



**SILIGURI INSTITUTE OF TECHNOLOGY
ELECTRICAL ENGINEERING**



COURSE FILE

1ST SEM, 4TH YEAR, 2019

SEC – ALL

PAPER DESCRIPTION : RENEWABLE & NON-CONVENTIONAL ENERGY

PAPER CODE : EE-704(D)

DEPARTMENT OF ELECTRICAL ENGINEERING

VISION OF THE INSTITUTE :

To be a recognised institution offering high quality education, opportunities to students to become globally employable Engineers/Professionals in best ranked industries and research organisation.

MISSION OF THE INSTITUTE :

To impart quality technical education for holistic development of students who will fulfil the needs of the industry/society and be actively engaged in making a successful career in industry/research/higher education in India & abroad.

VISION OF THE DEPARTMENT:

To emerge as a leading Department of Electrical Engineering that caters to the latest needs of power sector, electrical & allied industry in the region.

MISSION OF THE DEPARTMENT:

To evolve as an innovative & globally competent Electrical Engineering department that contributes to the socio - economic growth of region by utilizing the advancement in Electrical Engineering by providing conducive learning and interactive environment to students and faculty.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Apply science, engineering, mathematics through differential and integral calculus, complex variables to solve electrical engineering problems.

PSO2: Demonstrate proficiency in use of software & hardware to be required to practice Electrical engineering profession.

PROGRAM EDUCATION OBJECTIVE (PEO):

The graduates of Electrical Engineering will:

1. Possess strong educational foundation in science, mathematics and Electrical Engineering which is essential in making successful careers in Industry/ research / higher education and will understand the professional responsibility in modern electrical power and energy related Industry through global and rigorous education.
2. Possess technical competence in the fields of Electrical engineering & allied disciplines and will be successful for the execution of engineering solutions which are technically sound and environment friendly.
3. Utilize their broad based knowledge, skills and resources to design, invent and develop novel technology and find creative and innovative solutions to engineering problems in a multidisciplinary work environment.
4. Be professional with leadership qualities, effective communication skills, ethical attitude and competence to excel individually and work efficiently in teams.
5. Possess attitude to learn and adopt new technologies as it evolves and be lifelong learners.

SILIGURI INSTITUTE OF TECHNOLOGY

Academic Calendar for the year 2018 - 2019

ODD SEMESTER 2019 (July 2019 – December 2019):

Activity	Date
Eight weeks Summer Internship Program (MBA)	June 20 to August 20, 2019
FDP (supervised by R&D Committee)	July 8 to July 12, 2019
Commencement of Academic Programme (for continuing Batch, HMCT & MCA 5 th Sem)	July 8, 2019
Finishing School Program for 4 th Year students	July 12 to July 17, 2019
Commencement of Academic Programme (for continuing Batch, B. Tech.)	July 15, 2019
Commencement of Academic Programme (for newly admitted Batch, HMCT)	July 17, 2019
Commencement of Academic Programme (for newly admitted Batch, B. Tech.)	July 22, 2019
Induction program (as per the MAKAUT guideline) for newly admitted B. Tech. 1 st Year	July 22 to August 09, 2019
Commencement of Academic Programme (for continuing Batch, MCA 3 rd Sem)	July 29, 2019
Commencement of Academic Programme (for newly admitted Batch, MBA & MCA)	August 5, 2019
Finishing School Program for 4 th Year students, CIVIL & EE.	August 12 to August 17, 2019
Independence Day Celebration (supervised by Cultural Committee)	August 15, 2019
Akshay Urja Diwas Celebration (supervised by Tech-Management Fest Committee)	August 20, 2019
Commencement of Academic Programme (for continuing Batch, MBA)	August 26, 2019
Technical Training for 3 rd & 5 th Sem B. Tech.	August 26 to August 30, 2019
University Registration for newly admitted students	Last week of August (Tentative)
Continuous evaluation (Phase I)	August 29 to August 31, 2019
Fresher's Welcome	September 1 st week, 2019
Student Feedback and submission of ATR (Department Level)	September 4 to September 7, 2019
Games & Sports Activities	September 11 to September 14, 2019 (After class hours on working days)
Engineer's Day Celebration (supervised by Tech-Management Fest Committee)	September 13, 2019
Technical Training for 7 th Sem B. Tech.	September 16 to September 21, 2019
Meeting with the students with Director's Office	September 23 to September 27, 2019
Continuous evaluation (Phase II)	September 25 to September 27, 2019
Last date of reporting on Mentoring (Phase I)	September 30, 2019
22 Weeks Internship Program for 6 th Sem HMCT	October 1, 2019 Onwards
Technical Training for 1 st Sem B. Tech.	October 21 to October 24, 2019
Continuous evaluation (Phase III)	October 25 to October 28, 2019
Continuous evaluation (Phase IV)	November 18 to November 20, 2019
Practical & Project Viva	November 22 to November 30, 2019
Theory Examinations	December 4 to December 21, 2019
Last date of reporting on Mentoring (Phase II)	December 30, 2019
Inter Semester Break (For Students)	December 24, 2019 to January 12, 2020

Course File

Course Title : RENEWABLE & NON-CONVENTIONAL ENERGY

Code : EE-704(D)

Semester 1st Year 4th 2019

Name of the Faculty: PROF. JAYANTA BHUSAN BASU

Internet Homepage: <https://sites.google.com/site/apjbbasu/>

E-mail : jbb.sit@gmail.com

Class Schedule

Lecture		
Monday 10.00 – 10.50 am	Tuesday 15.50 – 16.40 pm	Thursday 14.10 – 15.00 pm

Hours for meeting students:

Monday	14.10 -15.00 pm
Wednesday	13.20 – 14.00 pm
Friday	14.00 – 15.00 pm
Or by appointment	

i) Course Objective

Students will acquire basic knowledge on different renewable energy sources and their application.

ii) Course Outcomes

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes.

The student will be able to:

Course Outcomes		Target
EE704D.1	Identify different Renewable and Non Renewable Energy Sources and realize their environmental impact (BT 2)	70% marks
EE704D.2	Illustrate Solar geometry and describe different methods of solar energy conversion. (BT 3)	65% marks
EE704D.3	Demonstrate knowledge about Working Principles of Wind Power generation and its application. (BT 3)	65% marks
EE704D.4	Explain generation & harnessing of power from Biomass, Geothermal, ocean energy. (BT 3)	65% marks
EE704D.5	Discuss about different direct energy conversion systems like MHD & Fuel cells. (BT 3)	65% marks
EE704D		66% MARKS

- i. Once the student has successfully completed this course, he/she must be able to answer the following questions or perform/demonstrate the following:

Sl.	Question	BT Level
1.	List different types of Renewable energy sources and their environmental impact.	BT 2
2.	Explain briefly the impact of conventional sources of energy on environment.	BT 2
3.	Distinguish between global radiation and diffuse radiation. Which is applicable during cloudy atmosphere?.	BT 2
4.	Calculate the day length in Srinagar on 1st July, 2012. The latitude of Srinagar is 34005'N.	BT 3
5.	Draw the equivalent circuit of a practical solar cell and describe its I-V characteristics.	BT 3
6.	Discuss various subsystems in a solar thermal energy conversion system	BT 2
7.	Explain the fill factor and its importance as a performance parameter for a solar cell.	BT 3
8.	Estimate power output from a wind turbine	BT 3
9.	List & briefly discuss the factors that you would take into consideration in selecting a site of a land-based wind turbine system.	BT 3
10.	Describe in brief a binary cycle geothermal power plant.	BT 2
11.	Explain fluidized bed combustion in harnessing power from bio-mass.	BT 3
12.	Explain the working principle of double basin tidal power plants	BT 2
13.	What is the extractable power from a deep-sea wave of wavelength 150m and height 1.5 m if $g = 9.8 \text{ m/s}^2$.	BT 3
14.	Calculate the open circuit voltage and maximum power output for an MHD generator having the following data : Plate area = 0.25 m ² , distance between electrodes = 0.50 m, flux density = 1.8 Wb/m ² , average gas velocity = 1200 m/s, gaseous conductivity = 10 mho/m.	BT 3
15.	Describe the principle of operation of Fuel Cell with suitable diagram	BT 2

iii) Unit Layout

Unit	Lecture Hours
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.	3
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 voltaics - 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.	8
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	5
Energy from Biomass : 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	4

Unit	Lecture Hours
Geothermal Energy : Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.	4
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	4
Magneto Hydrodynamic power generation : Principle of MHD power generation, MHD system, Design problems and developments, gas conductivity, materials for MHD generators and future prospects	2
Hydrogen Energy : Introduction, Hydrogen Production methods, Hydrogen storage, hydrogen transportation, utilization of hydrogen gas, hydrogen as alternative fuel for vehicles	2
Fuel cell : Introduction, Design principle and operation of fuel cell, Types of fuel cells, conversion efficiency of fuel cell, application of fuel cells	2

iv) Text books

- Non conventional Energy sources, G.D. Rai, Khanna Publishers.
- Renewable energy sources and conversion technology, Bansal Keemann, Meliss, Tata Mc Graw Hill.
- Non conventional Energy, Ashok V. Desai, New Age International Publishers Ltd.

Reference books :

- Renewable energy resources and emerging technologies, D.P. Kothari, Prentice Hall of India Pvt. Ltd.

(v) Evaluation Scheme

1) Theory

Evaluation Criteria	Marks
Internal Exam*	15
Assignment	10
Attendance	5
University Exam/External Exam	70
Total	100

* The Internal Marks will be determined through the continuous evaluation (CA) which is needed to be submitted 4 times in a semester based on performance of the students assessed at the end of August, September, October and November 2019 as per academic calendar published by the University. The 4 nos of CAs could be based on test/ viva/ quiz/ presentation/seminar/ GD etc out of which 2 nos preferably would be tests. **(MAKAUT notification Ref No. COE/MAKAUT/FACULTY/1/2019-20 Date: 13/09/2019)**

Course target attainment levels:

Attainment Level	Inference	Marks
Attainment Level 1	50% of the students have attained more than the target level of that CO	1
Attainment Level 2	60% of the students have attained more than the target level of that CO	2
Attainment Level 3	70% of the students have attained more than the target level of that CO	3

Course Target for the university examination = 65% of the students will get "A" Grade

Target has been set on the basis of last year's performance / result by the students, student quality this year and difficulty level of the course.

University Grading System:

Grade	Marks
O	90% and above
E	80 – 89.9%
A	70 – 79.9%
B	60 – 69.9%
C	50 – 59.9%
D	40 – 49.9%
F	Below 40%

(vi) Mapping of Course Outcomes and Program Outcomes:

Course Outcomes	Program Outcomes												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
EE704D.1	2	-	-	-	-	-	3	-	-	-	-	1	1	2
EE704D.2	3	2	-	-	-	-	2	-	-	-	-	1	2	3
EE704D.3	3	2	-	-	-	-	2	-	-	-	-	1	2	3
EE704D.4	3	-	-	-	-	-	3	-	-	-	-	1	2	3
EE704D.5	2	1	-	-	-	-	3	-	-	-	-	1	2	2
EE704D	2.6	1.7					2.6					1	1.8	2.6

- 1 = courses in which the student will be exposed to a topic.
 2 = courses in which students will gain competency in that area.
 3 = courses in which students will master that skill.

- EE704D.1 requires knowledge of renewable and non-renewable energy sources and understanding of societal impact in present scenario to provide long term solutions for energy problems. Hence it is highly linked with PO7, partially linked with PO1 and minimally linked with PO12 & PSO1.
- EE704D.2 and EE704D.3 require application of engineering knowledge to design/development of solutions & understanding of environmental contexts and also require knowledge of engineering to provide long lasting solutions of energy problem. Hence it is highly linked with PO1, partially linked with PO2, PO7 & PSO1 and minimally linked with PO12.
- EE704D.4 requires engineering knowledge & understanding of environmental conditions to providing economical and sustainable engineering solutions. Hence it is highly linked with PO1 & PO7, partially linked with PSO1 and minimally linked with PO12.
- EE704D.4 requires knowledge about understanding of engineering knowledge & understanding of environmental conditions to assess societal application and providing sustainable engineering solutions in long term. Hence it is highly linked with PO6 & PO7, partially linked with PO1, PO2 and minimally linked with PO12 & PSO1.
- EE704D.5 deals with different energy efficient technologies which require good engineering knowledge so that environment friendly sustainable solutions can be found for energy related problems. Hence it is highly linked with PO7, partially linked with PO1 & PSO1 and minimally linked with PO2 & PO12.

(vii) Assessment Methodology

Outcome	Assessment Tool
EE704D.1	Internal Test, Quiz/Assignment/Term Paper, University Exam
EE704D.2	Internal Test, Quiz/Assignment/Term Paper, University Exam
EE704D.3	Internal Test, Quiz/Assignment/Term Paper, University Exam
EE704D.4	Internal Test, Quiz/Assignment/Term Paper, University Exam
EE704D.5	Internal Test, Quiz/Assignment/Term Paper, University Exam

(viii) A. Weekly Lesson Plan

Week	Lectures
1	<p>Discussion of Course outcome and program outcome.</p> <p>Introduction to energy sources:</p> <ul style="list-style-type: none">• Renewable and non-renewable energy sources ,energy consumption as a measure of nations development• Strategy for meeting the future energy requirements, Global and National scenarios• Prospects of renewable energy sources.• Impact of renewable energy generation on environment
2	<p>Solar Energy:-</p> <ul style="list-style-type: none">• Solar radiation: beam and diffusion radiation ,solar constant, earth sun angel• attenuation and measurement of solar radiation, local solar time• Derived Solar angles, sunrise, Sunset and day length
3	<p>Solar Energy:-</p> <ul style="list-style-type: none">• Flat Plate Collectors , Concentrating Collectors• Solar air heater types, solar driers, storage of solar energy, thermal storage, solar pond, solar water heater• Solar distillation, Solar still, Solar cooker.
4	<p>Solar Energy:-</p> <ul style="list-style-type: none">• Solar heating and Cooling of buildings• Photo voltaic, Solar cell, different types of PV Cells, Mono Poly Crystalline and amorphous Silicon Solar Cell• Design of PV Array efficiency and cost of PV System and its application, PV Hybrid System.
5	<p>Wind Energy :-</p> <ul style="list-style-type: none">• Principle and Wind Energy Conversion Basic Components of Wind Energy Conversion System• Wind mill components and Various types and their constructional Feature• Design Considerations of Horizontal and Vertical Axis Wind Machines
6	<p>Wind Energy :-</p> <ul style="list-style-type: none">• Analysis of Aerodynamic forces acting on Wind Mill blades and Estimations of Power output• Wind data and site selection Consideration <p>Energy From Biomass</p> <ul style="list-style-type: none">• Biomass Conversion Technologies and Biogas generation Plant.
7	<p>Energy From Biomass</p> <ul style="list-style-type: none">• Classification, advantages disadvantages and constructional details.

	<ul style="list-style-type: none"> • Site Selection and digester design consideration • Filling a digester for Starting, maintaining • Biogas Production Properties and Utilization of Biogas
8	<p>Geothermal Energy :-</p> <ul style="list-style-type: none"> • Estimation and Nature of Geothermal Energy • Geothermal Resources and Resources like hydrothermal , geo-pressured and hot dry Rock magma
9	<p>Geothermal Energy :-</p> <ul style="list-style-type: none"> • Advantage and Disadvantage of Geothermal Energy • Application of Geothermal Energy • Prospect of Geothermal Energy in India. <p>Energy From Ocean:-</p> <ul style="list-style-type: none"> • OTEC systems like Open cycle and Closed Cycle and Hybrid Cycle Systems • Prospects of OTEC in India Energy From Tides , Basic Principle of Tidal Power Generation.
10	<p>Energy From Ocean:-</p> <ul style="list-style-type: none"> • Single Basin and Double Basin Tidal Power Plants advantage, limitation and Scope of Tidal Power • Wave Energy and Power From Wave • Wave Energy Conversion devices and Advantage, Disadvantages of Wave Energy
11	<p>Magneto Hydro Dynamic Power Generation :-</p> <ol style="list-style-type: none"> 1. Principle of MHD Power Generation MHD System 2. Design Problems and Developments gas Conductivity 3. Materials for MHD generation and Future Prospects
12	<p>Hydrogen Energy:-</p> <ul style="list-style-type: none"> • Introduction, Hydrogen Production Methods, Hydrogen Storage • Hydrogen Transportation, Utilization of Hydrogen Gas • Hydrogen as a Alternative Fuel For Vehicle.
13	<p>Fuel Cell :-</p> <ul style="list-style-type: none"> • Introduction, Design Principle and Operation of Fuel Cell • Types of Fuel Cells • Conversion efficiency of Fuel Cell and application of Fuel Cell.

(VIII) B. COMBINED DAILY LESSON PLAN & EXECUTION REPORT

NAME OF FACULTY : Mr. J. B. Basu	DEPARTMENT :EE	SUBJECT: RENEWABLE & NON-CONVENTIONAL ENERGY CODE : EE-704D	SEMESTER : 7th
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Unit / Module	Topic Description (to be quoted from syllabus)	No. of Lecture(s)	Plan Date(s)	Execution Date(s)	Details of home work/assignment/min i project/ ICT used/ partial delivery of courses by industry experts, Eminent speakers etc.)	Details of topics that are beyond syllabus (if any)	Remarks
1	Introduction	1					
	Discussion of Course outcome and program outcome. Overview of the course.	1	22.07.2019	22.07.2019			
2	Introduction to energy sources:	3					
	Renewable and non-renewable energy sources ,energy consumption as a measure of nations development Strategy for meeting the future energy requirements, Global and National scenarios	1	23.07.2019	23.07.2019			
	Prospects of renewable energy sources.	1	25.07.2019	29.07.2019			
	Impact of renewable energy generation on environment	1	29.07.2019	30.07.2019			
3	Solar Energy	9					
	Solar radiation: beam and diffusion radiation ,solar constant, earth sun angel	1	30.07.2019	01.08.2019			
	Attenuation and measurement of solar radiation, local solar time	1	01.08.2019	01.09.2019			
	Derived Solar angles, sunrise, Sunset and day length	1	05.08.2019	06.08.2019			

Unit / Module	Topic Description (to be quoted from syllabus)	No. of Lecture(s)	Plan Date(s)	Execution Date(s)	Details of home work/assignment/min i project/ ICT used/ partial delivery of courses by industry experts, Eminent speakers etc.)	Details of topics that are beyond syllabus (if any)	Remarks
	Flat Plate Collectors , Concentrating Collectors	1	06.08.2019	08.08.2019			
	Solar air heater types, solar driers, storage of solar energy, thermal storage, solar pond, solar water heater	1	08.08.2019	13.08.2019			
	Solar distillation, Solar still, Solar cooker.	1	13.08.2019	19.08.2019			
	Solar heating and Cooling of buildings Photo voltaic, Solar cell,	1	19.08.2019	19.08.2019			
	Different types of PV Cells, Mono Poly Crystalline and amorphous Silicon Solar Cell	1	20.08.2019	20.08.2019			
	Design of PV Array efficiency and cost of PV System and its application, PV Hybrid System	1	22.08.2019	20.08.2019			
4	Wind Energy	5					
	Principle and Wind Energy Conversion Basic Components of Wind Energy Conversion System	1	26.08.2019	22.08.2019			
	Wind mill components and Various types and their constructional Feature	1	27.08.2019	22.08.2019			
	Design Considerations of Horizontal and Vertical Axis Wind Machines	1	02.09.2019	26.08.2019			
	Analysis of Aerodynamic forces acting on Wind Mill blades and Estimations of Power output	1	03.09.2019	02.09.2019			
	Wind data and site selection Consideration	1	05.09.2019	02.09.2019			
5	Energy from Biomass	4					

Unit / Module	Topic Description (to be quoted from syllabus)	No. of Lecture(s)	Plan Date(s)	Execution Date(s)	Details of home work/assignment/mini project/ ICT used/ partial delivery of courses by industry experts, Eminent speakers etc.)	Details of topics that are beyond syllabus (if any)	Remarks
	Biomass Conversion Technologies and Biogas generation Plant.	1	09.09.2019	03.09.2019			
	Classification, advantages disadvantages and constructional details	1	23.09.2019	05.09.2019			
	Site Selection and digester design consideration	1	24.09.2019	09.09.2019			
	Filling a digester for Starting, maintaining Biogas Production Properties and Utilization of Biogas	1	30.09.2019	09.09.2019			
6	Geothermal Energy	3					
	Estimation and Nature of Geothermal Energy Advantage and Disadvantage of Geothermal Energy	1	01.10.2019	12.09.2019			
	Geothermal Resources and Resources like hydrothermal , geo-pressured and hot dry Rock magma	1	03.10.2019	16.09.2019			
	Application of Geothermal Energy Prospect of Geothermal Energy in India	1	10.10.2019	16.09.2019			
7	Energy From Ocean	4					
	OTEC systems like Open cycle and Closed Cycle and Hybrid Cycle Systems Prospects of OTEC in India Energy From Tides	1	14.10.2019	17.09.2019			
	Basic Principle of Tidal Power Generation	1	15.10.2019	21.10.2019			
	Single Basin and Double Basin Tidal Power Plants advantage, limitation and Scope of Tidal Power	1	17.10.2019	21.10.2019			

Unit / Module	Topic Description (to be quoted from syllabus)	No. of Lecture(s)	Plan Date(s)	Execution Date(s)	Details of home work/assignment/min i project/ ICT used/ partial delivery of courses by industry experts, Eminent speakers etc.)	Details of topics that are beyond syllabus (if any)	Remarks
	Wave Energy and Power From Wave Wave Energy Conversion devices and Advantage, Disadvantages of Wave Energy	1	21.10.2019	22.10.2019			
8	Magneto Hydro Dynamic Power Generation	2					
	Principle of MHD Power Generation MHD System	1	22.10.2019	04.11.2019			
	Design Problems and Developments gas Conductivity Materials for MHD generation and Future Prospects	1	24.10.2019	05.11.2019			
9	Hydrogen Energy	2					
	Introduction, Hydrogen Production Methods, Hydrogen Storage	1	31.10.2019	07.11.2019			
	Hydrogen Transportation, Utilization of Hydrogen Gas Hydrogen as a Alternative Fuel For Vehicle.	1	04.11.2019				
10	Fuel Cell	2					
	Introduction, Design Principle and Operation of Fuel Cell	1	05.11.2019	11.11.2019			
	Types of Fuel Cells Conversion efficiency of Fuel Cell and application of Fuel Cell.	1	07.11.2019				
	Recapitulation & discussion on previous year's question papers	2	11.11.2019 14.11.2019				

(ix) Teaching Strategy/Method

1. Learning by example
2. Learning by question and answering
3. Learning by problem solving
4. Use of Power point presentation.
5. Use of animations to understand the working principles.

(ixa) Strategy to support weak students

1. Reviewing student attendance in connection with performance, and counselling students about attending classes, advising them for making up classes missed and getting additional help.
2. Paying attention to their problems in understanding the subject
3. Encouraging them to express their point of trouble
4. Allotting extra time beyond schedules class hours to help them understand the topics
5. Suggesting them different ways (as found suitable depending upon the case) to overcome their problem.

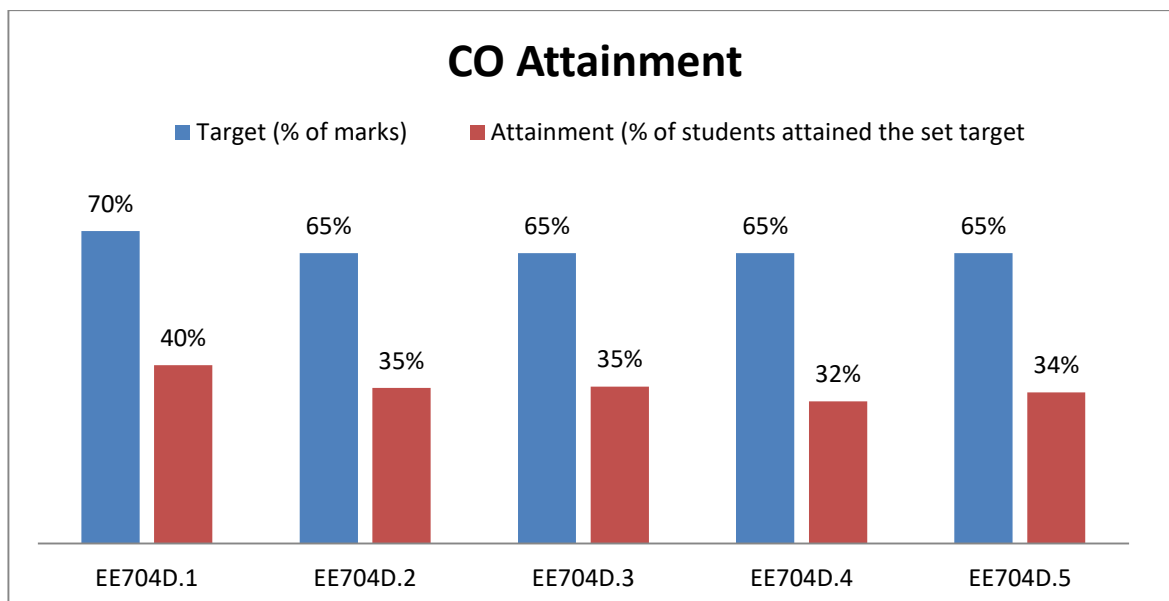
(ixb) Strategy to encourage bright students

1. Try to encourage them to study beyond the syllabus
2. Ask them to develop the habit of reading anything good and rich in content to update their knowledge about the development in the field of renewable energy.
3. Encourage them to help academically weak students.
4. Encourage them to do mini projects.

(ixc) Efforts to keep students engaged

1. summarize the previous day's lecture and ask random questions.
2. Providing informative data/examples/case study related to the topic from the industrial point of view.
3. Conducting Informal technical quiz/surprise tests.

(xi) Analysis of Students performance in the course



- 40% students have attained the set target of 70% marks for EE704D.1
- 35% students have attained the set target of 65% marks for EE704D.2
- 35% students have attained the set target of 65% marks for EE704D.3
- 32% students have attained the set target of 65% marks for EE704D.4
- 34% students have attained the set target of 65% marks for EE704D.5

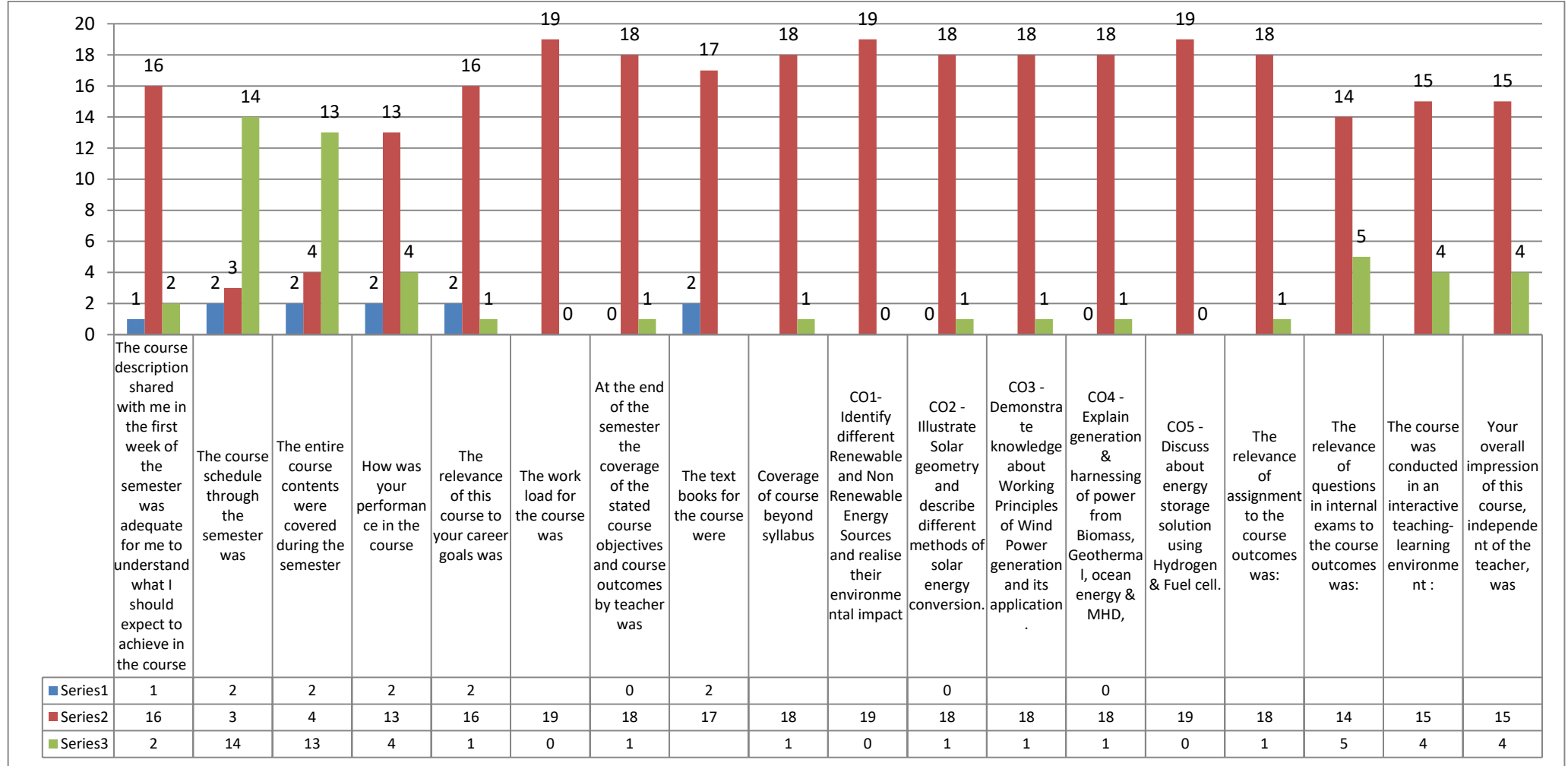
(xii) Analysis of Students performance in the course (university results)

	Target Course Outcome%	TOTAL STUDENTS	TOTAL STUDENT WHO ATTAINED OUTCOME	% STUDENTS WHO ATTAINED THE OUTCOME
University				

- 60% students have attained the set target of 7 in point for University Exams

(xiii) Analysis of Student Feed Back

Feedback is taken from 24 students based on the course survey.



(xiv) Teacher Self-Assessment (at the completion of course)

From the analysis of the results obtained it can be seen that set targets for the course outcome have been achieved moderately by the students. Since this course encompasses a wide range of activities and expertise in the optimal use of energy hence some hands-on activities will provide practical exposure for better understanding the course.

(xiv) Recommendations/Suggestions for improvement by faculty

This is a course which requires conceptual understanding of the subject. Students are needed to be motivated to understand the importance energy management & audit. They need to be motivated to understand the environmental impact due to energy consumption and the role of budding engineers to curb the same. Some practical case studies and views of industry expert will help the students to realise the importance of the subject.

CONTINUOUS ASSESMENT (CA) RECORD

Subject with code: RENEWABLE & NON CONVENTIONAL ENERGY (EE-704D)

Section: ALL

Semester :7th

Discipline: Electrical Engineering

NAME	CA1 (25)			CA2 (25)			CA3 (25)				CA4 (25)			Grand Total (100)
	Attendance (5)	Quiz (10)	Total (25)	Quiz 1 (10)	Internal Exam (15)	Total (25)	Attendance (5)	Assignment (10)	Quiz 2 (10)	Total (25)	PPT (10)	2nd Internal Exam (15)	Total (25)	100
VEDANT SINGH SHANKAR	4	7	18	7	11	18	4	0	8	12	0	6	6	59
TAMALIKA DAS	4		4	0	11	11	4	10	5	19	0	2	2	40
TAMAL BISWAS	4	3	10	0	12	12	4	10		14	0	1	1	41
SUMAN DUTTA	5	7	19	0	15	15	5	10	8	23	10	2.5	13	72
SUBRATA PRAMANIK	5	8	21	0	15	15	5	10	8	23	10	2.5	13	74
SUBHENDU BISWAS	4	9	22	0	15	15	4	0	8	12	0	3	3	56
SUBHANKAR DAS	4	7	18	0	12	12	4	10	8	22	10	2.5	13	68
SUBHAJIT BARMAN	4	7	18	4	14	18	4	10	7	21	0	1.5	2	63
SUBARNA TRIBEDI	4	6	16	9	14	23	4	10	7	21	0	8.5	9	73
SRINJOY GHOSH	4	8	20	5	14	19	4	10	8	22	0	3.5	4	68
SOURAV THAPA	4	8	20	6	14	20	4	10	9	23	0	0	0	65
SAYANTANI DEY	4	7	18	0	13	13	4	10	7	21	0	1.5	2	58
SAYANI BHATTACHARJEE	4	4	12	0	10	10	4	10		14	0	1.5	2	42
SARVAJEET KUMAR	4	10	24	5	15	20	4	10	8	22	10	1.25	11	80
SANTANU NAG	4		4	0	10	10	4	0	5	9	0	2	2	32
SAMBHU ROY	4	10	24	0	15	15	4	0		4	0	0	0	51
SAIBAL DAS	4	4	12	0	12	12	4	10	5	19	10	1.5	12	59
SAHIL RAI	4	8	20	0	14	14	4	10		14	0	2.5	3	55
RIYA SARKAR	5		5	0	14	14	5	10	8	23	10	3.5	14	58
RAKESH KUMAR NEOPANE	4		4	4	13	17	4	10	2	16	0	1	1	42

NAME	CA1 (25)			CA2 (25)			CA3 (25)				CA4 (25)			Grand Total (100)
	Attendance (5)	Quiz (10)	Total (25)	Quiz 1 (10)	Internal Exam (15)	Total (25)	Attendance (5)	Assignment (10)	Quiz 2 (10)	Total (25)	PPT (10)	2nd Internal Exam (15)	Total (25)	100
RAJAT KUMAR MAZUMDER	4	8	20	5	14	19	4	10	8	22	10	1	11	75
RAJA BABU	4		4	5	12	17	4	0		4	0	1	1	34
PUSHP RAJ ROY	4	6	16	6	13	19	4	0		4	0	2.5	3	49
PRIYANKA DAS	4	7	18	0	13	13	4	0	5	9	0	3	3	48
PRATUSHA GUPTA	4		4	0	13	13	4	0	2	6	0	2	2	33
PAULAMI GHOSH	5	6	17	1	12	13	5	0	5	10	0	2.5	3	47
NIRVESANKA ROY	4		4	7	12	19	4	10	7	21	0	2.5	3	50
NILRUDRA SARKAR	5	7	19	0	14	14	5	10	7	22	10	1.5	12	70
NEHA RANI	4	10	24	6	15	21	4	10	9	23	10	1.5	12	81
NAVA MALAKAR	5	7	19	4	12	16	5	0	7	12	10	2.5	13	64
MRINAL CHANDA	5	7	19	6	12	18	5	10		15	10	3.5	14	69
KUSHAL GURUNG	4	8	20	0	14	14	4	10	8	22	10	10	20	79
JOYDEB ROY	4	1	6	0	10	10	4	0		4	0	2.5	3	31
ISHITA ROY	4	6	16	0	12	12	4	0	4	8	0	2.5	3	45
DIPU DAS	4	8	20	5	14	19	4	10	8	22	10	2.5	13	77
DEBANGANA DAS	5	5	15	6	14	20	5	10	9	24	0	5.5	6	65
CHITRALEKHA CHOUHAN	5	7	19	0	12	12	5	10		15	0	4.5	5	55
CHHAYA KUMARI TUDDU	4	7	18	5	14	19	4	10		14	0	1.5	2	57
BINIT KUMAR YADAV	4		4	0	12	12	4	10		14	0	1	1	35
BASUDEB MOHANTA	4	8	20	0	14	14	4	10	5	19	10	4.5	15	72
BAPPADITYA SHOME	4	6	16	0	13	13	4	0	7	11	10	3	13	57
ARINDAM MONDAL	4	7	18	5	13	18	4	10	1	15	10	1	11	66
ANUSKA ROY	4	4	12	0	12	12	4	0	2	6	10	1.5	12	50
ANIRUDDHA CHAKI	5	7	19	9	14	23	5	10	7	22	10	10.5	21	88
AKASH SARKAR	5	4	13	0	13	13	5	10	2	17	0	4	4	51
AKASH PAUL	5	10	25	7	15	22	5	10	9	24	10	3	13	85
AISHIK BHATTACHARJEE	4	8	20	0	13	13	4	10	9	23	10	3.5	14	72

NAME	CA1 (25)			CA2 (25)			CA3 (25)				CA4 (25)			Grand Total (100)
	Attendance (5)	Quiz (10)	Total (25)	Quiz 1 (10)	Internal Exam (15)	Total (25)	Attendance (5)	Assignment (10)	Quiz 2 (10)	Total (25)	PPT (10)	2nd Internal Exam (15)	Total (25)	100
ABHISHEK DEY	4	2	8	0	10	10	4	0	3	7	0	1.5	2	34
ABHISEK SARKAR	5	1	7	0	10	10	5	10	4	19	10	1.5	12	52
ABHINABA ROY CHOUDHURY	5	5	15	0	12	12	5	10	9	24	10	1.5	12	64
ABHINAB TALUKDAR	5	10	25	7	15	22	5	10	9	24	10	4.5	15	87
SURAJIT CHANDA	4	10	24	4	15	19	4	10		14	0	3.5	4	65
SUJOY MODAK	5	5	15	8	12	20	5	10	1	16	0	1.5	2	56
SUDIPTA ROY	4	10	24	4	15	19	4	10	3	17	10	1.5	12	76
SUBRATA GOSWAMI	4		4	0	12	12	4	0		4	0	1.5	2	30
SOURAV MAJUMDER	4	10	24	3	15	18	4	0	8	12	10	2	12	70
SANCHARI GHOSH	5	10	25	6	15	21	5	10	10	25	10	2.5	13	84
SAJAN PRADHAN	5	10	25	11	15	26	5	10	9	24	10	6	16	92
PRITAM GAUTAM	5	9	23	10	15	25	5	10	9	24	10	4	14	87
HIMADRI DAS	4	9	22	3	15	18	4	10	3	17	10	1	11	72
GOURAB SARKAR	5	9	23	3	15	18	5	10	8	23	0	3	3	69
BISWAJIT KARMAKAR	5	3	11	6	12	18	5	10	7	22	0	3	3	57
BAPPADITYA BARMAN	5	10	25	5	15	20	5	10	8	23	0	2.5	3	73
ANAMIKA DUTTA	5	10	25	6	15	21	5	10	6	21	0	1.5	2	72
ABHRANEEL BHATTCHARJEE	4		4	5	10	15	4	10		14	0	1.5	2	38
UDAY ROY	5	10	25	6	15	21	5	10	9	24	10	5.5	16	87

NAME WITH ROLL NO.s OF STUDENT WHOSE ACADEMIC PERFORMACE IS NOT SATISFACTORY

Gr.	Roll No.	Name of Student	Remedial measures taken by teacher
ALL	11901616027	SANTANU NAG	<ul style="list-style-type: none">• Additional doubt clearing sessions beyond the class hours• Providing extra assignments to students.• Asking them to solve previous question papers.• Highlighting important and frequently asked questions
	11901616034	RAJA BABU	
	11901616037	PRATUSHA GUPTA	
	11901616046	JOYDEB ROY	
	11901616052	BINIT KUMAR YADAV	
	11901616062	ABHISHEK DEY	
	11901617004	SUBRATA GOSWAMI	
	11901617016	ABHRANEEL BHATTCHARJEE	

CERTIFICATE

I, the undersigned, have completed the course allotted to me as shown below

Sl. No.	Semester	Subject with Code	Total Units/ Chapters	Remarks
1	7th	Renewable & Non conventional Energy (EE704D)	09 Units	

Date :

Signature of Faculty

Submitted to HOD

Certificate by HOD

I, the undersigned, certify that *Prof. Jayanta Bhusan Basu* has completed the course work allotted to him / her satisfactorily / not satisfactorily.

Date :

Signature of HOD

Submitted to Principal/Director

Date :

Signature of Principal/Director

Student Feedback on Course Objectives & Outcomes

Faculty Prof. Jayanta Bhusan Basu

Semester 1st Year 4th

Course code EE-704D

Course Title Renewable & Non conventional Energy

Dear Students

This feedback that I intend to take from you is very precisely about fulfillment of course objectives and course outcomes. My course objectives and course outcomes are as follows that I had shared with you in the beginning of the semester, the same is repeated here.

Course Objectives

Students will acquire basic knowledge about current energy scenario, energy management, auditing and conservation.

Course Outcomes

The students will be able to:

- EE704D.1 Identify different Renewable and Non Renewable Energy Sources and realize their environmental impact (BT 2)
- EE704D.2 Illustrate Solar geometry and describe different methods of solar energy conversion. (BT 3)
- EE704D.3 Demonstrate knowledge about Working Principles of Wind Power generation and its application. (BT 3)
- EE704D.4 Explain generation & harnessing of power from Biomass, Geothermal, ocean energy. (BT 3)
- EE704D.5 Discuss about different direct energy conversion systems like MHD & Fuel cells. (BT 3)

The survey questions below has been designed to obtain your feedback so as to determine the extent of attainment of the intended course objectives and course outcomes.

1 = Poor 2= Good 3= Excellent

	Parameter	1	2	3
1.	The course description shared with me in the first week of the semester was adequate for me to understand what I should expect to achieve in the course			
2.	The course schedule through the semester was			
3.	The entire course contents were covered during the semester			
4.	How was your performance in the course			
5.	The relevance of this course to your career goals was			
6.	The work load for the course was			
7.	At the end of the semester the coverage of the stated course objectives and course outcomes by teacher was			
8.	The text books for the course were			
9.	Coverage of course beyond syllabus			
10.	The relevance of laboratory experiment to the course outcomes was:			
11.	Through the course, got the opportunity and confidence to:			
	<ul style="list-style-type: none">• Identify different Renewable and Non Renewable Energy Sources and realize their environmental impact (BT 2)			
	<ul style="list-style-type: none">• Illustrate Solar geometry and describe different methods of solar energy conversion. (BT 3)			
	<ul style="list-style-type: none">• Demonstrate knowledge about Working Principles of Wind Power generation and its application. (BT 3)			
	<ul style="list-style-type: none">• Explain generation & harnessing of power from Biomass, Geothermal, ocean energy. (BT 3)			
	<ul style="list-style-type: none">• Discuss about different direct energy conversion systems like MHD & Fuel cells. (BT 3)			
12.	The relevance of assignment to the course outcomes was:			
13.	The relevance of quiz to the course outcomes was:			
14.	The relevance of questions in internal exams to the course outcomes was:			
15.	The course was conducted in an interactive teaching-learning environment :			
16.	Your overall impression of this course, independent of the teacher, was			

Thank You

Department of EE

Quiz-1, 2019

Paper Name: RENEWABLE AND NON-CONVENTIONAL ENERGY

Paper Code: EE-704D,

Full Marks : 10

1. Which of these is not a renewable source of energy? EE704D.1
i. The sun **ii. Natural gas** iii. Wind iv. Tidal energy
2. Global warming is mainly caused due to EE704D.1
i. emission of heat from engines **ii. emission of CO₂ due to burning of fossil fuels**
iii. use of nuclear energy iv. air pollution
3. The materials that do not decay and remain in the environment called EE704D.1
i. biodegradable wastes ii. Garbage **iii. Non-biodegradable wastes** iv. Solid waste
4. The radiations absorbed by ozone layer are _____. EE704D.1
i. infra-red **ii. ultra-violet** iii. Visible iv. gamma rays
5. Direct Solar energy is used for EE704D.2
i. Water heating ii. Distillation iii. Drying **iv. All of the above**
6. Solar energy moves through space to the earth by EE704D.2
i. conduction ii. Convection **iii. radiation** iv. Transportation
7. Maximum efficiency is obtained in EE704D.2
i. Flat plate collector ii. Evacuated tube collector iii. Line focussing collector
iv. Paraboloid dish collector
8. Electrical output of a solar cell depends on EE704D.2
i. intensity of solar radiation ii. Heat component of solar radiation
iii. UV component of solar radiation iv. MIR component of solar radiation
9. Wind turbine uses EE704D.3
i. kinetic energy ii. Potential energy iii. Chemical energy iv. Thermal energy
10. A wind generator produces 5.0 kW of power for a wind speed of 6.0 m/sec . The best estimate for the power produced for a wind speed of 12.0 m/sec is EE704D.3
i. 10 kW ii. 25 kW **iii. 40 kW** iv. 125 kW.

Department of EE

Quiz-2, 2019

Paper Name: RENEWABLE AND NON-CONVENTIONAL ENERGY

Paper Code: EE-704D,

Full Marks : 10

1. Offshore wind farms are being seriously considered because _____. EE704D.3
 - i) they are more aesthetically pleasing
 - ii) they do not interfere with bird migration routes
 - iii) wind speeds are higher and turbulence is lower**
 - iv) maintenance costs are less than they are on land
2. Global Cold wind move from EE704D.3
 - i) Polar to equatorial region**
 - ii) Equatorial to polar region
 - iii) Equatorial to oceanic region
 - iv) Oceanic to Equatorial region
3. The molten rock within the earth is EE704D.4
 - i) Igneous
 - ii) Magma**
 - iii) Sedimentary
 - iv) Metamorphic
4. Floating generators are used in the sea to harness _____. EE704D.4
 - i) tidal energy
 - ii) wave energy**
 - iii) hydel energy
 - iv) energy from OTEC power plant
5. Hydrothermal fluids are _____ in nature. EE704D.4
 - i) Corrosive
 - ii) Abrasive
 - iii) Both (i) and (ii)**
 - iv) None of the above
6. Biogas is predominantly EE704D.4
 - i) Hydrogen
 - ii) carbon monoxide
 - iii) carbon dioxide
 - iv) methane**
7. Hydrogen can be used EE704D.5
 - i) as a primary energy source only
 - ii) as an energy carrier only**
 - iii) both as primary energy source as well as energy carrier
 - iv) neither as primary energy source as well as energy carrier
8. What do fuel cells emit? EE704D.5
 - i) Oxygen
 - ii) Hydrogen
 - iii) Nothing
 - iv) **Water**
9. When was the first fuel cell invented? EE704D.5
 - i) 1701
 - ii) 1901
 - iii) 1839**
 - iv) 1879
10. One difficulty with the process of using hydrogen as a power source is that it _____. EE704D.5
 - i) is not properly understood
 - ii) is less efficient than fossil fuels
 - iii) requires a fuel that is a nonrenewable resource
 - iv) requires an energy investment to begin the process**

Siliguri Institute of Technology
Department of Electrical Engineering
B. Tech. 4th Year 1st Semester 1st Internal Examination, 2019

Paper Name: Renewable & Non conventional Energy
Full Marks: 50

Paper Code: EE704D
Time: 1h 30m

Question 1. ANSWER ANY TWO (02) QUESTIONS

(EE704D.1)

5 X 2 = 10

- a. Discuss the advantages & limitations of renewable energy sources.
- b. Explain briefly the impact of conventional sources of energy on environment.
- c. Discuss the environmental impact due to power generation from solar energy
- d. Write a short note on Kyoto Protocol.

Question 2. ANSWER QUESTION NO. a AND ANY THREE(03) QUESTIONS FROM REST

(EE704D.2)

10+(5 X 3) = 25

- a. Choose the correct answer
 - (i) What is the standard value of solar constant
A. 1 kW/m² B. 1.367 kW/m² C. 1.5 kW/m² D. 5 kW/m²
 - (ii) At the inclination angle of 30°, what will be the magnitude of zenith angle?
A. 30° B. 120° C. 130° D. 60°
 - (iii) At solar noon, the hour angle is-
A. +90° B. -90° C. 0° D. +180°
 - (iv) Which is the most common material used for making solar cells
A. Silver B. Iron C. Aluminium D. Silicon
 - (v) Solar still is a device which is used for
A. heating of water B. Cooling of water C. distillation of water D. Production of electricity
- b. Define latitude, declination, hour angles with proper diagram
- c. Draw the equivalent circuit of a practical solar cell and describe its I-V characteristics.
- d. Write a short note on solar cooker
- e. With neat sketches, discuss important parts of flat plate solar collector.

Question 3. ANSWER QUESTION NO. a AND ANY TWO (02) QUESTIONS FROM REST

(EE704D.3)

6+(4.5X 2) = 15

- a. Choose the correct answer
 - (i) Horizontal axis and vertical axis are the types of:
A. Nuclear reactor B. Wind mills C. Biogas reactor D. Solar cell
 - (ii) The amount of energy available in the wind at any instant is proportional to ____ of the wind speed.
A. Square B. Square root iii. Cube iv. None of these
 - (iii) Wind turbine uses
A. kinetic energy B. Potential energy C. Chemical energy D. Thermal energy
- b. Discuss the main consideration in selecting site for wind generation.
- c. Define 'Betz Limit'.
- d. Discuss the advantages & disadvantages of WEC system

Siliguri Institute of Technology
Department of Electrical Engineering
B. Tech. 4th Year 1st Semester 2nd Internal Examination, 2019

Paper Name: Renewable & Non conventional Energy
Full Marks: 30

Paper Code: EE704D
Time: 1h

Question 1. Choose the correct answer (EE704D.4) 5 X 1 = 5

- (i) Which of the following fuels can be produced by fermenting sugar cane, sawdust, corn or wood
A. Alcohol B. Biogas C. Producer gas D. Bio-diesel
- (ii) The present estimated potential of small hydropower in our country is about
A. 15000 MW B. 12000 MW C. 11000 MW D. 10000 MW
- (iii) Biogas is predominantly
A. Hydrogen B. carbon monoxide C. carbon dioxide D. methane
- (iv) The temperature in the earth crust increases with depth at a rate of
A. 3000C/km B. 100C/km C. 10C/km D. 300C/km
- (v) The minimum tidal range required for power generation is about
A. 1 m B. 5 m C. 10 m D. 20 m

Question 2. ANSWER ANY TWO(02) QUESTIONS (EE704D.4) (5 X 2) = 10

- a. Write down the advantages & disadvantages of a tidal barrage scheme as a source of electrical power.
- b. Write short note on Biodiesel.
- c. Discuss the environmental effects of geothermal energy sources.
- d. Explain the principle of open cycle OTEC system with suitable diagram

Question 3. 7.5 X 2 = 15

- a. Describe the major components of a three bladed HAWT generator unit. (EE704D.3)
OR

Explain the types of generators used with wind turbines for producing electricity

- b. Briefly describe the production process of hydrogen through electrolysis of water with suitable diagram. (EE704D.5)

OR

Write short note on Alkaline fuel cell.

OR

Calculate the open circuit voltage and maximum power output of MHD engine with following specifications.

Plant area – 0.2 sq. m

Distance between plates – 0.4 m

Flux density – 2 Wb/sq.m.

Average gas velocity – 1000 m/s

Conductivity of gas – 10 mho/m

Siliguri Institute of Technology
Department of Electrical Engineering
 B. Tech. 4th Year 1st Semester, 2019

Paper Name: Renewable & Non conventional Energy

Paper Code: EE704D

ASSIGNMENT / TERM PAPER

SL	ROLL	NAME	TOPIC FOR TERM PAPER	TOPIC FOR PPT
1	11901616013	VEDANT SINGH SHANKAR	Scope of renewable energy in Siliguri City.	Solar Chimney.
2	11901616014	TAMALIKA DAS		
3	11901616015	TAMAL BISWAS		
4	11901616016	SUMAN DUTTA		
5	11901616017	SUBRATA PRAMANIK		
6	11901616018	SUBHENDU BISWAS	Comparative study of different types of generators used with wind turbines	Hydrogen as an alternative fuel for vehicles
7	11901616019	SUBHANKAR DAS		
8	11901616020	SUBHAJIT BARMAN		
9	11901616021	SUBARNA TRIBEDI		
10	11901616022	SRINJOY GHOSH		
11	11901616023	SOURAV THAPA	Biogas as a Sustainable Energy Source in India	Design principle and operation of fuel cell
12	11901616024	SAYANTANI DEY		
13	11901616025	SAYANI BHATTACHARJEE		
14	11901616026	SARVAJEET KUMAR		
15	11901616027	SANTANU NAG		
16	11901616028	SAMBHU ROY	Hydrogen storage methods	Wave energy conversion devices
17	11901616029	SAIBAL DAS		
18	11901616030	SAHIL RAI		
19	11901616031	RIYA SARKAR		
20	11901616032	RAKESH KUMAR NEOPANE		
21	11901616033	RAJAT KUMAR MAZUMDER	Concentrating solar power tower technology	MHD power generation
22	11901616034	RAJA BABU		
23	11901616035	PUSHP RAJ ROY		
24	11901616036	PRIYANKA DAS		
25	11901616037	PRATUSHA GUPTA		
26	11901616038	PAULAMI GHOSH	Energy storage and its importance in renewable energy	Double basin tidal power plants,
27	11901616039	NIRVESANKA ROY		
28	11901616040	NILRUDRA SARKAR		
29	11901616041	NEHA RANI		
30	11901616042	NAVA MALAKAR		
31	11901616043	MRINAL CHANDA		
32	11901616044	KUSHAL GURUNG		

SL	ROLL	NAME	TOPIC FOR TERM PAPER	TOPIC FOR PPT
33	11901616046	JOYDEB ROY	Role of renewable energy in smart cities.	Prospects of rooftop solar in India
34	11901616047	ISHITA ROY		
35	11901616048	DIPU DAS		
36	11901616049	DEBANGANA DAS		
37	11901616050	CHITRALEKHA CHOUHAN		
38	11901616051	CHHAYA KUMARI TUDDU		
39	11901616052	BINIT KUMAR YADAV	Importance of renewable energy in developing countries	Hybrid cycle Ocean Thermal Electric Conversion (OTEC)
40	11901616053	BASUDEB MOHANTA		
41	11901616054	BAPPADITYA SHOME		
42	11901616055	ARINDAM MONDAL		
43	11901616056	ANUSKA ROY		
44	11901616057	ANIRUDDHA CHAKI	Environmental impacts from the solar energy technologies	Biogas Digester
45	11901616059	AKASH SARKAR		
46	11901616060	AKASH PAUL		
47	11901616061	AISHIK BHATTACHARJEE		
48	11901616062	ABHISHEK DEY		
49	11901616063	ABHISEK SARKAR	Proton exchange membrane fuel cells (PEMFC)	Kyoto Protocol
50	11901616064	ABHINABA ROY CHOUDHURY		
51	11901616065	ABHINAB TALUKDAR		
52	11901617001	SURAJIT CHANDA		
53	11901617002	SUJOY MODAK		
54	11901617003	SUDIPTA ROY	Prospects of solar rooftop in India	Solar heating & cooling of buildings
55	11901617004	SUBRATA GOSWAMI		
56	11901617005	SOURAV MAJUMDER		
57	11901617007	SANCHARI GHOSH		
58	11901617008	SAJAN PRADHAN		
59	11901617009	PRITAM GAUTAM		
60	11901617011	HIMADRI DAS	Socio-economic and environmental impacts of renewable energy systems	Impact of renewable energy generation on environment
61	11901617012	GOURAB SARKAR		
62	11901617013	BISWAJIT KARMAKAR		
63	11901617014	BAPPADITYA BARMAN		
64	11901617015	ANAMIKA DUTTA		
65	11901617016	ABHRANEEL BHATTCHARJEE		
66	11901617081	UDAY ROY		

Siliguri Institute of Technology
Course Outcome Attainment
Course Code: EE-704D
Course Name: RENEWABLE AND NON CONVENTIONAL ENERGY

Record of Assesment Carried from different Sheets									
Total No of Students in the Class:			66						
S.No.	Exam	EE704D.1	EE704D.2	EE704D.3	EE704D.4	EE704D.5	Target	Overall Achievement	
1	1st Internal Exam	11	1	5			67%	6	
2	2nd Internal Exam			9	0	4	65%	4	
3	Assignments	29	29	29	29	29	66%	29	
4	Quize-1	39	39	39			67%	39	
5	Quize-2			34	34	34	65%	34	
	Average Internals	26	23	23	21	22	66%	23	

Record of Assesment Through Internals					
Course Outcome	Target Course Outcome%	TOTAL STUDENTS	TOTAL STUDENT WHO ATTAINED OUTCOME	% STUDENTS WHO ATTAINED THE OUTCOME	Attainment Level of Each Course Outcome
EE704D.1	70%	66	26	40%	1
EE704D.2	65%	66	23	35%	1
EE704D.3	65%	66	23	35%	1
EE704D.4	65%	66	21	32%	1
EE704D.5	65%	66	22	34%	1
EE503	66%	66	23	35.11%	1

Attainment Levels			
Attainment Level	Inference	Marks	Co-relation
Attainment Level 1	50% of the students have attained more than the target level of that CO	1	L
Attainment Level 2	60% of the students have attained more than the target level of that CO	2	M
Attainment Level 3	70% of the students have attained more than the target level of that CO	3	H

Record of Attainment Level of A Course through University and Internal Assessments					
	Target Course Outcome%	TOTAL STUDENTS	TOTAL STUDENT WHO ATTAINED OUTCOME	% STUDENTS WHO ATTAINED THE OUTCOME	Attainment Level
Internal Assessment	66%	66	23	35%	1
Assessment through University Exam					
Overall Attainment of Course Outcome					



Director
Siliguri Institute of Technology