 4th year students who are going to sit for Final Semester examination in May-June, 2018 are outside the preview of this Mandatory Additional Requirement**
- Every student shall participate in the co-curricular and extra-curricular activities and produce documentary proof to the designated Faculty Members appointed by the Head of Department / Principal / Director in the respective college. Thereby the student should earn the required Points before *her* she appears for his/ her Final Examinations.
- A student's result of his/her Final Examinations will be withheld until he/she completes the minimum Activity Points by the end of his/her B.Tech Program.
- In every semester, every student is required to prepare a file containing documentary proofs of activities, done by him / her. This file will be duly verified and Activity Points will be assigned by the teachers as appointed above, at the end of every semester.
- The college will form a 3 members committee and finalize the Activity Points for each student before entering them into the Online Point Entry System (at the URL, as specified by the COE of the University).
- Every student has to earn at least 100 activity points. The points students has earned will be reflected in the student's marksheet.
- Activity points earned by Lateral Entry students will be multiplied by 1.33.

Table III provides a List of Activity Heads and Sub-Activity Heads along with their capping of the Activity Points that can be earned by the students during the entire B.Tech duration.

Sl. No.	Name of the Activity	Points	Maximum Points Allowed
1.	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) (per course)	20	40
2.	Tech Fest/Teachers Day/Freshers Welcome		
	Organizer	5	10
	Participants	3	6
5.	Rural Reporting	5	10
6.	Tree Plantation (per tree)	1	10
7.	Participation in Relief Camps	20	40
8.	Participation in Debate/Group Discussion/ Tech quiz	10	20
9.	Publication of Wall magazine in institutional level (magazine/article/internet)	10	20
10.	Publication in News Paper, Magazine & Blogs	10	20
11.	Research Publication (per publication)	15	30
12.	Innovative Projects (other than course curriculum)	30	60
13.	Blood donation	8	16
	Blood donation camp Organization	10	20
15.	Participation in Sports/Games		
	College level	5	10
	University Level	10	20
	District Level	12	24
	State Level	15	30
	National/International Level	20	20
21.	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20
22.	Member of Professional Society	10	20
23.	Student Chapter	10	20
24.	Relevant Industry Visit & Report	10	20
25.	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	5	10
26.	Participation in Yoga Camp (Certificate to be submitted)	5	10
27.	Self-Entrepreneurship Programme	20	20
28.	Adventure Sports with Certification	10	20
29.	Training to under privileged/Physically challenged	15	30
30.	Community Service & Allied Activities	10	20

Suggestions from the College Principals will be considered to append in the above Table-III.

Sd/-

Registrar(Acting)
MAKAUT,WB

Maulana Abul Kalam Azad University of Technology, West Bengal
Record of Activities for Mandatory Additional Requirement

Annexure-I
Rev:00

College Name (College Code):						Department:						
Student Name:				University Roll No:			Registration No:					
Sl No	Activity	Points	Max. Points Allowed	Points Earned								
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	Total
1	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) per course											
	For 12 weeks duration	20	40									
	For 8 weeks duration	16										
2	Tech Fest/Teachers Day/Freshers Welcome											
	Organizer	5	10									
	Participants	3	6									
3	Rural Reporting	5	10									
4	Tree Plantation and up keeping (per tree)	1	10									
5	Participation in Relief Camps	20	40									
6	Participation in Debate/Group Discussion/ Tech quiz	10	20									
7	Publication of Wall magazine in institutional level (magazine/article/internet)											
	Editor	10	20									
	Writer	6	12									
8	Publication in News Paper, Magazine & Blogs	10	20									
9	Research Publication (per publication)	15	30									
10	Innovative Projects (other than course curriculum)	30	60									
11	Blood donation	8	16									
	Blood donation camp Organization	10	20									

Maulana Abul Kalam Azad University of Technology, West Bengal
Record of Activities for Mandatory Additional Requirement

Annexure-I
Rev:00

Sl No	Activity	Points	Max. Points Allowed	Points Earned								Total
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	
12	<i>Participation in Sports/Games</i>											
	College level	5	10									
	University Level	10	20									
	District Level	12	24									
	State Level	15	30									
	National/International Level	20	20									
13	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20									
14	Member of Professional Society	10	20									
15	Student Chapter	10	20									
16	Relevant Industry Visit & Report	10	20									
17	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	5	10									
18	Participation in Yoga Camp (Certificate to be submitted)	5	10									
19	Self-Entrepreneurship Programme	20	20									
20	Adventure Sports with Certification	10	20									
21	Training to under privileged / Differently abled	15	30									
22	Community Service & Allied Activities	10	20									
Total Points												
Signature of Mentor												
Signature of HOD												
*Please abide strictly to the Notes at the end of the Notice by Registrar, MAKAUT, WB regarding Mandatory Additional Requirement for earning B.Tech Degree												
* <i>Annexure-I</i> is to be retained in the Institute records with all documentary proofs of activities (<i>to be verified by the University as and when required</i>).												

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Computer Science & Engineering
 (Applicable from the academic session 2018-2019)

SEMESTER – III

Analog & Digital Electronics

Code: ESC-301

Contact: 3L

Name of the Course:	Analog & Digital Electronics		
Course Code: ESC-301	Semester: III		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: hrs./week		End Semester Exam : 70 Marks	
Credit Points:	3		
Objective:			
1	To acquire the basic knowledge of different analog components and their applications		
2	To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.		
3	To prepare students to perform the analysis and design of various digital electronic circuits		
Pre-Requisite:			
1	Basic Electronics Parts I & II learned in the First year, semesters 1 & 2. Basic BJTs,.		
2	Basic concept of the working of P-N diodes, Schottky diodes,		
3	Basic FETs and OPAMP as a basic circuit component. Concept of Feedback		

Unit	Content	Hrs/Unit	Marks/Unit
1	Different Classes of Amplifiers - (Class-A, B, AB and C - basic concepts, power, efficiency; Recapitulation of basic concepts of Feedback and Oscillation, Phase Shift, Wein Bridge oscillators Astable & Monostable Multivibrators; Schmitt Trigger circuits, 555 Timer.	9	
2	Binary Number System & Boolean Algebra (recapitulation); BCD, ASCII, EBCDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic, Venn diagram, Boolean algebra (recapitulation); Representation in SOP and POS forms; Minimization of logic	11	

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	expressions by algebraic method. Combinational circuits - Adder and Subtractor circuits (half & full adder & subtractor); Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator		
3	Sequential Circuits - Basic Flip-flop & Latch, Flip-flops -SR, JK, D, T and JK Master-slave Flip Flops, Registers (SISO, SIPO, PIPO, PISO) Ring counter, Johnson counter Basic concept of Synchronous and Asynchronous counters (detail design of circuits excluded), Design of Mod N Counter	10	
4.	A/D and D/A conversion techniques - Basic concepts (D/A :R-2-R only [2L] A/D: successive approximation [2L]) Logic families- TTL, ECL, MOS and CMOS - basic concepts. (2L)	6	

Text book and Reference books:

1. Microelectronics Engineering –Sedra & Smith-Oxford.
2. Analog Electronics, A.K. Maini, Khanna Publishing House (AICTE Recommended -2018)
3. Analog Electronics, L.K. Maheswari, Laxmi Publications (AICTE Recommended -2018)
4. Principles of Electronic Devices & circuits—B L Thereja & Sedha—S Chand
5. Digital Electronics – Kharate – Oxford
6. Digital Electronics – Logic & Systems by J.Bigmeil & R.Donovan; Cambridge Learning.
7. Digital Logic and State Machine Design (3rd Edition) – D.J.Comer, OUP
8. Electronic Devices & Circuit Theory – Boyelstad & Nashelsky - PHI
9. Bell-Linear IC & OP AMP—Oxford
10. P.Raja- Digital Electronics- Scitech Publications
11. Morries Mano- Digital Logic Design- PHI
12. R.P.Jain—Modern Digital Electronics, 2/e ,McGraw Hill
13. H.Taub & D.Shilling, Digital Integrated Electronics- McGraw Hill.
14. D.RayChaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers
15. Tocci, Widmer, Moss- Digital Systems,9/e- Pearson
16. J.Bignell & R.Donovan-Digital Electronics-5/e- Cenage Learning.
17. Leach & Malvino—Digital Principles & Application, 5/e, McGraw Hill
18. Floyed & Jain- Digital Fundamentals-Pearson.

Course Outcomes:

On completion of the course students will be able to

- ESC-301.1 Realize the basic operations of different analog components.
- ESC-301.2 Realize basic gate operations and laws Boolean algebra.
- ESC-301.3 Understand basic structure of digital computer, stored program concept and different arithmetic and control unit operations.

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Data Structure & Algorithm

Code: PCC-CS301

Contacts: 3L

Name of the Course:	Data Structure & Algorithm		
Course Code: PCC-CS301	Semester: III		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance : 5 marks	
Practical: hrs./week		End Semester Exam :70 Marks	
Credit Points:	3		
Objective:			
1	To learn the basics of abstract data types.		
2	To learn the principles of linear and nonlinear data structures.		
3	To build an application using sorting and searching		
Pre-Requisite:			
1	CS 201 (Basic Computation and Principles of C		
2	M101 & M201 (Mathematics), basics of set theory		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Technique sand their complexity analysis.	10	
2	Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.	9	
3	Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and	10	

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	the complexity analysis. Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis		
4.	Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing. Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.	9	

Text book and Reference books:

1. "Data Structures and Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung.
2. "Data Structure & Algorithms Using C", 5th Ed., Khanna Publishing House (AICTE Recommended – 2018)
3. "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed.
4. "Data Structures in C" by Aaron M. Tenenbaum.
5. "Data Structures" by S. Lipschutz.
6. "Data Structures Using C" by Reema Thareja.
7. "Data Structure Using C", 2/e by A.K. Rath, A. K. Jagadev.
8. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein
9. "Data Structures through C" by Yashwant Kanetkar, BPB Publications.
10. "Expert Data Structures with C++" by R.B Patel, Khanna Publishing House

Course Outcomes:

On completion of the course students will be able to

PCC-CS301.1 Differentiate how the choices of data structure & algorithm methods impact the performance of program.

PCC-CS301.2 Solve problems based upon different data structure & also write programs.

PCC-CS301.3 Identify appropriate data structure & algorithmic methods in solving problem.

PCC-CS301.4 Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing

PCC-CS301.5 Compare and contrast the benefits of dynamic and static data structures implementations.

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Computer Organization

Code: PCC-CS302

Contacts: 3L

Name of the Course:	Computer Organization		
Course Code: PCC-CS302	Semester: III		
Duration:6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz : 10 marks	
		Attendance: 5 marks	
Practical: hrs./week		End Semester Exam: 70 Marks	
Credit Points:	3		
Objective:			
1	To prepare students to perform the analysis and design of various digital electronic circuits.		
2	To know how Computer Systems work & its basic principles		
3	To know how I/O devices are being accessed and its principles etc		
Pre-Requisite:			
1	Concept of basic components of a digital computer, Basic concept of Fundamentals & Programme structures. Boolean Algebra		
2	Basic number systems, Binary numbers, representation of signed and unsigned numbers, Binary Arithmetic as covered in Basic Computation & Principles of Computer Programming		
3	Boolean Algebra		

Unit	Content	Hrs/Unit	Marks/Unit
1	Basic organization of the stored program computer and operation sequence for execution of a program. Role of operating systems and compiler/assembler. Fetch, decode and execute cycle, Concept of operator, operand, registers and storage, Instruction format. Instruction sets and addressing modes. [7L] Commonly used number systems. Fixed and floating point representation of numbers. [1L]	8	
2	Overflow and underflow. Design of adders - ripple carry and carry look ahead principles. [3L] Design of ALU. [1L] Fixed point multiplication - Booth's algorithm. [1L] Fixed point division - Restoring and non-restoring algorithms. [2L] Floating point - IEEE 754 standard. [1L]	8	
	Memory unit design with special emphasis on		

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3	implementation of CPU-memory interfacing. [2L] Memory organization, static and dynamic memory, memory hierarchy, associative memory. [3L] Cache memory, Virtual memory. Data path design for read/write access. [5L]	10	
4.	Design of control unit - hardwired and microprogrammed control. [3L] Introduction to instruction pipelining. [2L] Introduction to RISC architectures. RISC vs CISC architectures. [2L] I/O operations - Concept of handshaking, Polled I/O, interrupt and DMA. [3L]	10	

Text book and Reference books:

1. Mano, M.M., "Computer System Architecture", PHI.
2. Behrooz Parhami "Computer Architecture", Oxford University Press
3. Hayes J. P., "Computer Architecture & Organisation", McGraw Hill,
4. Hamacher, "Computer Organisation", McGraw Hill,
5. N. senthil Kumar, M. Saravanan, S. Jeevananthan, "Microprocessors and Microcontrollers" OUP
6. Chaudhuri P. Pal, "Computer Organisation & Design", PHI,
7. P N Basu- "Computer Organization & Architecture", Vikas Pub
8. Rajaraman – "Computer Organization & Architecture", PHI
9. B.Ram – "Computer Organization & Architecture", Newage Publications

Course Outcomes:

On completion of the course students will be able to

- PCC-CS302.1 Understand basic structure of digital computer, stored program concept and different arithmetic and control unit operations.
- PCC-CS302.2 Understand basic structure of different combinational circuits- multiplexer, decoder, encoder etc.
- PCC-CS302.3 Perform different operations with sequential circuits.
- PCC-CS302.4 Understand memory and I/O operations.

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Mathematics-III (Differential Calculus)

Code: BSC-301

Contacts: 2L

Name of the Course:	Mathematics-III (Differential Calculus)		
Course Code: BSC-301	Semester: III		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory:2 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam: 70 Marks	
Credit Points:	2		
Objective:			
1	To know Convergence of sequence and series		
2	To know Limit, continuity and partial derivatives, Chain rule, Implicit function		
3	To know First Order Differential Equation, Exact, Linear and Bernoulli's equations, Basic Concept of graph, Walk, Path Circuit, Euler and Hamiltonian graph, diagraph		
Pre-Requisite:			
1	Concept Linear Algebra Determinant and its properties (up to third order)		
2	Minor and cofactors, Matrices, addition, multiplication and transpose of a matrix, Symmetric and skew-symmetric		

Unit	Content	Hrs/Unit	Marks/Unit
1	Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions.	8	
2	Limit, continuity and partial derivatives, Chain rule, Implicit function, Jacobian, Directional derivatives, Total derivative; Maxima, minima and saddle points; Gradient, curl and divergence and related problems.	7	
3	Double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar). Theorems of Green, Gauss and Stokes (Statement only) and related problems.	8	
4.	First Order Differential Equation, Exact, Linear and Bernoulli's equations, Equations of first order but not of first degree: equations solvable for p, equations solvable for y, equations solvable for x	9	

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	and Clairaut's form, general & singular solution. [5L] Second order linear differential equations with constant coefficients, D-operator method, method of variation of parameters, Cauchy-Euler equation. [4L]		
5	Basic Concept of graph, Walk, Path Circuit, Euler and Hamiltonian graph, diagraph. Matrix Representation: Incidence & Adjacency matrix. Tree: Basic Concept of tree, Binary tree, Spanning Tree, KrusKal and Prim's algorithm for finding the minimal spanning tree.	8	

Text book and Reference books:

1. Higher Algebra, S. K. Mapa, Levant Books.
2. Advanced Higher Algebra, Chakravorty and Ghosh, U N Dhar Pvt. Ltd.
3. Co-ordinate Geometry, S. L. Loney
4. Integral Calculus, Das and Mukherjee, U N Dhar Pvt. Ltd.
5. Differential Calculus, Das and Mukherjee, U N Dhar Pvt. Ltd.
6. Advanced Engineering Mathematics, E Kreyszig
7. Advanced Engineering Mathematics, Chandrika Prasad & Reena Garg, Khanna Publishing House (AICTE Recommended Textbook -2018)

Course Outcomes:

On completion of the course students will be able to

BSC-301.1 Express a logic sentence in terms of predicates, quantifiers, and logical connectives.

BSC-301.2 Apply the rules of inference and methods of proof including direct and indirect proof forms, proof by contradiction, and mathematical induction.

BSC-301.3 Use tree and graph algorithms to solve problems

BSC-301.4 Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.

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Economics for Engineers (Humanities-II)

Code: HSMC-301

Contacts: 3L

Name of the Course:	Economics for Engineers (Humanities-II)		
Course Code: HSMC-301	Semester: III		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam: 70 Marks	
Credit Points:	3		
Objective:			
1	Understand the role and scope of Engineering Economics and the process of economic decision making		
2	Understand the different concepts of cost and different cost estimation techniques		
3	Familiarization with the concepts of cash flow, time value of money and different interest formulas		
4	Appreciation of the role of uncertainty in future events and using different concepts from probability to deal with uncertainty		
5	Understand the concepts of Depreciation and Replacement analysis along with their methods of calculation		
6	Familiarization with the phenomenon of inflation and the use of price indices in engineering Economics		
7	Introduction to basic concepts of Accounting and Financial Management		
Pre-Requisite:			
1	Mathematics		

Unit	Content	Hrs/Unit	Marks/Unit
1	1. Economic Decisions Making – Overview, Problems, Role, Decision making process. 2. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits.	9	
2	3. Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value of	9	

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	<p>Money, Debt repayment, Nominal & Effective Interest.</p> <p>4. Cash Flow & Rate of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing an Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity and Breakeven Analysis. Economic Analysis In The Public Sector -Quantifying And Valuing Benefits & drawbacks.</p>		
3	<p>5. Inflation and Price Change – Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates.</p> <p>6. Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.</p> <p>7. Uncertainty In Future Events - Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options.</p>	9	
4.	<p>8. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances.</p> <p>9. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems.</p> <p>10. Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.</p>	9	

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Text book and Reference books:

1. James L.Riggs, David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , Tata McGraw-Hill
2. Donald Newnan, Ted Eschembach, Jerome Lavelle: Engineering Economics Analysis, OUP
3. John A. White, Kenneth E. Case, David B. Pratt : Principle of Engineering Economic Analysis, John Wiley
4. Sullivan and Wicks: Engineering Economy, Pearson
5. R.Paneer Seelvan: Engineering Economics, PHI
6. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub
7. Premvir Kapoor, Sociology & Economics for Engineers, Khanna Publishing House (AICTE Recommended Textbook – 2018)

Course Outcome:

On completion of the course students will be able to

HSMC-301.1 Make different economic decisions and estimate engineering costs by applying different cost estimation models.

HSMC-301.2 Create cash flow diagrams for different situations and use different interest formulae to solve associated problems.

HSMC-301.3 Take decisions regarding different engineering projects by using various criteria like rate of return analysis, present worth analysis, cost-benefit analysis etc.

HSMC-301.4 Incorporate the effect of uncertainty in economic analysis by using various concepts like expected value, estimates and simulation.

HSMC-301.5 Understand the concepts of depreciation and replacement analysis and solve associated problems.

HSMC-301.6 Understand the process of inflation and use different price indices to adjust for its effect.

HSMC-301.7 Apply the various concepts of Accounting like balance sheet and ratio analysis.

HSMC-301.8 Understand the scope of Finance and the role of financial planning and management.

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PRACTICAL SYLLABUS
Semester III

Analog & Digital Electronics Lab

Code: ESC-391

Contacts: 4P

Name of the Course:	Analog & Digital Electronics Lab
Course Code: ESC-391	Semester: III
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Course Outcomes:	
1	ESC-301.1
2	ESC-301.2
3	ESC-301.3
Pre-Requisite:	
Pre-requisites as in ESC-301	

Laboratory Experiments:	
Analog Electronics	
1	Design a Class A amplifier
2	Design a Phase-Shift Oscillator
3	Design of a Schmitt Trigger using 555 timer
Digital Electronics	
4	Design a Full Adder using basic gates and verify its output / Design a Full Subtractor circuit using basic gates and verify its output.
5	Construction of simple Decoder & Multiplexer circuits using logic gates.
6	Realization of RS / JK / D flip flops using logic gates
7	Design of Shift Register using J-K / D Flip Flop
8	Realization of Synchronous Up/Down counter
9	Design of MOD- N Counter
10	Study of DAC

Any experiment specially designed by the college

(Detailed instructions for Laboratory Manual to be followed for further guidance)

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Data Structure & Algorithm Lab

Code: PCC-CS391

Contacts: 4P

Name of the Course:	Data Structure & Algorithm Lab
Course Code: PCC-CS391	Semester: III
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Course Outcomes:	
1	PCC-CS301.1
2	PCC-CS301.2
3	PCC-CS301.3
4	PCC-CS301.4
5	PCC-CS301.5
Pre-Requisite:	
Pre-requisites as in PCC-CS301	

Laboratory Experiments:	
Linear Data Structure	
1	Implementation of array operations
2	Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements
3	Merging Problem: Evaluation of expressions operations on Multiple stacks & queues:
4	Implementation of linked lists: inserting, deleting, inverting a linked list. Implementation of stacks & queues using linked lists
5	Polynomial addition, Polynomial multiplication
Non Linear Data Structure	
6	Recursive and Non-recursive traversal of Trees
7	Threaded binary tree traversal. AVL tree implementation
8	Application of Trees. Application of sorting and searching algorithms
9	Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.

Any experiment specially designed by the college
 (Detailed instructions for Laboratory Manual to be followed for further guidance)

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Computer Organization Lab
Code: PCC-CS392
Contacts: 4P

Name of the Course:	Computer Organization Lab
Course Code: PCC-CS392	Semester: III
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Course Outcomes:	
1	PCC-CS302.1
2	PCC-CS302.2
3	PCC-CS302.3
4	PCC-CS302.4
Pre-Requisite:	
Pre-requisites as in PCC-CS302	

Laboratory Experiments:	
1	Familiarity with IC-chips: a) Multiplexer, b) Decoder, c) Encoder b) Comparator Truth Table verification and clarification from Data-book.
2	Design an Adder/Subtractor composite unit.
3	Design a BCD adder.
4	Design of a 'Carry-Look-Ahead' Adder circuit.
5	Use a multiplexer unit to design a composite ALU
6	Use ALU chip for multibit arithmetic operation
7	Implement read write operation using RAM IC
8	8. (a) & (b) Cascade two RAM ICs for vertical and horizontal expansion.

Any experiment specially designed by the college
 (Detailed instructions for Laboratory Manual to be followed for further guidance)

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IT Workshop (Sci Lab/MATLAB/Python/R)

Code: PCC-CS393

Contacts: 4P

Name of the Course:	IT Workshop
Course Code: PCC-CS392	Semester: III
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: NIL	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Course Outcomes:	
1	To master an understanding of scripting & the contributions of scripting languages
2	Design real life problems and think creatively about solutions
3	Apply a solution in a program using R/Matlab/Python.
4	To be exposed to advanced applications of mathematics, engineering and natural sciences to program real life problems.
Pre-Requisite:	
1.	Knowledge of Programming Logic
2.	Experience with a high level language (C/C++,) is suggested.
3.	Prior knowledge of a scripting language and Object-Oriented concepts is helpful but not mandatory.

Practical Syllabus

Programming in R

1. Introduction to mechanism for statistics, data analysis, and machine learning; Introduction of R Programming, How to install and run R, Use of R help files, R Sessions, R Objects – Vectors, Attributes, Matrices, Array, Class, List, Data Frames etc. Operators in R.

2. R Programming Structures, Control Statements, Loops, Repeat and Break, R-Function, R-Vector Function, Recursive Function in R.

3. R Packages (Install and Use), Input/Output Features in R, Reading or Writing in File. Data Manipulation in R. Rearranging data, Random Number and Simulation, Statistical methods like min, max, median, mean, length, Linear Regression, Normal Distribution, Decision tree

4. Graphics, Creating Graphs, The Workhorse of R Base Graphics, Graphical Functions – Customizing Graphs, Saving Graphs to Files, Pie chart, Bar Chart, Histogram.

Text book and Reference books:

Dr. Jeeva Jose, Beginner's Guide for Data Analysis Using R Programming, Khanna Publishing House, New Delhi

Programming in Matlab

Introduction

Why MATLAB?, History, Its strengths, Competitors, Starting MATLAB, Using MATLAB as a calculator, Quitting MATLAB

Basics

Familiar with MATLAB windows, Basic Operations, MATLAB-Data types, Rules about variable names, Predefined variables

Programming-I

Vector, Matrix, Array Addressing, Built-in functions, Mathematical Operations, Dealing with strings (Array of characters), Array of array (cell) concept

Programming-II

Script file, Input commands, Output commands, Structure of function file, Inline functions, Feval command, Comparison between script file and function file

Conditional statements and Loop

Relational and Logical Operators, If-else statements, Switch-case statements, For loop, While loop, Special commands (Break and continue), Import data from large database, Export data to own file or database

2D Plotting

In-built functions for plotting, Multiple plotting with special graphics, Curve fitting, Interpolation, Basic fitting interface

3D Plotting

Use of meshgrid function, Mesh plot, Surface plot, Plots with special graphics

Programming with Python

Introduction

History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator

Conditional Statements

If, If- else, Nested if-else, Looping, For, While, Nested loops

Control Statements

Break, Continue, Pass

String Manipulation

Accessing Strings, Basic Operations, String slices, Function and Methods

Lists

Introduction, Accessing list, Operations, Working with lists, Function and Methods

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Tuple

Introduction, Accessing tuples, Operations, Working, Functions and Methods

Dictionaries

Introduction, Accessing values in dictionaries, Working with dictionaries, Properties

Functions

Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables

Modules

Importing module, Math module, Random module, Packages, Composition, Input-Output
Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files, Functions

Exception Handling

Exception, Exception Handling, Except clause, Try? finally clause, User Defined Exceptions.

Laboratory Experiments:	
1	Practical Assignments related with implementation of PCC-CS393

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SEMESTER – IV

Discrete Mathematics

Code: PCC-CS401

Contacts: 3L+1T

Name of the Course:	Discrete Mathematics		
Course Code: PCC-CS401	Semester: IV		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: 1 hour/week		Assignment and Quiz : 10 marks	
		Attendance : 5 marks	
Practical: NIL		End Semester Exam :70 Marks	
Credit Points:	4		
Objective:			
1	Use mathematically correct terminology and notation.		
2	Construct correct direct and indirect proofs.		
3	To know Syntax, Semantics, Validity and Satisfiability, Graphs and Trees		
4	Use counterexamples. Apply logical reasoning to solve a variety of problems.		
Pre-Requisite:			
1	Some concepts from basic math – algebra, geometry, pre-calculus		

Unit	Content	Hrs/Unit	Marks/Unit
1	<p>Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem.</p> <p>Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.</p>	8	
2	Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination	5	
3	Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables,	8	

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	Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.		
4.	Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form	7	
5	Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.	8	

Text book and Reference books:

1. Russell Merris, Combinatorics, Wiley-Interscience series in Discrete Mathematics and Optimisation
2. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI
3. Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics for Computer Science, CENGAGE Learning
4. Gary Chartrand and Ping Zhang – Introduction to Graph Theory, TMH
5. J.K. Sharma, Discrete Mathematics, Macmillan
6. Winfried Karl Grassmann and Jean-Paul Tremblay, Logic and Discrete Mathematics, PEARSON.
7. S. K. Chakraborty and B. K. Sarkar, Discrete Mathematics, OXFORD University Press.
8. Douglas B. West, Introduction to graph Theory, PHI
9. C. L. Liu, Elements of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 2000.
10. R. C. Penner, Discrete Mathematics: Proof Techniques and Mathematical Structures, World Scientific, 1999.
11. R. L. Graham, D. E. Knuth, and O. Patashnik, Concrete Mathematics, 2nd Ed., Addison-Wesley, 1994.
12. N. Deo, Graph Theory, Prentice Hall of India, 1974.
13. S. Lipschutz and M. L. Lipson, Schaum's Outline of Theory and Problems of Discrete

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Mathematics, 2nd Ed., Tata McGraw-Hill, 1999.

14. J. P. Tremblay and R. P. Manohar, Discrete Mathematics with Applications to Computer Science, Tata McGraw-Hill, 1997.

15. Russell Merris, Combinatorics, Wiley-Interscience series in Discrete Mathematics and Optimisation

16. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI

17. Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics for Computer Science, CENGAGE Learning

18. Gary Chartrand and Ping Zhang – Introduction to Graph Theory, TMH

19. S.B. Singh, Discrete Structures – Khanna Publishing House (AICTE Recommended Textbook – 2018)

20. S.B. Singh, Combinatorics and Graph Theory, Khanna Publishing House (AICTE Recommended Textbook – 2018)

Course Outcome(s)

On completion of the course students will be able to

PCC-CS401.1 Express a logic sentence in terms of predicates, quantifiers, and logical connectives

PCC-CS401.2 Derive the solution for a given problem using deductive logic and prove the solution based on logical inference

PCC-CS401.3 Classify its algebraic structure for a given a mathematical problem,

PCC-CS401.4 Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra

PCC-CS401.5 Develop the given problem as graph networks and solve with techniques of graph theory.

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Computer Architecture

Code: PCC-CS402

Contacts: 3L

Name of the Course:	Computer Architecture	
Course Code: PCC-CS402	Semester: IV	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		Examination Scheme
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: hrs./week		End Semester Exam: 70 Marks
Credit Points:	3	
Objective:		
1	To learn the basics of stored program concepts.	
2	To learn the principles of pipelining	
3	To learn mechanism of data storage	
4	To distinguish between the concepts of serial, parallel, pipeline architecture.	
Pre-Requisite:		
1	Basic Structure of Computers, Functional units, software, performance issues software, machine instructions	
2	RAM, ROM, Memory management	

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Review of basic computer architecture (Revisited), Quantitative techniques in computer design, measuring and reporting performance. (3L) Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques; Compiler techniques for improving performance. (9L)	12	
2	Hierarchical memory technology: Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies. (8L)	8	
3	Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, super-pipelined and VLIW processor architectures. Array and vector processors. (6L)	6	

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4.	Multiprocessor architecture: taxonomy of parallel architectures; Centralized shared- memory architecture: synchronization, memory consistency, interconnection networks. Distributed shared-memory architecture. Cluster computers. (8L) Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures. (4L)	7	
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Text/Reference Books:

1. V. Carl, G. Zvonko and S. G. Zaky, "Computer organization", McGraw Hill, 1978.
2. B. Brey and C. R. Sarma, "The Intel microprocessors", Pearson Education, 2000.
3. J. L. Hennessy and D. A. Patterson, "Computer Architecture A Quantitative Approach", Morgan Kauffman, 2011.
4. W. Stallings, "Computer organization", PHI, 1987.
5. P. Barry and P. Crowley, "Modern Embedded Computing", Morgan Kaufmann, 2012.
6. N. Mathivanan, "Microprocessors, PC Hardware and Interfacing", Prentice Hall, 2004.
7. Y. C. Lieu and G. A. Gibson, "Microcomputer Systems: The 8086/8088 Family", Prentice Hall India, 1986.
8. J. Uffenbeck, "The 8086/8088 Design, Programming, Interfacing", Prentice Hall, 1987.
9. B. Govindarajalu, "IBM PC and Clones", Tata McGraw Hill, 1991.
10. P. Able, "8086 Assembly Language Programming", Prentice Hall India.
6. Winfried Karl Grassmann and Jean-Paul Tremblay, Logic and Discrete Mathematics, PEARSON.
11. Rajaraman – "Computer Organization & Architecture", PHI
12. B. Ram – "Computer Organization & Architecture", Newage Publications

Course Outcomes:

On completion of the course students will be able to

PCC-CS402.1 Learn pipelining concepts with a prior knowledge of stored program methods

PCC-CS402.2 Learn about memory hierarchy and mapping techniques.

PCC-CS402.3 Study of parallel architecture and interconnection network

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Formal Language & Automata Theory

Code: PCC-CS403

Contacts: 3L

Name of the Course:	Formal Language & Automata Theory		
Course Code: PCC-CS403	Semester: IV		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam: 70 Marks	
Credit Points:	3		
Objective:			
1	Be able to construct finite state machines and the equivalent regular expressions.		
2	Be able to prove the equivalence of languages described by finite state machines and regular expressions		
3	Be able to construct pushdown automata and the equivalent context free grammars. And Be able to prove the equivalence of languages described by pushdown automata and context free grammars.		
4	Be able to construct Turing machines and Post machines. Be able to prove the equivalence of languages described by Turing machines and Post machines		
Pre-Requisite:			
1	Grammar and its classification (Context Free Grammar)		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.	6	
2	Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata)	7	
3	Context-free languages and pushdown automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms,	6	

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	nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic push down automata, closure properties of CFLs.		
4.	Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.	6	
5	Turing machines: The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators	6	
6	Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice's theorem, undecidable problems about languages	6	

Text books/ reference books:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.
2. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.
3. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
4. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.
5. John Martin, Introduction to Languages and The Theory of Computation, TataMcGraw Hill., PEARSON.
6. Dr. R.B.Patel, Theory of Computation, Khanna Publishing House

Course Outcomes:

On completion of the course students will be able to

- PCC-CS403.1 Write a formal notation for strings, languages and machines.
- PCC-CS403.2 Design finite automata to accept a set of strings of a language.
- PCC-CS403.3 For a given language determine whether the given language is regular or not.
- PCC-CS403.4 Design context free grammars to generate strings of context free language.
- PCC-CS403.5 Determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars
- PCC-CS403.6 Write the hierarchy of formal languages, grammars and machines.
- PCC-CS403.7 Distinguish between computability and non-computability and Decidability and undecidability.

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Design and Analysis of Algorithms

Code: PCC-CS404

Contacts: 3L

Name of the Course:	Design and Analysis of Algorithms		
Course Code: PCC-CS404	Semester: IV		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: hrs./week		End Semester Exam: 70 Marks	
Credit Points:	3		
Objective:			
1	The aim of this module is to learn how to develop efficient algorithms for simple computational tasks and reasoning about the correctness of them		
2	Through the complexity measures, different range of behaviors of algorithms and the notion of tractable and intractable problems will be understood.		
Pre-Requisite:			
1	To know data-structure and basic programming ability		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem	8	
2	Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branch and-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics –characteristics and their application domains.	8	
3	Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.	6	
	Tractable and Intractable Problems: Computability		

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4.	of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.	10	
5	Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE	4	

Text books/ reference books:

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.
4. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
5. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
6. Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA
7. Design & Analysis of Algorithms, Gajendra Sharma, Khanna Publishing House (AICTE Recommended Textbook – 2018)
8. Algorithms Design and Analysis, Udit Agarwal, Dhanpat Rai

Course Outcomes

On completion of the course students will be able to

PCC-CS404.1 For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.

PCC-CS404.2 Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.

PCC-CS404.3 Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.

PCC-CS404.4 Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and

PCC-CS404.5 develop the dynamic programming algorithms, and analyze it to determine its computational complexity.

PCC-CS404.6 For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.

PCC-CS404.7 Explain the ways to analyze randomized algorithms (expected running time, probability of error).

PCC-CS404.8 Explain what an approximation algorithm is. Compute the approximation factor of an approximation algorithm (PTAS and FPTAS).

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Biology
Code: BSC 401
Contacts: 2L+1T

Name of the Course:		Biology	
Course Code: BSC-401		Semester: IV	
Duration: 6 months		Maximum Marks:100	
Teaching Scheme		Examination Scheme	
Theory: 2hrs./week		Mid Semester exam: 15	
Tutorial: 1 hour		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam: 70 Marks	
Credit Points:		3	
Objective:			
1	Bring out the fundamental differences between science and engineering		
2	Discuss how biological observations of 18 th Century that lead to major discoveries		
Pre-Requisite:			
1	Basic knowledge of Physics ,Chemistry and mathematics		

Unit	Content	Hrs/Unit	Marks/Unit
1	To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18 th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.	2	
2	The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c)	3	

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	energy and Carbon utilisation -Autotrophs, heterotrophs, lithotrophs (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e) Habitata- aquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus		
3	To convey that “Genetics is to biology what Newton’s laws are to Physical Sciences” Mendel’s laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.	4	
4.	Biomolecules: To convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA.Two carbon units and lipids.	4	
5	Enzymes: To convey that without catalysis life would not have existed on earth Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyse reactions? Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.	4	
6	Information Transfer:The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA	4	

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	structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.		
7	Macromolecular analysis: How to analyse biological processes at the reductionist level Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.	5	
8	Metabolism: The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergonic reactions. Concept of K_{eq} and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to $CO_2 + H_2O$ (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge	4	
9	Microbiology Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.	3	

Text books/ reference books:

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

Course Outcomes:

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On completion of the course students will be able to

BSC-401.1 Describe how biological observations of 18th Century that lead to major discoveries.

BSC-401.2 Convey that classification *per se* is not what biology is all about but highlight the underlying

criteria, such as morphological, biochemical and ecological

BSC-401.3 Highlight the concepts of recessiveness and dominance during the passage of genetic material

from parent to offspring

BSC-401.4 Convey that all forms of life have the same building blocks and yet the manifestations are as

diverse as one can imagine

BSC-401.5 Classify enzymes and distinguish between different mechanisms of enzyme action.

BSC-401.6 Identify DNA as a genetic material in the molecular basis of information transfer.

BSC-401.7 Analyse biological processes at the reductionistic level

BSC-401.8 Apply thermodynamic principles to biological systems.

BSC-401.9 Identify and classify microorganisms.

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Environmental Sciences

Code: MC-401

Contacts: 1L

Name of the Course:	Environmental Sciences		
Course Code: MC-401	Semester: IV		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:1hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz : 10 marks	
		Attendance : 5 marks	
Practical: NIL		End Semester Exam :70 Marks	
Credit Points:	1		
Objective:			
1	Be able to understand the natural environment and its relationships with human activities.		
2	Be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.		
3	Be able to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.		
4	Be able to solve scientific problem-solving related to air, water, noise & land pollution		
Pre-Requisite:			
1	Basic knowledge of Environmental science		

Unit	Content	Hrs/Unit	Marks/Unit
1	<p>Basic ideas of environment, basic concepts, man, society & environment, their interrelationship (1L)</p> <p>Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development. (2L)</p> <p>Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function. (1L)</p> <p>Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic</p>	6	

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	degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering. (2L)		
2	<p>Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. (1L)</p> <p>Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web.(2L)</p> <p>Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. (1L)</p> <p>Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.(2L)</p>	6	
3	<p>Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. (1L)</p> <p>Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.(1L)</p> <p>Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth's heat budget.(1L)</p> <p>Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).(2L)</p> <p>Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.(2L)</p> <p>Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria</p>	11	

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	<p>pollutant. Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. (2L)</p> <p>Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green-house gases, effect of ozone modification. (1L)</p> <p>Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP, cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference). (1L)</p>		
4.	<p>Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. (2L)</p> <p>River/Lake/ground water pollution: River: DO, 5-day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenation, reaeration], COD, Oil, Greases, pH. (2L)</p> <p>Lake: Eutrophication [Definition, source and effect]. (1L)</p> <p>Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only)(1L)</p> <p>Standard and control: Waste water standard [BOD, COD, Oil, Grease],</p> <p>Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. (2L)</p> <p>Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic (1L)</p>	9	
5	Lithosphere; Internal structure of earth, rock and soil (1L)	3	

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	Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste).(2L)		
6	Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] (1L) Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L10 (18hr Index) ,n Ld.Noise pollution control. (1L)	3	
7	Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. (2L)	2	

Text books/ reference books:

1. M.P. Poonia & S.C. Sharma, Environmental Studies, Khanna Publishing House (AICTE Recommended Textbook – 2018)
2. Masters, G. M., “Introduction to Environmental Engineering and Science”, Prentice-Hall of India Pvt. Ltd.,1991.
3. De, A. K., “Environmental Chemistry”, New Age International

Course Outcomes:

On completion of the course students will be able to

MC-401.1 To understand the natural environment and its relationships with human activities.

MC-401.2 To apply the fundamental knowledge of science and engineering to assess environmental and health risk.

MC-401.3 To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations.

MC-401.4 Acquire skills for scientific problem-solving related to air, water, noise& land pollution.

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PRACTICAL SYLLABUS
Semester IV

Computer Architecture Lab
Code: PCC-CS492
Contacts: 4P

Name of the Course:	Computer Architecture Lab
Course Code: PCC-CS492	Semester: IV
Duration: 6 months	Maximum Marks:100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assesement: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Course Outcomes:	
1	PCC-CS402.1
2	PCC-CS402.2
3	PCC-CS402.3
Pre-Requisite:	
1	The hardware based design has been done in 1.the Analog & Digital Electronics laboratory
2	Computer Organisation laboratory

Laboratory Experiments:	
1	HDL introduction.
2	Basic digital logic base programming with HDL
3	8-bit Addition, Multiplication, Division
4	8-bit Register design
5	Memory unit design and perform memory operations.
6	8-bit simple ALU design
7	8-bit simple CPU design
8	Interfacing of CPU and Memory.

Any experiment specially designed by the college
 (Detailed instructions for Laboratory Manual to be followed for further guidance)

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Design & Analysis Algorithm Lab

Code: PCC-CS494

Contact: 4P

Name of the Course:	Design & Analysis Algorithm Lab
Course Code: PCC-CS494	Semester: IV
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Course Outcomes:	
1	PCC-CS402.1
2	PCC-CS402.2
3	PCC-CS402.3
Pre-Requisite:	
Pre-Requisite as in : PCC-CS404	

Laboratory Experiments:	
Divide and Conquer:	
1	Implement Binary Search using Divide and Conquer approach Implement Merge Sort using Divide and Conquer approach
2	Implement Quick Sort using Divide and Conquer approach Find Maximum and Minimum element from an array of integers using Divide and Conquer approach
3	Find the minimum number of scalar multiplications needed for chain of matrix
4	Implement all pair of Shortest path for a graph (Floyd-Warshall Algorithm) Implement Traveling Salesman Problem
5	Implement Single Source shortest Path for a graph (Dijkstra, Bellman Ford Algorithm)
Brute Force and Bound:	
6	Implement 15 Puzzle Problem
Backtracking:	
7	Implement 8 Queen problem
8	Graph Coloring Problem Hamiltonian Problem
Greedy method	
9	Knapsack Problem Job sequencing with deadlines
10	Minimum Cost Spanning Tree by Prim's Algorithm Minimum Cost Spanning Tree by Kruskal's Algorithm
Graph Traversal Algorithm:	
11	Implement Breadth First Search (BFS)

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	Implement Depth First Search (DFS)
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Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

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SEMESTER – V

Software Engineering

Code: ESC501

Contact: 3L

Name of the Course:	Software Engineering		
Course Code: ESC501	Semester: V		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: hrs./week		End Semester Exam:70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Overview of System Analysis & Design , Business System Concept, System Development Life Cycle, Waterfall Model , Spiral Model, Feasibility Analysis, Technical Feasibility, Cost- Benefit Analysis, COCOMO model. [10L]	10	
2	System Design – Context diagram and DFD, Problem Partitioning, Top-Down And Bottom-Up design; Decision tree, decision table and structured English; Functional vs. Object- Oriented approach. [5L]	5	
3	Coding & Documentation – Structured Programming, OO Programming, Information Hiding, Reuse, System Documentation. [4L]	12	
	Testing – Levels of Testing, Integration Testing, Test case Specification, Reliability Assessment, Validation & Verification Metrics, Monitoring & Control. [8L]		
4.	Software Project Management – Project Scheduling, Staffing, Software Configuration Management, Quality Assurance, Project Monitoring. [7L]	7	

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5	Static and dynamic models, why modeling, UML diagrams: Class diagram, interaction diagram: collaboration diagram, sequence diagram, state chart diagram, activity diagram, implementation diagram. [10 L]	10	
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Text book and Reference books:

1. Pressman, Software Engineering : A practitioner's approach– (TMH)
2. Pankaj Jalote, Software Engineering- (Wiley-India)
3. N.S. Gill, Software Engineering – (Khanna Publishing House)
4. Rajib Mall, Software Engineering- (PHI)
5. Agarwal and Agarwal, Software Engineering – (PHI)
6. Sommerville, Software Engineering – Pearson
7. Martin L. Shooman, Software Engineering – TMH

Compiler Design
Code: PCC-CS501
Contact: 3L

Name of the Course:		Compiler Design	
Course Code: PCC-CS501		Semester:V	
Duration:6 months		Maximum Marks:100	
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam:70 Marks	
Credit Points:	3		
Objective:			
1	To understand and list the different stages in the process of compilation.		
2	Identify different methods of lexical analysis		
3	Design top-down and bottom-up parsers		
4	Identify synthesized and inherited attributes		
5	Develop syntax directed translation schemes		

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6	Develop algorithms to generate code for a target machine
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Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction to Compiling [3L] Compilers, Analysis of the source program, The phases of the compiler, Cousins of the compiler.	3	
2	Lexical Analysis [6L] The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, Finite automata, From a regular expression to an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).	6	
3	Syntax Analysis [9L] The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.	9	
4	Syntax directed translation [5L] Syntax director definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.	5	
5	Type checking [4L] Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions	4	
6	Run time environments [5L] Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.	5	
7	Intermediate code generation [4L] Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).	4	

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8	Code optimization [5L] Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representation of basic blocks, The principle sources of optimization, Loops in flow graph, Peephole optimization.	5	
9	Code generations [4L] Issues in the design of code generator, a simple code generator, Register allocation & assignment.	4	

Text book and Reference books:

1. Aho, Sethi, Ullman - "Compiler Principles, Techniques and Tools" - Pearson Education.
2. Holub - "Compiler Design in C" - PHI.

Course Outcomes:

On completion of the course students will be able to

1. Understand given grammar specification develop the lexical analyser
2. Design a given parser specification design top-down and bottom-up parsers
3. Develop syntax directed translation schemes
4. Develop algorithms to generate code for a target machine

Operating Systems

Code: PCC-CS502

Contacts: 3L

Name of the Course:	Operating Systems		
Course Code: PCC-CS502	Semester: V		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance : 5 marks	
Practical: hrs./week		End Semester Exam :70 Marks	
Credit Points:	3		
Objective:			
1	To learn the mechanisms of OS to handle processes and threads and their communication		
2	To learn the mechanisms involved in memory management in contemporary OS		
3	To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols		
4	To know the components and management aspects of concurrency management		
Pre-Requisite:			

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1	Computer Organization & Architecture
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Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Concept of Operating Systems, Generations of Operating systems, Types of	3	
	Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.		
2	Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.	10	
3.	Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problem etc.	5	
4.	Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.	5	
5.	Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation– Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation –Page allocation Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently	8	

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	used(LRU).		
6.	<p>I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms</p> <p>File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.</p> <p>Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks</p>	6	

Text book and Reference books:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.
3. Operating System Concepts, Ekta Walia, Khanna Publishing House (AICTE Recommended Textbook – 2018)
4. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
5. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
6. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
7. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

Course Outcomes:

On completion of the course students will be able to

1. Create processes and threads.
2. Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.
3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time. Design and implement file management system.

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4. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Object Oriented Programming

Code: PCC-CS503

Contacts: 3L

Name of the Course:	Computer Organization		
Course Code: PCC-CS503	Semester: V		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz : 10 marks	
		Attendance: 5 marks	
Practical: hrs./week		End Semester Exam:70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Abstract data types and their specification. How to implement an ADT. Concrete state space, concrete invariant, abstraction function. Implementing operations, illustrated by the Text example.	8	
2	Features of object-oriented programming. Encapsulation, object identity, polymorphism – but not inheritance.	8	
3	Inheritance in OO design. Design patterns. Introduction and classification. The iterator pattern.	6	
4	Model-view-controller pattern. Commands as methods and as objects. Implementing OO language features. Memory management.	6	
5	Generic types and collections GUIs. Graphical programming with Scale and Swing . The software development process	6	

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Text book and Reference books:

1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
2. Ali Bahrami – "Object Oriented System Development" – Mc Graw Hill
3. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" – TMH
4. R.K Das – "Core Java For Beginners" – VIKAS PUBLISHING
5. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson
6. Ivor Horton's Beginning Java 2 SDK – Wrox
7. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH

Course Outcomes:

On completion of the course students will be able to

1. Specify simple abstract data types and design implementations, using abstraction functions to document them.
2. Recognise features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.
3. Name and apply some common object-oriented design patterns and give examples of their use.
4. Design applications with an event-driven graphical user interface.

Introduction to Industrial Management (Humanities III) Code:

HSMC-501

Contacts: 3L

Name of the Course:	Introduction to Industrial Management (Humanities III)	
Course Code: HSMC-501	Semester: V	
Duration:6 months	Maximum Marks:100	
Teaching Scheme		Examination Scheme
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz : 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:	3	

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Unit	Content	Hrs/Unit	Marks/Unit
1	<p>Introduction</p> <p>System- concept, definition, types, parameters, variables and behavior.</p> <p>Management – definition and functions.</p> <p>Organization structure:</p> <ol style="list-style-type: none"> Definition. Goals. Factors considered in formulating structure. Types. Advantages and disadvantages. Applications. <p>Concept, meaning and importance of division of labor, scalar & functional processes, span of control, delegation of authority, centralization and decentralization in industrial management.</p> <p>Organizational culture and climate – meaning, differences and factors affecting them.</p> <p>Moral-factors affecting moral.</p> <p>Relationship between moral and productivity.</p> <p>Job satisfaction- factors influencing job satisfaction.</p> <p>Important provisions of factory act and labor laws.</p>	6	
2	<p>Critical Path Method (CPM) and Programme Evaluation Review Technique (PERT):</p> <p>2.1 CPM & PERT-meaning, features, difference, applications. 2.2 Understand different terms used in network diagram.</p> <p>Draw network diagram for a real life project containing 10-15 activities, computation of LPO and EPO.(Take minimum three examples).</p> <p>Determination of critical path on network.</p> <p>Floats, its types and determination of floats.</p> <p>Crashing of network, updating and its applications.</p>	8	

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3	<p>Materials Management:</p> <p>Material management-definition, functions, importance, relationship with other departments.</p> <p>Purchase - objectives, purchasing systems, purchase procedure, terms and forms used in purchase department.</p> <p>Storekeeping- functions, classification of stores as centralized and decentralized with their advantages, disadvantages and application in actual practice.</p> <p>Functions of store, types of records maintained by store, various types and applications of storage equipment, need and general methods for codification of stores.</p> <p>Inventory control:</p> <ol style="list-style-type: none"> i. Definition. ii. Objectives. iii. Derivation for expression for Economic Order Quantity (EOQ) and numeric examples. iv. ABC analysis and other modern methods of analysis. v. Various types of inventory models such as Wilson's inventory model, replenishment model and two bin model. (Only sketch and understanding, no derivation.). <p>3.6 Material Requirement Planning (MRP)- concept, applications and brief details about software packages available in market.</p>	6	
4	<p>Production planning and Control (PPC):</p> <p>Types and examples of production.</p> <p>PPC : i. Need and importance. ii. Functions. iii. Forms used and their importance. iv. General approach for each type of production.</p> <p>Scheduling- meaning and need for productivity and utilisation.</p> <p>Gantt chart- Format and method to prepare.</p> <p>Critical ratio scheduling-method and numeric examples.</p> <p>Scheduling using Gantt Chart (for at least 5-7 components having 5-6</p>	8	

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	machining operations, with processes, setting and operation time for each component and process, resources available, quantity and other necessary data), At least two examples. 4.7 Bottlenecking- meaning, effect and ways to reduce.		
5	Value Analysis (VA) and Cost Control: 5.1 VA-definition, terms used, process and importance. 5.2 VA flow diagram. DARSIRI method of VA. Case study of VA-at least two. Waste-types, sources and ways to reduce them. Cost control-methods and important guide lines.	4	
6	Recent Trends in IM: ERP (Enterprise resource planning) - concept, features and applications. Important features of MS Project. Logistics- concept, need and benefits. Just in Time (JIT)-concept and benefits. Supply chain management-concept and benefits.	4	

Text book and Reference books:

1. L.S. Srinath– “CPM & PERT principles and Applications”.
2. Buffa – “Modern Production Management”.
3. N. Nair – “Materials Management”.
4. O. P. Khanna – “ Industrial Engineering & Management”.
5. Mikes – “Value Analysis”.
6. S.C. Sharma, “Engineering Management – Industrial Engineering & Management”, Khanna Book Publishing Company, New Delhi

Course Outcomes:

On completion of the course students will be able to

1. Interpret given organization structure, culture, climate and major provisions of factory acts and laws.
2. Explain material requirement planning and store keeping procedure.
3. Plot and analyze inventory control models and techniques.
4. Prepare and analyze CPM and PERT for given activities.
5. List and explain PPC functions.

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Theory of Computation

Code: PEC-IT501A

Contacts: 3L

Name of the Course:	Theory of Computation	
Course Code: PEC-IT501A	Semester: V	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		Examination Scheme
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance : 5 marks
Practical: NIL		End Semester Exam :70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	Fundamentals: Basic definition of sequential circuit, block diagram, mathematical representation, concept of transition table and transition diagram (Relating of Automata concept to sequential circuit concept) Design of sequence detector, Introduction to finite state model [2L] Finite state machine: Definitions, capability & state equivalent, kth-equivalent concept [1L] Merger graph, Merger table, Compatibility graph [1L] Finite memory definiteness, testing table & testing graph. [1L] Deterministic finite automaton and non deterministic finite automaton. [1L] Transition diagrams and Language recognizers. [1L] Finite Automata: NFA with \hat{I} transitions - Significance, acceptance of languages. [1L] Conversions and Equivalence: Equivalence between NFA with and without \hat{I} transitions. NFA to DFA conversion. [2L] Minimization of FSM, Equivalence between two FSM's , Limitations of FSM [1L] Application of finite automata, Finite Automata with output- Moore & Melay machine. [2L]	13	
2	Regular Languages : Regular sets. [1L] Regular expressions, identity rules. Arden's theorem state and prove [1L] Constructing finite Automata for a given regular expressions, Regular string accepted by NFA/DFA [1L] Pumping lemma of regular sets. Closure properties of regular sets (proofs not required). [1L] Grammar Formalism: Regular grammars-right linear and left linear	8	

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	<p>9grammars. [1L] Equivalence between regular linear grammar and FA. [1L] Inter conversion, Context free grammar. [1L] Derivation trees, sentential forms. Right most and leftmost derivation of strings. (Concept only) [1L]</p>		
3.	<p>Context Free Grammars, Ambiguity in context free grammars. [1L] Minimization of Context Free Grammars. [1L] Chomsky normal form and Greibach normal form. [1L] Pumping Lemma for Context Free Languages. [1L] Enumeration of properties of CFL (proofs omitted). Closure property of CFL, Ogden's lemma & its applications [1L] Push Down Automata: Push down automata, definition. [1L] Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. [1L] Equivalence of CFL and PDA, interconversion. (Proofs not required). [1L] Introduction to DCFL and DPDA. [1L]</p>	9	
4.	<p>Turing Machine : Turing Machine, definition, model [1L] Design of TM, Computable functions [1L] Church's hypothesis, counter machine [1L] Types of Turing machines (proofs not required) [1 L] Universal Turing Machine, Halting problem [2L]</p>	5	

Text book and Reference books:

1. "Introduction to Automata Theory Language and Computation", Hopcroft H.E. and Ullman J. D., Pearson education.
2. "Theory of Computation", R.B Patel, Khanna Publishing House, New Delhi
3. "Theory of Computer Science ", Automata Languages and computation", Mishra and Chandra shekaran, 2nd edition, PHI.
4. "Formal Languages and Automata Theory", C.K.Nagpal, Oxford
5. "Switching & Finite Automata", ZVI Kohavi, 2nd Edn., Tata McGraw Hill
6. "Introduction to Computer Theory", Daniel I.A. Cohen, John Wiley
7. "Introduction to languages and the Theory of Computation", John C Martin, TMH
8. "Elements of Theory of Computation", Lewis H.P. & Papadimitrou C.H. Pearson, PHI.

Course Outcomes:

On completion of the course students will be able to

1. Define a system and recognize the behavior of a system. They will be able to minimize a system and compare different systems

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2. Convert Finite Automata to regular expression. Students will be able to check equivalence between regular linear grammar and FA.
3. Minimize context free grammar. Student will be able to check equivalence of CFL and PDA. They
4. Will be able to design Turing Machine.
5. Design Turing machine.

Artificial Intelligence

Code: PEC-IT501B

Contacts: 3L

Name of the Course:	Artificial Intelligence		
Course Code: PEC-IT501B	Semester: V		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance : 5 marks	
Practical: NIL		End Semester Exam :70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction [2] Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem. Intelligent Agents [2] Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents. Problem Solving [2] Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.	6	
2.	Search techniques [5] Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies [5] Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search,	13	

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	genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems. Adversarial search [3] Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.		
3	Knowledge & reasoning [3] Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.	3	
4	Using predicate logic [2] Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. Probabilistic reasoning [4] Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.	6	
5	Natural Language processing [2] Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing. Learning [2] Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning. Expert Systems [2] Representing and using domain knowledge, expert system shells, knowledge acquisition.	6	

Text book and Reference books:

1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
4. Poole, Computational Intelligence, OUP
5. Logic & Prolog Programming, Saroj Kaushik, New Age International
6. Expert Systems, Giarranto, VIKAS
7. M.C. Trivedi, Artificial Intelligence, Khanna Publishing House, New Delhi (AICTE Recommended Textbook – 2018)

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Advanced Computer Architecture

Code: PEC-IT501C

Contacts: 3L

Name of the Course:	Advanced Computer Architecture		
Course Code: PEC-IT501C	Semester: V		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance : 5 marks	
Practical: NIL		End Semester Exam :70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Computer Architecture and Organization-Review, Fundamentals of Computer Design, Technology Trends Cost Performance Analysis (3L) Parallel Processing Architectures- Taxonomy- SISD, MISD, SIMD,MIMD, PRAM models (3L)	6	
2.	Data and Resource Dependencies, Program Partitioning and Scheduling, Control Flow vs. Data Flow (3L) Network topologies-Static, Dynamic, Types of Networks (3L) RISC vs. CISC, Memory Hierarchy, Virtual Memory (4L)	10	
3	Concepts of Pipelining, Instruction Pipelining, dynamic pipelining, arithmetic pipelines. (4L) Multiprocessors- Multistage Networks, Cache Coherence, Synchronization, Message- passing (4L) Vector Processing Principles- Instruction types, Compound, Vector Loops, Chaining (4L)	12	
4	Array Processors- Structure, Algorithms (3L) Data Flow Architecture- Graphs. Petri Nets, Static and Dynamic DFA, VLSI Computations (4L) Parallel Programming Models, Languages, Compilers (4L)	11	

Text book and Reference books:

1. Computer Architecture and Parallel Processing- Kai Hwang and A. .Briggs International Edition, McGraw Hill
2. Advanced Computer Architecture: D. Sima, T. fountain, P. Kacsuk, Pearson
3. Parallel Computer Architecture: D. Culler, J.P.Singh, A.Gupta, Elsevier

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Computer Graphics
Code: PEC-IT501D
Contacts: 3L

Name of the Course:	Computer Graphics		
Course Code: PEC-IT501D	Semester: V		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance : 5 marks	
Practical: NIL		End Semester Exam :70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction to computer graphics & graphics systems [6L]: Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics software. Scan conversion [8L]: Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.	14	
2	2D transformation & viewing [15L]: Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline, Window to view port co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse. Cohen and Sutherland line clipping, Sutherland-Hodgeman Polygon clipping, Cyrus-beck clipping method 3D transformation & viewing [5L]: 3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, view port clipping, 3D viewing.	20	
	Curves [3L]: Curve representation, surfaces, designs, Bezier curves,		

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3.	B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves. Hidden surfaces [3L]: Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Painter's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry. Color & shading models [2L]: Light & color model; interpolative shading model; Texture. Introduction to Ray-tracing: [3L] Human vision and color, Lighting, Reflection and transmission models.	6	
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Text book and Reference books:

1. Hearn, Baker – “Computer Graphics (C version 2nd Ed.)” – Pearson education
2. Z. Xiang, R. Plastock – “Schaum's outlines Computer Graphics (2nd Ed.)” – TMH
3. D. F. Rogers, J. A. Adams – “Mathematical Elements for Computer Graphics (2nd Ed.)” – TMH

Constitution of India

Code: MC-CS501

Contacts: 3L

Name of the Course:	Constitution of India		
Course Code: MC-CS501	Semester: V		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance : 5 marks	
Practical: NIL			
Credit Points:	0		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Constitution' meaning of the term,, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy	3	
2	Union Government and its Administration : Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha	6	

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3.	State Government and its Administration Governor: Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions	6	
4.	Local Administration District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different 4.departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy	8	
5.	Election Commission Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women		

Text book and Reference books:

1. 'Indian Polity' by Laxmikanth
2. 'Indian Administration' by Subhash Kashyap
3. 'Indian Constitution' by D.D. Basu
4. 'Indian Administration' by Avasti and Avasti

PRACTICAL SYLLABUS

Software Engineering Lab Code:

ESC591

Contact: 4P

Name of the Course:	Software Engineering Lab
Course Code: ESC591	Semester:V
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
Course Outcomes:	
1	To understand the software engineering methodologies involved in the phases for project development.
2	To gain knowledge about open source tools used for implementing software engineering methods.
3	To exercise developing product-startups implementing software engineering methods.
4	Learn simple optimization techniques
Pre-Requisite:	

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Laboratory Experiments:

- Problem Analysis and Project Planning -Thorough study of the problem – Identify Project scope, Objectives and Infrastructure.
- Software Requirement Analysis – Describe the individual Phases/modules of the project and Identify deliverables. Identify functional and non-functional requirements.
- Data Modeling – Use work products – data dictionary.
- Software Designing - Develop use case diagrams and activity diagrams, build and testclass diagrams, sequence diagrams and add interface to class diagrams.
- Prototype model – Develop the prototype of the product.

The SRS and prototype model should be submitted for end semester examination.

Any experiment specially designed by the college

(Detailed instructions for Laboratory Manual to be followed for further guidance)

Operating System Lab

Code: PCC-CS592

Contacts: 4P

Name of the Course:	Operating System Lab
Course Code: PCC-CS592	Semester:V
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2

1 1. Managing Unix/Linux Operating System [8P]:

Creating a bash shell script, making a script executable, shell syntax (variables, conditions, control structures, functions,

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commands). Partitions, Swap space, Device files, Raw and Block files, Formatting disks, Making file systems, Superblock, I-nodes, File system checker, Mounting file systems, Logical Volumes, Network File systems, Backup schedules and methods Kernel loading, init and the inittab file, Run-levels, Run level scripts. Password file management, Password security, Shadow file, Groups and the group file, Shells, restricted shells, user-management commands, homes and permissions, default files, profiles, locking accounts, setting passwords, Switching user, Switching group, Removing users & user groups.

2. **Process [4P]**: starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.

3. **Signal [4P]**: signal handling, sending signals, signal interface, signal sets.

4. **Semaphore [6P]**: programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v).

5. **POSIX Threads [6P]**: programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)

6. **Inter-process communication [6P]**: pipes (use functions pipe, popen, pclose), named pipes (FIFOs, accessing FIFO), message passing & shared memory (IPC version V).

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Object Oriented Programming Lab

Code: PCC-CS593

Contacts: 4P

Name of the Course:	Object Oriented Programming Lab
Course Code: PCC-CS593	Semester: V
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2

Laboratory Experiments:

1. Assignments on class, constructor, overloading, inheritance, overriding
2. Assignments on wrapper class, arrays
3. Assignments on developing interfaces- multiple inheritance, extending interfaces
4. Assignments on creating and accessing packages

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5. Assignments on multithreaded programming
6. Assignments on applet programming

Note: Use Java for programming

Any experiment specially designed by the college
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SEMESTER – VI

Database Management Systems

Code: PCC-CS601

Contact: 3L

Name of the Course:	Database Management Systems		
Course Code: PCC-CS601	Semester: VI		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: hrs./week		End Semester Exam:70 Marks	
Credit Points:	3		
Objective:			
1	To understand the different issues involved in the design and implementation of a database system.		
2	To study the physical and logical database designs, database modeling, relational, hierarchical, and network models		
3	To understand and use data manipulation language to query, update, and manage a database		
4	To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.		
5	To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.		
6	To understand the different issues involved in the design and implementation of a database system.		

Unit	Content	Hrs/Unit	Marks/Unit
1	Database system architecture: Data Abstraction, Data Independence, Data Definition Language(DDL), Data Manipulation Language(DML). Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.	9	

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2	Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQLserver. Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design. Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.	13	
3	Storage strategies: Indices, B-trees, hashing.	3	
4.	Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.	5	
5	Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.	3	
6	Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.	3	

Text book and Reference books:

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.
2. "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press.
3. Database Management Systems, R.P. Mahapatra, Khanna Publishing House, New Delhi (AICTE Recommended Textbook – 2018)

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4. “Fundamentals of Database Systems” , 5th Edition by R. Elmasri and S. Navathe,
5. Pearson Education “Foundations of Databases”, Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley

Course Outcomes:

On completion of the course students will be able to

1. For a given query write relational algebra expressions for that query and optimize the developed expressions
2. For a given specification of the requirement design the databases using E R method and normalization.
3. For a given specification construct the SQL queries for Open source and Commercial DBMS -MySQL, ORACLE, and DB2.
4. For a given query optimize its execution using Query optimization algorithms
5. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.
6. Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

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Computer Networks

Code: PCC-CS602

Contact: 3L

Name of the Course:	Computer Networks		
Course Code: PCC-CS602	Semester: VI		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: hrs./week		End Semester Exam:70 Marks	
Credit Points:	3		
Objective:			
1	To develop an understanding of modern network architectures from a design and performance perspective.		
2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).		
3	To provide an opportunity to do network programming		
4	To provide a WLAN measurement ideas.		

Unit	Content	Hrs/Unit	Marks/Unit
1	Data communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.	9	
2	Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking,	8	

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	Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA		
3	Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.	14	
4.	Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.	8	
5	Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.	8	

Text book and Reference books:

1. Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
3. "Algorithm Design" by Kleinberg and Tardos.
4. Design & Analysis of Algorithms, Gajendra Sharma, Khanna Publishing House, New Delhi

Course Outcomes:

On completion of the course students will be able to

1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

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Advanced Algorithms
Code: PEC-IT601 A
Contact: 3L

Name of the Course:		Advanced Algorithms	
Course Code: PEC-IT601A		Semester: VI	
Duration:6 months		Maximum Marks:100	
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam:70 Marks	
Credit Points:		3	
Objective:			
1	Introduce students to the advanced methods of designing and analyzing algorithms.		
2	The student should be able to choose appropriate algorithms and use it for a specific problem.		
3	To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.		
4	Students should be able to understand different classes of problems concerning their computation difficulties.		
5	To introduce the students to recent developments in the area of algorithmic design.		
Pre-Requisite:			
1	Algorithm Design and Analysis		

Unit	Content	Hrs/Unit	Marks/Unit
1	Sorting: Review of various sorting algorithms, topological sorting Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkstra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.	6	
2	Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to	8	

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	MST. Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.		
	Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm. Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.	9	
3	Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming. Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem. Discrete Fourier Transform (DFT): In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm	10	
4.	Linear Programming: Geometry of the feasibility region and Simplex algorithm NP-completeness: Examples, proof of NP-hardness and NP-completeness. One or more of the following topics based on time and interest Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm	10	
5	Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.	5	

Text book and Reference books:

1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
3. "Algorithm Design" by Kleinberg and Tardos.
4. Design & Analysis of Algorithms, Gajendra Sharma, Khanna Publishing House, New Delhi

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Course Outcomes:

On completion of the course students will be able to

1. Analyze the complexity/performance of different algorithms.
2. Determine the appropriate data structure for solving a particular set of problems.
3. Categorize the different problems in various classes according to their complexity.
4. Students should have an insight of recent activities in the field of the advanced data structure.

Distributed Systems

Code: PEC-IT601B

Contact: 3L

Name of the Course:		Distributed Systems	
Course Code: PEC-IT601B		Semester: VI	
Duration:6 months		Maximum Marks:100	
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam:70 Marks	
Credit Points:		3	
Objective:			
1	To introduce the fundamental concepts and issues of managing large volume of shared data in a parallel and distributed environment, and to provide insight into related research problems.		
Pre-Requisite:			
1	Database Management Systems		

Unit	Content	Hrs/Unit	Marks/Unit
1	INTRODUCTION Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts DISTRIBUTED DATABASE MANAGEMENT SYSTEM ARCHITECTURE Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues	8	

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2	DISTRIBUTED DATABASE DESIGN Alternative design strategies; Distributed design issues; Fragmentation; Data allocation SEMANTICS DATA CONTROL View management; Data security; Semantic Integrity Control QUERY PROCESSING ISSUES Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data	11	
3	DISTRIBUTED QUERY OPTIMIZATION Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms TRANSACTION MANAGEMENT The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models CONCURRENCY CONTROL Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management	11	
4.	Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols Algorithm	8	
5	PARALLEL DATABASE SYSTEMS Parallel architectures; parallel query processing and	6	
6	ADVANCED TOPICS Mobile Databases, Distributed Object Management, Multi-databases	4	

Text book and Reference books:

1. Principles of Distributed Database Systems, M.T. Ozsu and PValduriez, Prentice-Hall, 1991.
2. Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley, 1992.

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Course Outcomes:

On completion of the course students will be able to

1. Design trends in distributed systems.
2. Apply network virtualization.
3. Apply remote method invocation and objects.

Signals & Systems

Code: PEC-IT601C

Contacts: 3L

Name of the Course:	Signals & Systems	
Course Code: PEC-IT601C	Semester: VI	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		Examination Scheme
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction to Signals and Systems : Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.	3	

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2	Behavior of continuous and discrete-time LTI systems (8 hours) Impulse response and step response, convolution, input-output behavior with periodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.	8	
3	Fourier, Laplace and z- Transforms Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete- Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.	10	
4.	The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.	9	

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Text book and Reference books:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, “ Signalsand systems”, Prentice Hall India,1997.
2. J. G. Proakis and D. G. Manolakis, “ Digital Signal Processing: Principles, Algorithms, and Applications” , Pearson,2006.
3. H. P. Hsu, “ Signals and systems”, Schaum’sseries, McGraw Hill Education,2010.
4. S. Haykinand B. V. Veen, “ Signals and Systems”, John Wiley and Sons,2007.
5. A. V. Oppenheim and R. W. Schafer, “ Discrete-Time Signal Processing”, Prentice Hall,2009.
6. M. J. Robert “ Fundamentals of Signals and Systems”, McGraw Hill Education, 2007.
7. B. P. Lathi, “ LinearSystems and Signals”, Oxford University Press,2009.
8. A. V. Oppenheim and R. W. Schafer, “ Discrete-Time Signal Processing”, Prentice Hall,2009.
9. M. J. Robert “ Fundamentals of Signals and Systems”, McGraw Hill Education, 2007.
10. B. P. Lathi, “ LinearSystems and Signals”, Oxford University Press,2009.
11. R. Anand, “Signals and Systems, Khanna Publishing House, 2018.

Course Outcomes:

- On completion of the course students will be able to
- Understand the concepts of continuous time and discrete time systems.
- Analyse systems in complex frequency domain.
- Understand sampling theorem and its implications.
- Understand the concepts of continuous time and discrete time systems.

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Image Processing
Code:PEC-IT601 D
Contact: 3L

Name of the Course:	Image Processing
Course Code: PEC-IT601D	Semester: VI
Duration:6 months	Maximum Marks:100
Teaching Scheme	Examination Scheme
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks
Credit Points:	3

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction [3L] Background, Digital Image	9	
	Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.		
2	Digital Image Formation [4L] A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform.	4	
3	Mathematical Preliminaries[9L] Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & Sine Transform.	9	

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4.	Image Enhancement [8L] Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High-pass Filtering, High- boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.	8	
5	Image Restoration [7L] Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation - Spatial Transformation, Gray Level Interpolation.	7	
6	Image Segmentation [7L] Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection - Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.	7	

Text book and Reference books:

1. Hearn, Baker – “Computer Graphics (C version 2nd Ed.)” – Pearson education
2. Z. Xiang, R. Plastock – “Schaum’s outlines Computer Graphics (2nd Ed.)” – TMH
3. D. F. Rogers, J. A. Adams – “Mathematical Elements for Computer Graphics (2nd Ed.)” – TMH

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Parallel and Distributed Algorithms

Code: PEC-IT602A

Contacts: 3L

Name of the Course:	Parallel and Distributed Algorithms		
Course Code PEC-IT602A	Semester: VI		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam:70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	UNIT-I :Basic Techniques, Parallel Computers for increase Computation speed, Parallel & Cluster Computing	8	
2	UNIT-II :Message Passing Technique- Evaluating Parallel programs and debugging, Portioning and Divide and Conquer strategies examples	8	
3	UNIT-III :Pipelining- Techniques computing platform, pipeline programs examples	8	
4.	UNIT-IV :Synchronous Computations, load balancing, distributed termination examples, programming with shared memory, shared memory multiprocessor constructs for specifying parallelism sharing data parallel programming languages and constructs, open MP	11	
5	UNIT-V :Distributed shared memory systems and programming achieving constant memory distributed shared memory programming primitives, algorithms – sorting and numerical algorithms.	9	

Text book and Reference books:

1. Parallel Programming, Barry Wilkinson, Michael Allen, Pearson Education, 2nd Edition.
2. Introduction to Parallel algorithms by Jaja from Pearson, 1992.

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Data Warehousing and Data Mining

Code: PEC-IT602B

Contacts: 3L

Name of the Course:	Data Warehousing and Data Mining	
Course Code PEC-IT602B	Semester: VI	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		Examination Scheme
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
	Unit 1:		
1	Introduction to Data Warehousing; Data Mining: Mining frequent patterns, association and correlations; Sequential Pattern Mining concepts, primitives, scalable methods;	8	
2	Unit 2: Classification and prediction; Cluster Analysis – Types of Data in Cluster Analysis, Partitioning methods, Hierarchical Methods; Transactional Patterns and other temporal based frequent patterns,	8	
3	Unit 3: Mining Time series Data, Periodicity Analysis for time related sequence data, Trend analysis, Similarity search in Time-series analysis;	8	
4.	Unit 4: Mining Data Streams, Methodologies for stream data processing and stream data systems, Frequent pattern mining in stream data, Sequential Pattern Mining in Data Streams, Classification of dynamic data streams, Class Imbalance Problem; Graph Mining; Social Network Analysis;modulation for communication, filtering, feedback control systems.	11	

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Unit 5: Web Mining, Mining the web page layout structure, mining web link structure, mining multimedia data on the web, Automatic classification of web documents and web usage mining; Distributed Data Mining.	9	
Unit 6: Recent trends in Distributed Warehousing and Data Mining, Class Imbalance Problem; Graph Mining; Social Network Analysis	5	

Text book and Reference books:

1. Data Warehousing Fundamentals for IT Professionals, Second Edition by Paulraj Ponniah, Wiley India.
2. Data Warehousing, Data Mining, & OLAP – Second Edition by Alex Berson and Stephen J. Smith, Tata McGraw Hill Education
3. Data warehouse Toolkit by Ralph Kimball, Wiley India
4. Data Mining & Warehousing by Ikvinderpal Singh, Khanna Publishing House
5. Jiawei Han and M Kamber, Data Mining Concepts and Techniques,, Second Edition, Elsevier Publication, 2011.
6. Vipin Kumar, Introduction to Data Mining - Pang-Ning Tan, Michael Steinbach, Addison Wesley, 2006.
7. G Dong and J Pei, Sequence Data Mining, Springer, 2007.

Course Outcomes:

After completion of course, students would be:

1. Study of different sequential pattern algorithms
2. Study the technique to extract patterns from time series data and its application in real world.
3. Can extend the Graph mining algorithms to Web mining
4. Help in identifying the computing framework for Big Data

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Human Computer Interaction

Code:PEC-IT602C

Contact: 3L

Name of the Course:		Human Computer Interaction	
Course Code: PEC-IT602C		Semester: VI	
Duration: 6 months		Maximum Marks:100	
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance : 5 marks	
Practical: NIL		End Semester Exam :70 Marks	
Credit Points:		3	
Objective:			
1	Learn the foundations of Human Computer Interaction		
2	Be familiar with the design technologies for individuals and persons with disabilities		
3	Be aware of mobile Human Computer interaction		
4	Learn the guidelines for user interface.		
Pre-Requisite:			
1	Computer Organization &Architecture		

Unit	Content	Hrs/Unit	Marks/Unit
1	Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.	9	
2	Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.	11	
3.	Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.	8	

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4.	Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.	8	
5.	Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.	8	
6.	Recent Trends: Speech Recognition and Translation, Multimodal System	3	

Text book and Reference books:

1. Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security, Addison Wesley.

Course Outcomes:

On completion of the course students will be able to

1. Differentiate between various software vulnerabilities.
2. Software process vulnerabilities for an organization.
3. Monitor resources consumption in a software.
4. Interrelate security and software development process.

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Pattern Recognition

Code: PEC-IT602D

Contact: 3L

Name of the Course:	Pattern Recognition		
Course Code: PEC-IT602D	Semester: VI		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam:70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Basics of pattern recognition	2	
2	Bayesian decision theory 8L Classifiers, Discriminant functions, Decision surfaces Normal density and discriminant functions Discrete features	8	
3	Parameter estimation methods 6L Maximum-Likelihood estimation Gaussian mixture models Expectation-maximization method Bayesian estimation	6	
4.	Hidden Markov models for sequential pattern classification 8L Discrete hidden Markov models Continuous density hidden Markov models	8	
5	Dimension reduction methods 3L 5.1. Fisher discriminant analysis 5.2 Principal component analysis. Parzen-window method K-Nearest Neighbour method	3	
6	Non-parametric techniques for density estimation	2	

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7	Linear discriminant function based classifier 5L Perceptron Support vector machines	5	
8	Non-metric methods for pattern classification 4L Non-numeric data or nominal data Decision trees	4	
9	Unsupervised learning and clustering 2L Criterion functions for clustering Algorithms for clustering: K-means, Hierarchical and other methods	2	

Text book and Reference books:

1. R. O. Duda, P. E. Hart and D. G. Stork: Pattern Classification, John Wiley, 2001.
2. S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.
3. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

Numerical Methods

Code: OEC-IT601A

Contact: 3L

Name of the Course:	Numerical Methods		
Course Code: OEC-IT601A	Semester: VI		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam:70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors.	2	
2	Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation.	8	

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3	Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.	3	
4.	Numerical solution of a system of linear equations: Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method.	8	
5	Numerical solution of Algebraic equation: Bisection method, Regula-Falsi method, Newton-Raphson method.	3	
6	Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method.	2	

Text book and Reference books:

1. R.S. Salaria: Computer Oriented Numerical Methods, Khanna Publishing House
2. C.Xavier: C Language and Numerical Methods.
3. Dutta & Jana: Introductory Numerical Analysis.
4. J.B.Scarborough: Numerical Mathematical Analysis.
5. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).
6. Balagurusamy: Numerical Methods, Scitech.
7. Baburam: Numerical Methods, Pearson Education.
8. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.

Human Resource Development and Organizational Behavior

Code: OEC-IT601 B

Contact: 3L

Name of the Course:	Human Resource Development and Organizational Behavior		
Course Code: OEC-IT601 B	Semester: VI		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam:70 Marks	
Credit Points:	3		

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Unit	Content	Hrs/Unit	Marks/Unit
1	Organizational Behaviour: Definition, Importance, Historical Background, Fundamental Concepts of OB, Challenges and Opportunities for OB. [2] Personality and Attitudes: Meaning of personality, Personality Determinants and Traits, Development of Personality, Types of Attitudes, Job Satisfaction.	4	
2	Perception: Definition, Nature and Importance, Factors influencing Perception, Perceptual Selectivity, Link between Perception and Decision Making. [2] 4. Motivation: Definition, Theories of Motivation - Maslow's Hierarchy of Needs Theory, McGregor's Theory X & Y, Herzberg's Motivation-Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory.	8	
3	Group Behaviour: Characteristics of Group, Types of Groups, Stages of Group Development, Group Decision Making. [2] Communication: Communication Process, Direction of Communication, Barriers to Effective Communication. [2] Leadership: Definition, Importance, Theories of Leadership Styles.	4	
4.	Organizational Politics: Definition, Factors contributing to Political Behaviour. [2] Conflict Management: Traditional vis-a-vis Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation – Bargaining Strategies, Negotiation Process. [2] Organizational Design: Various Organizational Structures and their Effects on Human Behaviour, Concepts of Organizational Climate and Organizational Culture.	8	

Text book and Reference books:

1. Robbins, S. P. & Judge, T.A.: Organizational Behavior, Pearson Education, 15th Edn.
2. Luthans, Fred: Organizational Behavior, McGraw Hill, 12th Edn.

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3. Shukla, Madhukar: Understanding Organizations – Organizational Theory & Practice in India, PHI
4. Fincham, R. & Rhodes, P.: Principles of Organizational Behaviour, OUP, 4th Edn.
5. Hersey, P., Blanchard, K.H., Johnson, D.E.- Management of Organizational Behavior Leading Human Resources, PHI, 10th Edn.

Research Methodology

Code: PROJ- CS601

Contact: 3L

Name of the Course:	Research Methodology	
Course Code: PROJ- CS601	Semester: VI	
Duration:6 months	Maximum Marks:100	
Teaching Scheme		Examination Scheme
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	RESEARCH FORMULATION AND DESIGN Motivation and objectives – Research methods vs. Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, concept of applied and basic research process, criteria of good research. Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review-primary and secondary sources, reviews, monograph, patents, research databases, web as a source, searching the web, critical literature review, identifying gap areas from literature and research database, development of working hypothesis.	9	
2	DATA COLLECTION AND ANALYSIS Accepts of method validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies and tools,data analysis with statically package (Sigma	9	

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	STAT,SPSS for student t-test, ANOVA, etc.), hypothesis testing.		
3	RESEARCH ETHICS, IPR AND SCHOLARY PUBLISHING Ethics-ethical issues, ethical committees (human & animal); IPR- intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS); scholarly publishing- IMRAD concept and design of research paper, citation and acknowledgement, plagiarism, reproducibility and accountability.	9	
4.	INTERPRETATION AND REPORT WRITING Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Project Report, Layout of the Project/Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Project/Research Report, Precautions for Writing Research Reports, Conclusions.	9	

Text book and Reference books:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
3. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
4. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
5. Wadehra, B.L. 2000. Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.

Additional reading

1. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
2. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.
3. Coley, S.M. and Scheinberg, C. A., 1990, "Proposal Writing", Sage Publications.
4. Day, R.A., 1992. How to Write and Publish a Scientific Paper, Cambridge University Press.
5. Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage

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Publications

6. Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall.
7. Satarkar, S.V., 2000. Intellectual property rights and Copy right. Ess Ess Publications.

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PRACTICAL SYLLABUS

Database Management System Lab

Code: PCC-CS691

Contacts: 4P

Name of the Course:	Database Management System Lab
Course Code: PCC-CS691	Semester: VI
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2

Laboratory Experiments:

Structured Query Language

1. Creating Database

- ☐ Creating a Database
- ☐ Creating a Table
- ☐ Specifying Relational Data Types
- ☐ Specifying Constraints
- ☐ Creating Indexes

2. Table and Record Handling

- ☐ INSERT statement
- ☐ Using SELECT and INSERT together
- ☐ DELETE, UPDATE, TRUNCATE statements
- ☐ DROP, ALTER statements

3. Retrieving Data from a Database

1. The SELECT statement
2. Using the WHERE clause
3. Using Logical Operators in the WHERE clause
4. Using IN, BETWEEN, LIKE, ORDER BY, GROUP BY and HAVING

Clause

5. Using Aggregate Functions
6. Combining Tables Using JOINS
7. Subqueries

4. Database Management

- Creating Views
- Creating Column Aliases
- Creating Database Users
- Using GRANT and REVOKE

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Cursors in Oracle PL / SQL Writing Oracle PL / SQL Stored Procedures

Any experiment specially designed by the college
 (Detailed instructions for Laboratory Manual to be followed for further guidance)

Computer Networks Lab
Code: PCC-CS692
Contacts: 4P

Name of the Course:	Computer Networks Lab
Course Code: PCC-CS692	Semester: VI
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2

Laboratory Experiments:

- | |
|---|
| 1) NIC Installation & Configuration (Windows/Linux)
2) Understanding IP address, subnet etc
Familiarization with <ul style="list-style-type: none"> • Networking cables (CAT5, UTP) • Connectors (RJ45, T-connector) • Hubs, Switches 3) TCP/UDP Socket Programming <ul style="list-style-type: none"> • Simple, TCP based, UDP based • Multicast & Broadcast Sockets • Implementation of a Prototype Multithreaded Server 4) Implementation of <ul style="list-style-type: none"> <input type="checkbox"/> <input type="checkbox"/> Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window) <input type="checkbox"/> <input type="checkbox"/> Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check) <input type="checkbox"/> <input type="checkbox"/> Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N) 5) Server Setup/Configuration
FTP, TelNet, NFS, DNS, Firewall |
|---|

Any experiment specially designed by the college
 (Detailed instructions for Laboratory Manual to be followed for further guidance)

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SEMESTER – VII

Quantum Computing

Code: PEC-CS701A

Contacts: 3L

Name of the Course:		Quantum Computing	
Course Code: PEC-CS701A		Semester: VII	
Duration: 6 months		Maximum Marks:100	
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance : 5 marks	
Practical: NIL		End Semester Exam :70 Marks	
Credit Points:		3	
Objective:			
1	The course will provide an insight of basic of quantum physics from a computer scientist's perspective, and how it describes reality and understand the philosophical implications of quantum computing		
Pre-Requisite:			
1	Linear Algebra, Theory of Computation		

Unit	Content	Hrs/Unit	Marks/Unit
1	Qubit & Quantum States: The Qubit, Vector Spaces. Linear Combination Of Vectors, Uniqueness of a spanning set, basis & dimensions, inner Products, orthonormality, gram-schmidt orthogonalization, bra-ket formalism, the Cauchy-Schwarz and triangle Inequalities.	3	
2	Matrices & Operators: Observables, The Pauli Operators, Outer Products, The Closure Relation, Representation of operators using matrices, outer products & matrix representation, matrix representation of operators in two dimensional spaces, Pauli Matrix, Hermitian unitary and normal operator, Eigen values & Eigen Vectors, Spectral Decomposition, Trace of an operator, important properties of Trace, Expectation Value of Operator, Projection Operator, Positive Operators,	10	
3.	Commutator Algebra, Heisenberg uncertainty principle, polar decomposition & singular values, Postulates of Quantum Mechanics.	5	
4.	Tensor Products: Representing Composite States in Quantum Mechanics, Computing inner products, Tensor products of	5	

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	column vectors, operators and tensor products of Matrices. Density Operator: Density Operator of Pure & Mix state, Key Properties, Characterizing Mixed State, Practical Trace & Reduce Density Operator, Density Operator & Bloch Vector.		
5.	Quantum Measurement Theory: Distinguishing Quantum states & Measures, Projective Measurements, Measurement on Composite systems, Generalized Measurements, Positive Operator- Valued Measures.	8	
6.	Recent trends in Quantum Computing Research, Quantum Computing Applications of Genetic Programming.	6	

Text book and Reference books:

- Quantum Computing without Magic by Zdzislaw Meglicki
 2. Quantum Computing Explained By DAVID Mc MAHON
 3. Quantum Computer Science By Marco Lanzagorta, Jeffrey Uhlmann
 4. An Introduction to Quantum Computing Phillip Kaye, Raymond Laflamme, Michele Mosca.

Course Outcomes:

On completion of the course students will be able to
 knowledge of Vector spaces, Matrices, Quantum state, Density operator and Quantum

Cloud Computing

Code: PEC-CS701B

Contact: 3L

Name of the Course:	Cloud Computing		
Course Code: PEC-CS701B	Semester: VII		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical:		End Semester Exam: 70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	<u>Definition of Cloud Computing and its Basics (Lectures)</u> . Defining a Cloud, Cloud Types – NIST model, Cloud Cube	9	

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	<p>model, Deployment models (Public , Private, Hybrid and Community Clouds), Service Platform as a Service, Software as a Service with examples of services/ service providers, models – Infrastructure as a Service, Cloud Reference model, Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing, A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients, IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos PaaS – Basic concept, tools and development environment with examples</p> <p>SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS)</p> <p>Compliance as a Service (CaaS)</p>		
2	<p>Use of Platforms in Cloud Computing</p> <p>Concepts of Abstraction and Virtualization</p> <p>Virtualization technologies : Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D) Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Advanced load balancing (including Application Delivery Controller and Application Delivery Network), Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine Imaging (including mention of Open Virtualization Format – OVF)</p> <p>Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance, Concepts of Platform as a Service, Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development</p> <p>Use of PaaS Application frameworks,</p>	12	

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	<p>Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service., Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service, Windows Azure platform: Microsoft’s approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services,</p>		
3	<p><u>Cloud Infrastructure:</u> Cloud Management: An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle). Concepts of Cloud Security: Cloud security concerns, Security boundary, Security service boundary Overview of security mapping Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management (awareness of Identity protocol standards)</p>	7	
4.	<p><u>Concepts of Services and Applications :</u></p> <p>Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs, Applications in the Cloud: Concepts of cloud transactions, functionality mapping,</p>	8	

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	Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs Cloud-based Storage: Cloud storage definition – Manned and Unmanned Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services		
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Text book and Reference books:

1. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013
2. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education (India) Private Limited, 2013
3. Cloud computing: A practical approach, Anthony T. Velte, Tata Mcgraw-Hill
4. Cloud Computing, Miller, Pearson
5. Building applications in cloud: Concept, Patterns and Projects, Moyer, Pearson
6. Cloud Computing – Second Edition by Dr. Kumar Saurabh, Wiley India

Digital Signal Processing
Code: PEC-CS701C
Contacts: 3L

Name of the Course:	Digital Signal Processing		
Course Code: PEC-CS701C	Semester: VII		
Duration:6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz : 10 marks	
		Attendance: 5 marks	
Practical:		End Semester Exam: 70 Marks	
Credit Points:	3		

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Unit	Content	Hrs/Unit	Marks/Unit
1	Module 1: Discrete-time signals and systems (6 hours) Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.	6	
2	Module 2: Z-transform (6 hours) z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z transform, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.	6	
3	Module 2: Discrete Fourier Transform (10 hours) Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform Algorithm, Parseval's Identity, Implementation of Discrete Time Systems.	10	
4.	Module 3: Design of Digital filters (12 hours) Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Band stop and High-pass filters. Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multi-rate signal processing.	12	
	Module 4: Applications of Digital Signal Processing (6 hours) Correlation Functions and Power Spectra, Stationary Processes, Optimal filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter.	6	

Text book and Reference books:

1. S. K. Mitra, "Digital Signal Processing: A computer based approach", McGraw Hill, 2011.
2. A.V. Oppenheim and R. W. Schaffer, "Discrete Time Signal Processing", Prentice Hall, 1989.
3. J. G. Proakis and D.G. Manolakis, "Digital Signal Processing: Principles, Algorithms And Applications", Prentice Hall, 1997.
4. L. R. Rabiner and B. Gold, "Theory and Application of Digital Signal Processing", Prentice Hall, 1992.
5. J. R. Johnson, "Introduction to Digital Signal Processing", Prentice Hall, 1992.
6. D. J. DeFatta, J. G. Lucas and W. S. Hodgkiss, "Digital Signal Processing", John Wiley & Sons, 1988.

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Multi-agent Intelligent Systems

Code: PEC-CS701D

Contacts: 3L

Name of the Course:	Multi-agent Intelligent Systems
Course Code: PEC-CS701D	Semester: VII
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz : 10 marks
	Attendance: 5 marks
Practical:	End Semester Exam: 70 Marks
Credit Points:	3

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: what is an agent?: agents and objects; agents and expert systems; agents and distributed systems; typical application areas for agent systems.	3	
2	Intelligent Agents: the design of intelligent agents - reasoning agents (eg AgentO), agents as reactive systems (eg subsumption architecture); hybrid agents (eg PRS); layered agents (eg Interrap) a contemporary (Java-based) framework for programming agents (eg the Jack language, the JAM! system).	9	
3	Multi-Agent Systems: Classifying multi-agent interactions - cooperative versus non-cooperative; zero-sum and other interactions; what is cooperation? how cooperation occurs - the Prisoner's dilemma and Axelrod's experiments; Interactions between self-interested agents: auctions & voting systems: negotiation; Interactions between benevolent agents: cooperative distributed problem solving (CDPS), partial global planning; coherence and coordination; Interaction languages and protocols: speech acts, KQML/KIF, the FIPA framework.	12	
4.	Advanced topics: One issue selected from the contemporary research literature, perhaps by guest lecturer.	9	

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Text book and Reference books:

1. An Introduction to Multi Agent Systems - Second Edition. Michael Wooldridge (Wiley, 2009)
2. Programming Multi-agent Systems in Agent Speak Using Jason. Rafael H. Bordini, Jomi Fred Hubner and Michael Wooldridge (Wiley, 2007)

Machine Learning
Code: PEC-CS701E
Contacts: 3L

Name of the Course:	Machine Learning
Course Code: PEC-CS701D	Semester: VII
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: Nil	End Semester Exam: 70 Marks
Credit Points:	3

COURSE OBJECTIVE

- ☐ To learn the concept of how to learn patterns and concepts from data without being explicitly programmed
- ☐ To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
- ☐ Explore supervised and unsupervised learning paradigms of machine learning.
- ☐ To explore Deep learning technique and various feature extraction strategies.

	Hrs/unit	Marks/unit
Unit 1: Supervised Learning (Regression/Classification) <ul style="list-style-type: none"> <input type="checkbox"/> Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes <input type="checkbox"/> Linear models: Linear Regression, Logistic Regression, Generalized Linear Models <input type="checkbox"/> Support Vector Machines, Nonlinearity and Kernel Methods <input type="checkbox"/> Beyond Binary Classification: Multi-class/Structured Outputs, Ranking 	10	

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Unit 2: Unsupervised Learning <ul style="list-style-type: none"> <input type="checkbox"/> Clustering: K-means/Kernel K-means <input type="checkbox"/> Dimensionality Reduction: PCA and kernel PCA <input type="checkbox"/> Matrix Factorization and Matrix Completion <input type="checkbox"/> Generative Models (mixture models and latent factor models) 	7	
Unit 3 Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)	6	
Unit 4 Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning	9	
Unit 5 Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference	9	
Unit 6: Recent trends in various learning techniques of machine learning and classification methods	5	

References:

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007
4. Dr. Rajiv Chopra, Machine Learning, Khanna Publishing House, 2018

Neural Networks and Deep Learning

Code: PEC-CS702A

Contacts: 3L

Name of the Course:	Neural Networks and Deep Learning	
Course Code: PEC-CS702A	Semester: VII	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		Examination Scheme
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz : 10 marks
		Attendance: 5 marks
Practical:		End Semester Exam: 70 Marks
Credit Points:	3	

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Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Various paradigms of learning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques.	3	
2	Feed forward neural network: Artificial Neural Network, activation function, multi-layer neural network, cardinality, operations, and properties of fuzzy relations.	6	
3	Training Neural Network: Risk minimization, loss function, backpropagation, regularization, model selection, and optimization.	6	
4.	Conditional Random Fields: Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy.	9	
5	Deep Learning: Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Recurrent Neural Network, Deep Belief Network.	6	
6	Deep Learning research: Object recognition, sparse coding, computer vision, natural language	6	

Text book and Reference books:

1. Goodfellow, I., Bengio, Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.
3. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
4. Golub, G.,H., and Van Loan, C.,F., Matrix Computations, JHU Press, 2013.
5. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.
6. Dr. Rajiv Chopra, Deep Learning, Khanna Publishing House, New Delhi (AICTE Recommended Textbook – 2018)

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Soft Computing
Code: PEC-CS702B
Contacts: 3L

Name of the Course:	Soft Computing		
Course Code: PEC- CS702B	Semester: VII		
Duration:6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz : 10 marks	
		Attendance: 5 marks	
Practical:		End Semester Exam: 70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Introduction to soft computing; introduction to fuzzy sets and fuzzy logic systems; introduction to biological and artificial neural network; introduction to Genetic Algorithm	8	
2	Fuzzy sets and Fuzzy logic systems: Classical Sets and Fuzzy Sets and Fuzzy relations : Operations on Classical sets, properties of classical sets, Fuzzy set operations, properties of fuzzy sets, cardinality, operations, and properties of fuzzy relations. Membership functions : Features of membership functions, standard forms and boundaries, different fuzzification methods. Fuzzy to Crisp conversions: Lambda Cuts for fuzzy sets, fuzzy Relations, Defuzzification methods. Classical Logic and Fuzzy Logic: Classical predicate logic, Fuzzy Logic, Approximate reasoning and Fuzzy Implication Fuzzy Rule based Systems: Linguistic Hedges, Fuzzy Rule based system – Aggregation of fuzzy Rules, Fuzzy Inference System- Mamdani Fuzzy Models – Sugeno Fuzzy Models. Applications of Fuzzy Logic: How Fuzzy Logic is applied in Home Appliances, General Fuzzy Logic controllers, Basic Medical Diagnostic systems and Weather forecasting	10	

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3	Neural Network Introduction to Neural Networks: Advent of Modern Neuroscience, Classical AI and Neural Networks, Biological Neurons and Artificial neural network; model of artificial neuron. Learning Methods : Hebbian, competitive, Boltzman etc., Neural Network models: Perceptron, Adaline and Madaline networks; single layer network; Back-propagation and multi layer networks. Competitive learning networks: Kohonen self organizing networks, Hebbian learning; Hopfield Networks. Neuro-Fuzzy modelling: Applications of Neural Networks: Pattern Recognition and classification	10	
4.	Genetic Algorithms: Simple GA, crossover and mutation, Multi-objective Genetic Algorithm (MOGA). Applications of Genetic Algorithm: genetic algorithms in search and optimization, GA based clustering Algorithm, Image processing and pattern Recognition	10	
5	PSO: Other Soft Computing techniques: Simulated Annealing, Tabu search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO).	4	

Text book and Reference books:

1. Fuzzy logic with engineering applications, Timothy J. Ross, John Wiley and Sons.
2. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI
3. Principles of Soft Computing , S N Sivanandam, S. Sumathi, John Wiley & Sons
4. Genetic Algorithms in search, Optimization & Machine Learning by David E. Goldberg
5. Neuro-Fuzzy and Soft computing, Jang, Sun, Mizutani, PHI
6. Neural Networks: A Classroom Approach, 1/e by Kumar Satish, TMH,
7. Genetic Algorithms in search, Optimization & Machine Learning by David E. Goldberg, Pearson/PHI
8. A beginners approach to Soft Computing, Samir Roy & Udit Chakraborty, Pearson
9. Fuzzy Sets and Fuzzy Logic: Theory and Applications, George J. Klir and Bo Yuan, Prentice Hall
10. Neural Networks: A Comprehensive Foundation (2nd Edition), Simon Haykin, Prentice Hall.

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Adhoc –Sensor Network

Code: PEC-CS702C

Contact: 3L

Name of the Course:	Adhoc –Sensor Network	
Course Code: PEC-CS702C	Semester: VII	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		Examination Scheme
Theory: 3 hrs		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: 4 hrs		End Semester Exam: 70 Marks
Credit Points:	3	
Objective:		
1	provide an overview about sensor networks and emerging technologies	
2	To study about the node and network architecture of sensor nodes and its execution environment.	
3	To understand the concepts of communication, MAC, routing protocols and also study about the naming and addressing in WSN	
4	To learn about topology control and clustering in networks with timing synchronization for localization services with sensor tasking and control. .	
5	To study about sensor node hardware and software platforms and understand the simulation and programming techniques..	

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction and Overview [4L] :Overview of wireless networks, types, infrastructure-based and infrastructure-less, introduction to MANETs (Mobile Ad-hoc Networks), characteristics, reactive and proactive routing protocols with examples, introduction to sensor networks, commonalities and differences with MANETs, constraints and challenges, advantages, applications, enabling technologies for WSNs.	4	
2	Architectures Single-node architecture - hardware components, design constraints, energy consumption of sensor nodes , operating systems and execution environments, examples of sensor nodes,	9	

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	sensor network scenarios, types of sources and sinks – single hop vs. multi hop networks, multiple sources and sinks – mobility, optimization goals and figures of merit, gateway concepts, design princip		
3	Communication Protocols [9L]: Physical layer and transceiver design considerations, MAC protocols for wireless sensor networks, low duty cycle protocols and wakeup concepts - S-MAC , the mediation device protocol, wakeup radio concepts, address and name management, assignment of MAC addresses, routing protocols-classification, gossiping, flooding, energy-efficient routing, unicast protocols, multi-path routing, data-centric routing, data aggregation, SPIN, LEACH, Directed-Diffusion, geographic routing.	9	
4.	Infrastructure Establishment: Topology control, flat network topologies, hierarchical networks by clustering, time synchronization, properties, protocols based on sender-receiver and receiver-receiver synchronization, LTS, TPSN, RBS, HRTS, localization and positioning, properties and approaches, single-hop localization, positioning in multi-hop environment, range based localization algorithms – location services, sensor tasking and control		
5	Sensor Network Platforms and Tools [9L]: Sensor node hardware, Berkeley motes, programming challenges, node-level software platforms, node-level simulators, state-centric programming, Tiny OS, nesC components, NS2 simulator, TOSSIM.		

Text book and Reference books:

1. Holger Karl & Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley, 2005.

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2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
3. REFERENCES
 1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007.
 2. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.
 3. Thomas Haenselmann, "Sensor Networks", available online for free, 2008.

Information Theory and Coding
Code: PEC-CS702D
Contact: 3L

Name of the Course:	Information Theory and Coding		
Course Code: PEC-CS702D	Semester: VII		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical:NIL		End Semester Exam: 70 Marks	
Credit Points:	3		
Objective:			
1	To develop an understanding of modern network architectures from a design and performance perspective.		
2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).		
3	To provide an opportunity to do network programming		
4	To provide a WLAN measurement ideas.		
Pre-Requisite:			
1			
2			
3			

Unit	Content	Hrs/Unit	Marks/Unit
1	Source Coding [7L] Uncertainty and information, average mutual information and entropy, information measures for continuous random variables, source coding	7	

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	theorem, Huffman codes		
2	Channel Capacity And Coding [7L] Channel models, channel capacity, channel coding, information capacity theorem, The Shannon limit	7	
3	Linear And Block Codes For Error Correction [8L] Matrix description of linear block codes, equivalent codes, parity check matrix, decoding of a linear block code, perfect codes, Hamming codes	8	
4.	Cyclic Codes [7L] Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Golay codes..	7	
5	BCH Codes [8L] Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, examples of BCH codes.	8	
6	Convolutional Codes [8L] Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding	8	

Text book and Reference books:

1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Information and Coding - N Abramson; McGraw Hill.
3. Introduction to Information Theory - M Mansurpur; McGraw Hill.
4. Information Theory - R B Ash; Prentice Hall.
5. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.

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Cyber Security
Code: PEC-CS702E
Contact: 3L

Name of the Course:	Cyber Security	
Course Code: PEC-CS702E	Semester: VII	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		Examination Scheme
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	3	
Objective:		
1	To develop an understanding of modern network architectures from a design and performance perspective.	
2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).	
3	To provide an opportunity to do network programming	
4	To provide a WLAN measurement ideas.	

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Introduction to Cyber Security, Importance and challenges in Cyber Security, Cyberspace, Cyber threats, Cyberwarfare, CIA Triad, Cyber Terrorism, Cyber Security of Critical Infrastructure, Cybersecurity - Organizational Implications.	6	
2	Hackers and Cyber Crimes: Types of Hackers, Hackers and Crackers, Cyber-Attacks and Vulnerabilities, Malware threats, Sniffing, Gaining Access, Escalating Privileges, Executing Applications, Hiding Files, Covering Tracks, Worms, Trojans, Viruses, Backdoors.	7	
3	Ethical Hacking and Social Engineering: Ethical Hacking Concepts and Scopes, Threats and Attack Vectors, Information Assurance, Threat Modelling, Enterprise Information Security Architecture, Vulnerability Assessment and Penetration Testing, Types of Social Engineering, Insider Attack, Preventing Insider Threats, Social Engineering Targets and Defence Strategies.	8	

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4.	Cyber Forensics and Auditing: Introduction to Cyber Forensics, Computer Equipment and associated storage media, Role of forensics Investigator, Forensics Investigation Process, Collecting Network based Evidence, Writing Computer Forensics Reports, Auditing, Plan an audit against a set of audit criteria, Information Security Management System Management. Introduction to ISO 27001:2013	10	
5	Cyber Ethics and Laws: Introduction to Cyber Laws, E-Commerce and E-Governance, Certifying Authority and Controller, Offences under IT Act, Computer Offences and its penalty under IT Act 2000, Intellectual Property Rights in Cyberspace. at Network Layer-IPSec.	5	

Text book and Reference books:

1. Cyber security , Nina Gobole & Sunit Belapune; Pub: Wiley India.
2. Information Security and Cyber Laws, Pankaj Agarwal
3. Donaldson, S., Siegel, S., Williams, C.K., Aslam, A., Enterprise Cybersecurity -How to Build a Successful Cyberdefense Program Against Advanced Threats, A-press
4. Nina Godbole, SumitBelapure, Cyber Security, Willey
5. Hacking the Hacker, Roger Grimes, Wiley
6. Cyber Law By Bare Act, Govt Of india, It Act 2000.
7. Information Security & Cyber Laws, Gupta & Gupta, Khanna Publishing House, (AICTE Recommended Textbook- 2018)

Operation Research

Code: OEC-CS701A

Contact: 3L

Name of the Course:	Operation Research
Course Code: OEC-CS701A	Semester: VII
Duration: 6 months	Maximum Marks: 100

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Teaching Scheme		Examination Scheme
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	Basic LPP and Applications; Various Components of LP Problem Formulation. Solution of Linear Programming Problems: Solution of LPP: Using Simultaneous Equations and Graphical Method; Definitions: Feasible Solution, Basic and non-basic Variables, Basic Feasible Solution, Degenerate and Non-degenerate Solution, Convex set and explanation with examples Solution of LPP by Simplex Method; Charnes' Big-M Method; Duality Theory. Transportation Problems and Assignment Problems.	17	
2	Network Analysis: Shortest Path: Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource Allocation excluded). Inventory Control: Introduction to EOQ Models of Deterministic and Probabilistic ; Safety Stock; Buffer Stock.	9	
3	Game Theory: Introduction; 2-Person Zero-sum Game; Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance	5	
4.	Queuing Theory: Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) and problems.	5	

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Text book and Reference books:

1. H. A. Taha, “Operations Research”, Pearson
2. P. M. Karak – “Linear Programming and Theory of Games”, ABS Publishing House
3. Ghosh and Chakraborty, “Linear Programming and Theory of Games”, Central Book Agency
4. Ravindran, Philips and Solberg - “Operations Research”, WILEY INDIA

Multimedia Technology

Code: OEC-CS701B

Contacts: 3L

Name of the Course:	Multimedia Technology	
Course Code: OEC-CS701B	Semester: VII	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		Examination Scheme
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance : 5 marks
Practical: Nil		End Semester Exam :70 Marks

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Multimedia today, Impact of Multimedia, Multimedia Systems, Components and Its Applications	2	
2	Text and Audio, Image and Video(14L) Text: Types of Text, Ways to Present Text, Aspects of Text Design, Character, Character Set, Codes, Unicode, Encryption; Audio: Basic Sound Concepts, Types of Sound, Digitizing Sound, Computer Representation of Sound (Sampling Rate, Sampling Size, Quantization), Audio Formats, Audio tools, MIDI Image: Formats, Image Color Scheme, Image Enhancement; Video: Analogue and Digital Video, Recording Formats and Standards (JPEG, MPEG, H.261) Transmission of Video Signals, Video Capture, and	14	

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	Computer based Animation.		
3.	Synchronization, Storage models and Access Techniques: Temporal relationships, synchronization accuracy specification factors, quality of service, Magnetic media, optical media, file systems (traditional, multimedia) Multimedia devices – Output devices, CD-ROM, DVD, Scanner, CCD	8	
4.	Image and Video Database, Document Architecture and Content Management (17L): Image representation, segmentation, similarity based retrieval, image retrieval by color, shape and texture; indexing- k-d trees, R-trees, quad trees; Case studies- QBIC, Virage. Video Content, querying, video segmentation, indexing, Content Design and Development, General Design Principles Hypertext: Concept, Open Document Architecture (ODA), Multimedia and Hypermedia Coding Expert Group (MHEG), Standard Generalized Markup Language (SGML), Document Type Definition (DTD), Hypertext Markup Language (HTML) in Web Publishing. Case study of Applications	17	
5.	Multimedia Applications(4L): Interactive television, Video-on-demand, Video Conferencing, Educational Applications, Industrial Applications, Multimedia archives and digital libraries, media editors	4	

Text book and Reference books:

1. Ralf Steinmetz and Klara Nahrstedt , Multimedia: Computing, Communications & Applications , Pearson Ed.
2. Nalin K. Sharda , Multimedia Information System , PHI.
3. Fred Halsall , Multimedia Communications , Pearson Ed.
4. Koegel Buford , Multimedia Systems , Pearson Ed.
5. Fred Hoffstetter , Multimedia Literacy , McGraw Hill.
6. Ralf Steinmetz and Klara Nahrstedt , Multimedia Fundamentals: Vol. 1- Media Coding and Content Processing , PHI.
7. J. Jeffcoate , Multimedia in Practice: Technology and Application , PHI.
8. V.K. Jain, Multimedia and Animation, Khanna Publishing House, New Delhi (AICTE Recommended Textbook – 2018)

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Introduction to Philosophical Thoughts

Code: OEC-CS701C

Contact: 3L

Name of the Course:	Introduction to Philosophical Thoughts	
Course Code: OEC-CS701C	Semester: VII	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		Examination Scheme
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	Nature of Indian Philosophy : Plurality as well as common concerns. 2. Basic concepts of the Vedic and Upanisadic views : Atman, Jagrata, Svapna, Susupti, Turiya, Brahman, Karma, Rta,Rna,	17	
2	Carvaka school : its epistemology, metaphysics and ethics. Mukti	9	
3	Jainism : Concepts of sat, dravya, guna, paryaya, jiva, ajiva, anekantavada, syadvada, and nayavada ; pramanas, ahimsa, bondage and liberation.		
4	5. Buddhism : theory of pramanas, theory of dependent origination, the four noble truths; doctrine of momentaryness; theory of no soul. The interpretation of these theories in schools of Buddhism : Vaibhasika, Sautrantrika, Yogacara, Madhyamika.	5	
5	6. Nyaya : theory of Pramanas; the individual self and its liberation ; the idea of God and proofs for His existence.	5	

Text book and Reference books:

1. M. Hiriyanna : Outlines of Indian Philosophy.

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2. C.D.Sharma : A Critical Survey of Indian Philosophy.
 3. S.N.Das Gupta : A History of Indian Philosophy Vol – I to V.
 4. S.Radhakrishnan : Indian Philosophy Vol – I & II.
 5. T.R.V.Murti : Central Philosophy of Buddhism.
 6. J.N.Mahanty : Reason and Tradition of Indian Thought.
 7. R.D.Ranade : A Constructive Survey of Upanisadic Philosophy.
 8. P.T.Raju : Structural Depths of Indian Thought.
 9. K.C.Bhattacharya : Studies in Philosophy Vol – 1.
 10. Datta and Chatterjee : Introduction of Indian Philosophy
-

Project Management and Entrepreneurship

Code: HSMC 701

Contact: 2L+1T

Name of the Course:	Project Management and Entrepreneurship
Course Code: HSMC 701	Semester: VII
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: 1hr	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam: 70 Marks
Credit Points:	3

ENTREPRENEURSHIP

1. Introduction: Meaning and Concept of Entrepreneurship, Innovation and entrepreneurship, Contributions of entrepreneurs to the society, risk-opportunities perspective and mitigation of risks [2L]
2. Entrepreneurship – An Innovation: Challenges of Innovation, Steps of Innovation Management, Idea Management System, Divergent v/s Convergent Thinking, Qualities of a prospective Entrepreneur [2L]
3. Idea Incubation: Factors determining competitive advantage, Market segment, blue ocean strategy, Industry and Competitor Analysis (market structure, market size, growth potential), Demand-supply analysis [4L]
4. Entrepreneurial Motivation: Design Thinking - Driven Innovation, TRIZ (Theory of Inventive Problem Solving), Achievement motivation theory of entrepreneurship – Theory of McClelland, Harvesting Strategies [2L]
5. Information: Government incentives for entrepreneurship, Incubation, acceleration. Funding new ventures – bootstrapping, crowd sourcing, angel investors, Government of India's efforts at promoting entrepreneurship and innovation – SISI, KVIC, DGFT, SIDBI, Defense and Railways [4L]
6. Closing the Window: Sustaining Competitiveness, Maintaining Competitive Advantage, the Changing Role of the Entrepreneur. [2L]

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7. Applications and Project Reports Preparation [4L]
8. PROJECT MANAGEMENT : Definitions of Project and Project Management, Issues and Problems in Project Management, Project Life Cycle - Initiation / Conceptualization Phase, Planning Phase, Implementation / Execution Phase, Closure / Termination Phase [4L]
9. Project Feasibility Studies – Pre-Feasibility and Feasibility Studies, Preparation of Detailed Project Report, Technical Appraisal, Economic/Commercial/Financial Appraisal including Capital Budgeting Process, Social Cost Benefit Analysis [2L]
10. Project Planning – Importance of Project Planning, Steps of Project Planning, Project Scope, Work Breakdown Structure (WBS) and Organization Breakdown Structure (OBS), Phased Project Planning [2L]
11. Project Scheduling and Costing – Gantt chart, CPM and PERT Analysis, Identification of the Critical Path and its Significance, Calculation of Floats and Slacks, Crashing, Time Cost Trade-off Analysis, Project Cost Reduction Methods. [6L]
12. Project Monitoring and Control – Role of Project Manager, MIS in Project Monitoring, Project Audit [2L]
13. Case Studies with Hands-on Training on MS-Project [4L]

Text Books and References

1. Innovation and Entrepreneurship by Drucker, P.F.; Harper and Row
2. Business, Entrepreneurship and Management: Rao, V.S.P. ;Vikas
3. Entrepreneurship: Roy Rajeev; OUP.
4. Text Book of Project Management: Gopalkrishnan, P. and Ramamoorthy, V.E.; McMillan
5. Project Management for Engineering, Business and Technology: Nicholas, J.M., and Steyn, H.; PHI
6. Project Management: The Managerial Process: Gray, C.F., Larson, E.W. and Desai, G.V.; MGH

Project-II

Code: PROJ-IT781

Contact: 12P

Project work I

The object of Project Work I is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

Project Work II & Dissertation

The object of Project Work II & Dissertation is to enable the student to extend

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further the investigative study taken up under EC P1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned in the light of the Report prepared under EC P1;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar Presentation before a Departmental Committee.

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SEMESTER – VIII

Signal and Networks

Code: PEC-CS801A

Contact: 3L

Name of the Course:	Signal and Networks		
Course Code: PEC-CS801A	Semester: VIII		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam : 70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Objective and overview, signal and system types and classifications, step response, impulse response and convolution integral;	3	
2	Periodic signal analysis: Fourier series and properties; Aperiodic signal analysis : Fourier Transform - its properties and sinusoidal steady state analysis of systems;	7	
3	Elements of electrical network : dependent and independent sources, active and passive components; classical differential equations for description of transient conditions of Network; Solutions of linear time invariant networks with initial conditions; Unilateral and Bilateral Laplace Transforms and properties; Transient solutions of networks using Laplace Transform; Network functions: poles, zeros, transfer function, Bode plot;	12	
4.	One and two port network parameters and functions : Z, Y and ABCD parameters, driving point and transfer impedances and admittances; Network Theorems and Formulation of Network equations: generalized formulation of KCL, KVL, State Variable descriptions; Thevenin, Norton, Maximum Power Transfer, Tellegen and	10	

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	Reciprocity Theorems;		
5	Graph theory: Tree, Co-tree, fundamental cut-set, fundamental loop analysis of network; Analog filter design: Butterworth, Sallen Key, frequency transformation and scaling;	6	

Text book and Reference books:

1. Signals and Systems by P. Ramesh Babu & R. Ananda Natarajan, Scitech Publications (India) .
2. Signals & Systems by A. V. Oppenheim, A. S. Willsky and S. H. Nawab, Prentice-Hall India .
3. Networks & Systems by D Roy Choudhury .
4. Networks & Systems by Asfhaq Husain.

Cryptography and Network Security

Code: PEC-CS801B

Contact: 3L

Name of the Course:	Cryptography and Network Security		
Course Code: PEC-CS801B	Semester: VIII		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam : 70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Attacks on Computers & Computer Security - Introduction, Need for Security, Security approaches, Principles of Security, Types of attack	5	
2	Cryptography: Concepts & Techniques- Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, Symmetric & Asymmetric key Cryptography, Key Range & Key Size	7	

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3	Symmetric Key Algorithm - Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES(Data Encryption Standard) algorithm, IDEA(International Data Encryption Algorithm) algorithm, RC5(Rivest Cipher 5) algorithm.	8	
4.	Asymmetric Key Algorithm, Digital Signature and RSA - Introduction, Overview of Asymmetric key Cryptography, RSA algorithm, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required).	5	
5	Internet Security Protocols, User Authentication - Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication.	6	
6	Electronic Mail Security - Basics of mail security, Pretty Good Privacy, S/MIME.	4	
7	Firewall - Introduction, Types of firewall, Firewall Configurations, DMZ Network	3	

Text book and Reference books:

1. "Cryptography and Network Security", William Stallings, 2nd Edition, Pearson Education Asia
2. "Cryptography and Network Security" by V.K. Jain, Khanna Publishing House,
3. "Network Security private communication in a public world", C. Kaufman, R. Perlman and M. Speciner, Pearson
4. Cryptography & Network Security: Atul Kahate, TMH.
5. "Network Security Essentials: Applications and Standards" by William Stallings, Pearson.
6. "Designing Network Security", Merike Kaeo, 2nd Edition, Pearson Books
7. "Building Internet Firewalls", Elizabeth D. Zwicky, Simon Cooper, D. Brent Chapman, 2nd Edition, Oreilly .
8. "Practical Unix & Internet Security", Simson Garfinkel, Gene Spafford, Alan Schwartz, 3rd Edition, Oreilly

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Natural Language Processing

Code: PEC-CS801C

Contacts: 3L

Name of the Course:	Natural Language Processing
Course Code: PEC-CS801C	Semester: VIII
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance : 5 marks
Practical: NIL	End Semester Exam : 70 Marks
Credit Points:	3

Unit	Content	Hrs/Unit	Marks/Unit
1	Regular Expressions and Automata (Recap) - Introduction to NLP, Regular Expression, Finite State Automata [2L] Tokenization - Word Tokenization, Normalization, Sentence Segmentation, Named Entity Recognition, Multi Word Extraction, Spell Checking – Bayesian Approach, Minimum Edit Distance [5L] Morphology - Morphology – Inflectional and Derivational Morphology, Finite State Morphological Parsing, The Lexicon and Morphotactics, Morphological Parsing with Finite State Transducers, Orthographic Rules and Finite State Transducers, Porter Stemmer [4L]	11	
2	Language Modeling Introduction to N-grams, Chain Rule, Smoothing – Add-One Smoothing, Witten-Bell Discounting; Backoff, Deleted Interpolation, N-grams for Spelling and Word Prediction, Evaluation of language models. [4L] Hidden Markov Models and POS Tagging Markov Chain, Hidden Markov Models, Forward Algorithm, Viterbi Algorithm, Part of Speech Tagging – Rule based and Machine Learning based approaches, Evaluation. [4L]	8	
3	Text Classification Text Classification, Naïve Bayes' Text Classification, Evaluation, Sentiment Analysis – Opinion Mining and Emotion Analysis, Resources and Techniques. [4L] Context Free Grammar Context Free Grammar and Constituency, Some common CFG phenomena for	9	

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	English, Top-Down and Bottom-up parsing, Probabilistic Context Free Grammar, Dependency Parsing [4L]		
4.	Computational Lexical Semantics Introduction to Lexical Semantics – Homonymy, Polysemy, Synonymy, Thesaurus – WordNet, Computational Lexical Semantics – Thesaurus based and Distributional Word Similarity [4L] Information Retrieval Boolean Retrieval, Term-document incidence, The Inverted Index, Query Optimization, Phrase Queries, Ranked Retrieval – Term Frequency – Inverse Document Frequency based ranking, Zone Indexing, Query term proximity, Cosine ranking, Combining different features for ranking, Search Engine Evaluation, Relevance Feedback [5L]	9	

Text book and Reference books:

1. Speech and Language Processing, Jurafsky and Martin, Pearson Education
2. Foundation of Statistical Natural Language Processing, Manning and Schutze, MIT Press
3. Multilingual Natural Language Processing Applications from Theory to Practice: Bikel, Pearson.

Web and Internet Technology

Code: PEC-CS801D

Contacts: 3L

Name of the Course:	Web and Internet Technology		
Course Code: PEC-CS801D	Semester: VIII		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance : 5 marks	
Practical:NIL		End Semester Exam :70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction (1L): Overview, Network of Networks, Intranet, Extranet	6	

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	and Internet. World Wide Web (1L): Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. Review of TCP/IP (1L): Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6. IP Subnetting and addressing (1L): Classful and Classless Addressing, Subnetting. NAT, IP masquerading, IP tables. Internet Routing Protocol (1L): Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast. Electronic Mail (1L): POP3, SMTP.		
2	HTML (3L): Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Colorname, Colorvalue. Image Maps (1L): map, area, attributes of image area. Extensible Markup Language (XML) (4L): Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief. CGI Scripts (1L): Introduction, Environment Variable, GET and POST Methods.	9	
3	PERL (3L): Introduction, Variable, Condition, Loop, Array, Implementing data structure, Hash, String, Regular Expression, File handling, I/O handling. JavaScript (4L): Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array, Boolean, reg-ex. Function, Errors, Validation. Cookies (1L): Definition of cookies, Create and Store a cookie with example. Java Applets (2L): Container Class, Components, Applet Life Cycle, Update method; Parameter passing applet, Applications.	10	
	Client-Server programming In Java (2L):		

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4.	Java Socket, Java RMI. Threats (1L): Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks. Network security techniques (2L): Password and Authentication; VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH). Firewall (1L): Introduction, Packet filtering, Stateful, Application layer, Proxy.	4	
	Internet Telephony (1L): Introduction, VoIP. Multimedia Applications (2L): Multimedia over IP: RSVP, RTP, RTCP and RTSP. Streaming media, Codec and Plugins, IPTV. Search Engine and Web Crawler (2L): Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.	5	

Text book and Reference books:

1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013. (Chapters 1-5,7,8,9).
2. Internetworking Technologies, An Engineering Perspective, Rahul Banerjee, PHI Learning, Delhi, 2011. (Chapters 5,6,12)

Internet of Things
Code: PEC-CS801E
Contacts: 3L

Course Code	PEC-CS801 E
Course Name	Internet of Things
Credits	3
Pre-Requisites	Wireless Networks

Total Number of Lectures: 48

COURSE OBJECTIVE
<input type="checkbox"/> Able to understand the application areas of IOT

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<input type="checkbox"/> Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
<input type="checkbox"/> Able to understand building blocks of Internet of Things and characteristics

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: Environmental Parameters Measurement and Monitoring: Why measurement and monitoring are important, effects of adverse parameters for the living being for IOT	7
Unit 2: Sensors: Working Principles: Different types; Selection of Sensors for Practical Applications Introduction of Different Types of Sensors such as Capacitive, Resistive, Surface Acoustic Wave for Temperature, Pressure, Humidity, Toxic Gas etc	8
Unit 3: Important Characteristics of Sensors: Determination of the Characteristics Fractional order element: Constant Phase Impedance for sensing applications such as humidity, water quality, milk quality Impedance Spectroscopy: Equivalent circuit of Sensors and Modelling of Sensors Importance and Adoption of Smart Sensors	11
Unit 4: Architecture of Smart Sensors: Important components, their features Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol-gel	10
Unit 5: Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor, Usefulness of Silicon Technology in Smart Sensor And Future scope of research in smart sensor	7
Unit 6: Recent trends in smart sensor for day to day life, evolving sensors and their architecture.	5

COURSE OUTCOMES
On completion of the course the student should be able to
<input type="checkbox"/> Understand the vision of IoT from a global context.
<input type="checkbox"/> Determine the Market perspective of IoT.
<input type="checkbox"/> Use of Devices, Gateways and Data Management in IoT.
<input type="checkbox"/> Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.
<input type="checkbox"/> Building state of the art architecture in IoT.

References:

1. Yasuura, H., Kyung, C.-M., Liu, Y., Lin, Y.-L., Smart Sensors at the IoT Frontier, Springer International Publishing
2. Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems, Springer International Publishing
3. Jeeva Jose, Internet of Things, Khanna Publishing House.

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4. Internet of Things, Arsheep Bahga and Vijay Madisetti

Big Data Analytics
Code: OEC-CS801A
Contacts: 3L

Name of the Course:	Big Data Analytics	
Course Code: OEC-CS801A	Semester: VIII	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		Examination Scheme
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz : 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	3	

Total Number of Lectures: 48

COURSE OBJECTIVE	
<input type="checkbox"/> Understand big data for business intelligence. Learn business case studies for big data analytics. Understand nosql big data management. Perform map-reduce analytics using Hadoop and related tools	
LECTURE WITH BREAKUP	NO. OF LECTUR
Unit 1: What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.	8
Unit 2: Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.	8

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Unit 3: Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures	9
Unit 4: MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats	10
Unit 5: Hbase, data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration.	7
Unit 6: Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveOL queries.	6

COURSE OUTCOMES
After completion of course, students would be:
<input type="checkbox"/> Describe big data and use cases from selected business domains <input type="checkbox"/> Explain NoSQL big data management <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Install, configure, and run Hadoop and HDFS <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Perform map-reduce analytics using Hadoop <input type="checkbox"/> Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics

References:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging
2. V.K. Jain, Big Data and Hadoop, Khanna Publishing House, New Delhi (2017).
3. V.K. Jain, Data Analysis, Khanna Publishing House, New Delhi (2019).
4. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
5. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
6. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
7. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
8. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
9. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
10. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
11. Alan Gates, "Programming Pig", O'Reilley, 2011.

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Cyber Law and Ethics
Code: OEC-CS801B
Contacts: 3L

Name of the Course:	Cyber Law and Ethics		
Course Code: OEC-CS801B	Semester:VIII		
Duration:6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz : 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam: 70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction of Cybercrime: What is cybercrime?, Forgery, Hacking, Software Piracy, Computer Network intrusion[4L]. Category of Cybercrime: how criminals plan attacks, passive attack, Active attacks, cyberstalking. [4L]	8	
2	Cybercrime Mobile & Wireless devices: Security challenges posted by mobile devices, cryptographic security for mobile devices, Attacks on mobile/cellphones, Theft, Virus, Hacking. Bluetooth; Different viruses on laptop [8L]	8	
3	Tools and Methods used in Cyber crime: Proxy servers, password checking, Random checking, Trojan Horses and Backdoors; DOS & DDOS attacks; SQL injection: buffer over flow. [8L]	8	
4.	Phishing & Identity Theft: Phishing methods, ID Theft; Online identity method. [4L] Cybercrime & Cybersecurity: Legal aspects, indian laws, IT act, Public key certificate. [4L]	8	

Text book and Reference books:

1. Cyber security by Nina Gobole & Sunit Belapune; Pub: Wiley India.
2. Information Security & Cyber laws, Gupta & Gupta, Khanna Publishing House

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Mobile Computing
Code: OEC-CS801C
Contacts: 3L

Name of the Course:	Mobile Computing		
Course Code: OEC-CS801C	Semester: VIII		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: 3L		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam: 70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction to Personal Communications Services (PCS): PCS Architecture, Mobility management, Networks signalling. Global System for Mobile Communication (GSM) system overview: GSM Architecture, Mobility management, Network signalling.	5	
2	General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes. Mobile Data Communication: WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP.	5	
3	Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML). Wireless Local Loop(WLL): Introduction to WLL Architecture, wireless Local Loop Technologies.	7	
4.	Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G	7	
5	Global Mobile Satellite Systems; case studies of the IRIDIUM and GLOBALSTAR systems. Wireless Enterprise Networks: Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols.	7	
6	Server-side programming in Java, Pervasive web application architecture, Device independent example application	8	

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Text book and Reference books:

1. "Pervasive Computing", Burkhardt, Pearson
2. "Mobile Communication", J. Schiller, Pearson
3. "Wireless and Mobile Networks Architectures", Yi-Bing Lin & Imrich Chlamtac, John Wiley & Sons, 2001
4. "Mobile and Personal Communication systems and services", Raj Pandya, Prentice Hall of India, 2001.
5. "Guide to Designing and Implementing wireless LANs", Mark Ciampa, Thomson learning, Vikas Publishing House, 2001.
6. "Wireless Web Development", Ray Rischpater, Springer Publishing,
7. "The Wireless Application Protocol", Sandeep Singhal, Pearson .
8. "Third Generation Mobile Telecommunication systems", by P.Stavronlakis, Springer Publishers,
9. Brijesh Gupta "Mobile Computing", Khanna Publishing House, New Delhi

Robotics

Code: OEC-IT801D

Contacts: 3L

Name of the Course:	Robotics		
Course Code: OEC-IT801	Semester: VIII		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam: 70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction :Introduction -- brief history, types, classification and usage, Science and Technology of robots, Some useful websites, textbooks and research journals.	1	
2	Elements of robots – links, joints, actuators, and sensors Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link	5	

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	representation using D-H parameters, Examples of D-H parameters and link transforms, different kinds of actuators – stepper, DC servo and brushless motors, model of a DC servo motor, Types of transmissions, Purpose of sensors, internal and external sensors, common sensors – encoders, tachometers, strain gauge based force-torque sensors, proximity and distance measuring sensors, and vision.		
3	Kinematics of serial robots Introduction, Direct and inverse kinematics problems, Examples of kinematics of common serial manipulators, workspace of a serial robot, Inverse kinematics of constrained and redundant robots, Tractrix based approach for fixed and free robots and multi-body systems, simulations and experiments, Solution procedures using theory of elimination, Inverse kinematics solution for the general 6R serial manipulator.	4	
4.	Kinematics of parallel robots Degrees-of-freedom of parallel mechanisms and manipulators, Active and passive joints, Constraint and loop-closure equations, Direct kinematics problem, Mobility of parallel manipulators, Closed-form and numerical solution, Inverse kinematics of parallel manipulators and mechanisms, Direct kinematics of Gough-Stewart platform.	5	
5.	Velocity and static analysis of robot manipulators Linear and angular velocity of links, Velocity propagation, Manipulator Jacobians for serial and parallel manipulators, Velocity ellipse and ellipsoids, Singularity analysis for serial and parallel manipulators, Loss and gain of degree of freedom, Statics of serial and parallel manipulators, Statics and force transformation matrix of a Gough-Stewart platform, Singularity analysis and statics.	5	
6	Dynamics of serial and parallel manipulators Mass and inertia of links, Lagrangian formulation for equations of motion for serial and parallel manipulators, Generation of symbolic equations of motion using a computer, Simulation (direct and inverse) of dynamic equations of motion, Examples of a planar 2R and four-bar mechanism, Recursive dynamics, Commercially available multi-body simulation software (ADAMS) and Computer algebra software Maple.	4	
7	Motion planning and control Joint and Cartesian space trajectory planning and generation, Classical	6	

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	control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non-linear model based control schemes, Simulation and experimental case studies on serial and parallel manipulators, Control of constrained manipulators, Cartesian control, Force control and hybrid position/force control, Advanced topics in non-linear control of manipulators. 8 Module 8: Modeling and		
8	Modeling and control of flexible robots Models of flexible links and joints, Kinematic modeling of multi-link flexible robots, Dynamics and control of flexible link manipulators, Numerical simulations results, Experiments with a planar two-link flexible manipulator.	4	
9	Modeling and analysis of wheeled mobile robots 3Introduction and some well known wheeled mobile robots (WMR), two and three-wheeled WMR on flat surfaces, Slip and its modeling, WMR on uneven terrain, Design of slip-free motion on uneven terrain, Kinematics, dynamics and static stability of a three-wheeled WMR's on uneven terrain, Simulations using Matlab and ADAMS.	3	
10	Selected advanced topics in robotics Introduction to chaos, Non-linear dynamics and chaos in robot equations, Simulations of planar 2 DOF manipulators, Analytical criterion for unforced motion. Gough-Stewart platform and its singularities, use of near singularity for fine motion for sensing, design of Gough-Stewart platform based sensors. Over-constrained mechanisms and deployable structures, Algorithm to obtain redundant links and joints, Kinematics and statics of deployable structures with pantographs or scissor-like elements (SLE's).	3	

Text book and Reference books:

1. Robotics Process Automation, Khanna Publishing House
2. Saha, S.K., "Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014
3. Ghosal, A., "Robotics", Oxford, New Delhi, 2006.

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Soft Skill & Interpersonal Communication

Code: OEC-CS801E

Contact: 3L

Name of the Course:	Soft Skill & Interpersonal Communication		
Course Code: OEC-CS801E	Semester: VII		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		Examination Scheme	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam: 70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: A New Approach To Learning, Planning And Goal-Setting, Human Perceptions: Understanding People, Types Of Soft Skills: Self-Management Skills, Aiming For Excellence: Developing Potential And Self-Actualization, Need Achievement And Spiritual Intelligence	5	
2	Conflict Resolution Skills: Seeking Win-Win Solution, Inter-Personal Conflicts: Two Examples, Inter-Personal Conflicts: Two Solutions, Types Of Conflicts: Becoming A Conflict Resolution Expert Types Of Stress: Self-Awareness About Stress, Regulating Stress: Making The Best Out Of Stress	5	
3	Habits: Guiding Principles, Habits: Identifying Good And Bad Habits, Habits: Habit Cycle, Breaking Bad Habits, Using The Zeigarnik Effect For Productivity And Personal Growth,	5	

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	Forming Habits Of Success		
4.	Communication: Significance Of Listening, Communication: Active Listening, Communication: Barriers To Active Listening, Telephone Communication: Basic Telephone Skills , Telephone Communication: Advanced Telephone Skills, Telephone Communication: Essential Telephone Skills	5	
5.	Technology And Communication: Technological Personality, Technology And Communication: Mobile Personality?, Topic: Technology And Communication: E-Mail Principles, Technology And Communication: How Not To Send E-Mails!, Technology And Communication: Netiquette, Technology And Communication: E-Mail Etiquette	5	
6	Communication Skills: Effective Communication, Barriers To Communication: Arising Out Of Sender/Receiver's Personality, Barriers To Communication: Interpersonal Transactions, Barriers To Communication: Miscommunication, Non-Verbal Communication: Pre-Thinking Assessment-1, Non-Verbal Communication: Pre-Thinking Assessment-2	5	
7	Nonverbal Communication: Introduction And Importance, Non-Verbal Communication: Issues And Types, Non-Verbal Communication: Basics And Universals, Non-Verbal Communication: Interpreting Non-Verbal Cues, Body Language: For Interviews, Body Language: For Group Discussions	5	
	Presentation Skills: Overcoming Fear,	5	

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8	Presentation Skills: Becoming A Professional, Presentation Skills: The Role Of Body Language, Presentation Skills: Using Visuals, : Reading Skills: Effective Reading, Human Relations: Developing Trust And Integrity		
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TEXT BOOKS AND REFERENCES

Dorch, Patricia. *What Are Soft Skills?* New York: Execu Dress Publisher, 2013.

Kamin, Maxine. *Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders.* Washington, DC: Pfeiffer & Company, 2013.

Klaus, Peggy, Jane Rohman & Molly Hamaker. *The Hard Truth about Soft Skills.* London: HarperCollins E-books, 2007.

Petes S. J., Francis. *Soft Skills and Professional Communication.* New Delhi: Tata McGraw-Hill Education, 2011.

Stein, Steven J. & Howard E. Book. *The EQ Edge: Emotional Intelligence and Your Success.* Canada: Wiley & Sons, 2006.

E-Commerce & ERP:
Code: OEC-CS802A
Contacts: 3L

1. Overview, Definitions, Advantages & Disadvantages of E – Commerce, Threats of E – Commerce, Managerial Prospective, Rules & Regulations For Controlling E – Commerce, Cyber Laws. [3 L]
2. Technologies : Relationship Between E – Commerce & Networking, Different Types of Networking Commerce, Internet, Intranet & Extranet, EDI Systems Wireless Application Protocol : Definition, Hand Held Devices, Mobility & Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement For E – Commerce . [5 L]
3. Business Models of e – commerce : Model Based On Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C, E – Governance. [2 L]
4. E – strategy : Overview, Strategic Methods for developing E – commerce. [2 L]
5. Four C's : (Convergence, Collaborative Computing, Content Management & Call Center).
Convergence : Technological Advances in Convergence – Types, Convergence and its implications, Convergence & Electronic Commerce. Collaborative Computing : Collaborative product development, contract as per CAD, Simultaneous Collaboration, Security. Content Management : Definition of content, Authoring Tools & Content Management, Content – partnership, repositories, convergence, providers, Web Traffic & Traffic Management ; Content Marketing. Call Center : Definition, Need, Tasks Handled, Mode of Operation, Equipment , Strength & Weaknesses of Call Center, Customer Premises Equipment (CPE). [6 L]

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7. Supply Chain Management : E – logistics, Supply Chain Portal, Supply Chain Planning Tools (SCP Tools), Supply Chain Execution (SCE), SCE - Framework, Internet's effect on Supply Chain Power. [3 L]
8. E – Payment Mechanism : Payment through card system, E – Cheque, E – Cash, E – Payment Threats & Protections. [1 L]
9. E – Marketing :. Home –shopping, E-Marketing, Tele-marketing [1 L]
10. Electronic Data Interchange (EDI) : Meaning, Benefits, Concepts, Application, EDI Model, Protocols (UN EDI FACT / GTDI, ANSI X – 12), Data Encryption (DES / RSA). [2 L]
11. Risk of E – Commerce : Overview, Security for E – Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital certificates, Digital signatures. [4 L]
12. Enterprise Resource Planning (ERP) : Features, capabilities and Overview of Commercial Software, re-engineering work processes for IT applications, Business Process Redesign, Knowledge engineering and data warehouse . Business Modules: Finance, Manufacturing (Production), Human Resources, Plant Maintenance, Materials Management, Quality Management, Sales&Distribution ERPPackage, ERP Market: ERP Market Place, SAP AG, PeopleSoft, BAAN, JD Edwards, Oracle Corporation ERP-Present and Future: Enterprise Application Integration (EAI), ERP and E-Commerce, ERP and Internet, Future Directions in ERP [10]

Reference :

1. E-Commerce, M.M. Oka, EPH
2. Kalakotia, Winston : Frontiers of Electronic Commerce , Pearson Education.
3. Bhaskar Bharat : Electronic Commerce - Technologies & Applications. TMH
4. Loshin Pete, Murphy P.A. : Electronic Commerce , Jaico Publishing Housing.
5. Murthy : E – Commerce , Himalaya Publishing.
6. E – Commerce : Strategy Technologies & Applications, Tata McGraw Hill.
7. Global E-Commerce, J. Christopher & T.H.K. Clerk, University Press
8. Beginning E-Commerce, Reynolds, SPD
9. Krishnamurthy, E-Commerce Mgmt, Vikas

Micro-electronics and VLSI Design

Code: OEC-CS802B

Contact: 3L

Credits: 3

Allotted Hrs: 39L

Introduction to CMOS circuits: MOS Transistors, MOS transistor switches, CMOS Logic, The inverter, Combinational Logic, NAND gate, NOT Gate, Compound Gates, Multiplexers, Memory-Latches and Registers. [6L]

Processing Technology: Silicon Semiconductor Technology- An Overview, wafer processing, oxidation, epitaxy deposition, Ion-implantation and diffusion, The Silicon Gate Process- Basic CMOS Technology, basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator, CMOS process enhancement-Interconnect, circuit elements, 3-D CMOS. Layout Design Rule: Layer Representations, CMOS n-well Rules, Design Rule of background scribe line, Layer Assignment, SOI Rule [10L] .

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Power Dissipation: Static dissipation, Dynamic dissipation, short-circuit dissipation, total power dissipation. Programmable Logic, Programmable Logic structure, Programmable interconnect, and Reprogrammable Gate Array: Xilinx Programmable Gate Array, Design Methods: Behavioural Synthesis, RTL synthesis [8L]

Placement: placement: Mincut based placement – Iterative improvement placement simulated annealing. Routing: Segmented channel routing – maze routing – routability and routing resources – net delays. [5L]

Verification and Testing: Verification Versus Testing, Verification: logic simulation design validation – timing verification – Testing concepts: failures – mechanisms and faults – fault coverage – ATPG methods – types of tests – FPGAs – programmability failures – design for testability. [5L]

Overview of VHDL [5L]

Text Book:

1. “Digital Integrated Circuit”, J.M.Rabaey, Chandrasan, Nicolic, Pearson
2. “CMOS Digital Integrated Circuit”, S.M.Kang & Y.Leblebici, TMH
3. “Modern VLSI Design” Wayne Wolf, Pearson
4. “Algorithm for VLSI Design & Automation”, N.Sherwani, Kluwer
5. “VHDL”, Bhaskar, PHI

References:

1. “ Digital Integrated Circuits” Demassa & Ciccone, Willey Pub.
2. “Modern VLSI Design: system on silicon” Wayne Wolf; Addison Wesley Longman Publisher
3. “Basic VLSI Design” Douglas A. Pucknell & Kamran Eshranghian; PHI
4. “CMOS Circuit Design, Layout & Simulation”, R.J.Baker, H.W.Lee, D.E. Boyee, PHI

Economic Policies in India

Code: OEC-CS802C

Contacts: 3L

Economic Development and its Determinants

Approaches to economic development and its measurement – sustainable development; Role of State, market and other institutions; Indicators of development – PQLI, Human Development Index (HDI), gender development indices.

Planning in India

Objectives and strategy of planning; Failures and achievements of Plans; Developing grass-root organizations for development – Panchayats, NGOs and pressure groups.

Demographic Features, Poverty and Inequality

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Broad demographic features of Indian population; rural-urban migration; Urbanization and civic amenities; Poverty and Inequality.

Resource Base and Infrastructure

Energy; social infrastructure – education and health; Environment; Regional imbalance; Issues and policies in financing infrastructure development.

The Agricultural Sector

Institutional Structure – land reforms in India; Technological change in agriculture – pricing of agricultural inputs and output; industry; Agricultural finance policy; Agricultural Marketing and Warehousing; Issues Terms of trade between agriculture and in food security – policies for sustainable agriculture.

Section – II

Industrial policy; Public Sector enterprises and their performance; Problem of sick units in India; Privatization and disinvestment debate; Growth and pattern of industrialization; Small-scale sector; Productivity in industrial sector; Exit policy – issues in labour market reforms; approaches for employment generation.

Public Finances

Fiscal federalism – Centre-State financial relations; Finances of central government; Finances of state governments; Parallel economy; Problems relating to fiscal policy; Fiscal sector reforms in India.

Money, Banking and Prices

Analysis of price behaviour in India; Financial sector reforms; Interest rate policy; Review of monetary policy of RBI; Money and capital markets; Working of SEBI in India.

External Sector

Structure and direction of foreign trade; Balance of payments; Issues in export-import policy and FEMA; Exchange rate policy; Foreign capital and MNCs in India; The progress of trade reforms in India.

Economic Reforms

Rationale of internal and external reforms; Globalization of Indian economy; WTO and its impact on the different sectors of the economy; Need for and issues in good governance; Issues in competition and safety nets in Indian economy.

BASIC READING LIST

1. Ahluwalia, I. J. and I. M. D Little (Eds.) (1999), India's Economic Reforms and Development (Essays in honour of Manmohan Singh), Oxford University Press, New Delhi.
2. Bardhan, P. K. (9th Edition) (1999), The Political Economy of Development in India, Oxford University Press, New Delhi.
3. Bawa, R. s. and P. S. Raikhy (Ed.) (1997), Structural Changes in Indian Economy, Guru Nanak Dev University Press, Amritsar.

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4. Brahmananda, P. R. and V. R. Panchmukhi (Eds.) (2001), Development Experience in the Indian Economy: Inter-State Perspectives, Book well, Delhi.
5. Chakravarty, S. (1987), Development Planning : The Indian Experience, Oxford University Press, New Delhi.
6. Dantwala, M. L. (1996), Dilemmas of Growth : The Indian Experience, Sage Publications, New Delhi.
7. Datt, R. (Ed.) (2001), Second Generation Economic Reforms in India, Deep & Deep Publications, New Delhi.
8. Government of India, Economic Survey (Annual), Ministry of Finance, New Delhi.
9. Jain, a. K. (1986), Economic Planning in India, Ashish Publishing House, New Delhi.
10. Jalan, B. (1992), The Indian Economy – Problems and Prospects, Viking, New Delhi.