SILIGURI INSTITUTE OF TECHNOLOGY

ELECTRONICS & COMMUNICATION ENGINEERING

COURSE FILE

1ST SEM, 3RD YEAR, ECE,2016

PAPER NAME : Analog Communication

PAPER CODE : EC 501 & EC 591

Course File

Course Title: **Analog communication (EC- 501) & analog communication Lab (EC- 591)**

Semester: 1st Year 3rd, 2016

Name of the Faculty: **Prof *Sudip Kumar Ghosh & Aritra De***

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Class Schedule:

Lecture		Tutorial	Practical	
Wednesday	**Thursday**	**Wednesday**	**Monday**	**Tuesday** –
10.50am – 11.40am (1L)	11.40am – 1.20pm (2L)	03.00pm – 03.50pm (GR-A1)1L 03.50pm – 04.40pm (GR-A2)1L	– 10.50am – 1.20pm (3L)	10.50am – 1.20pm (3L)

- An additional Lecture per week has been incorporated for facilitating better understanding and coverage of the syllabus.

Hours for meeting students:

Monday	Saturday	Other Days
3.00pm – 4.50pm	2.10pm – 4pm	1.30pm – 2pm or by appointment

i) Course Objective

Student will be able to analyze the concept of various continuous wave modulations and evaluate their performance.

ii) Course Outcomes

i. 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:

EC501	CO	Target
EC501.1	**Describe** the need for modulation and identify type of modulation to be used in analog communication system [B.T LEVEL 1]	60% marks
EC501.2	**Understand** about AM transmission and reception including noise	60% marks

	analysis [B.T LEVEL 2]	
EC501.3	**Understand** about FM transmission and reception including noise analysis [B.T LEVEL 2]	60% marks
EC501.4	**Apply** and relate the analog modulation and demodulation techniques to real time applications. B.T LEVEL 3]	60% marks
EC501.5	**Generate** various types of modulated signals and perform their basic operations [B.T LEVEL 5]	60% marks
EC501.6	**Design** the analog modulator and demodulator circuits in communication system [B.T LEVEL 6]	60% marks

ii) Once the student has successfully complete this course, he/she must be able to answer the following questions or perform/demonstrate the following:

Sl.	Question	BT Level
1.	**Explain** the basic block diagram of communication system	1
2.	**Calculate** maximum limit of transmission efficiency of an AM signal for a Single tone message.	3
3.	**Determine** I) Modulation index ii) Frequency present in the modulated signal iii) Total transmission power of a modulating signal is given by $V_m = 2 \sin (2\pi \times 500$ t) amplitude modulates a carrier signal given by $V_c = 10 \sin (2\pi \times 10\ 6$ t)	3
4.	**Calculate** the maximum limit of RC component of a envelope detector to avoid diagonal clipping	3
5.	**Draw** and Sketch the spectrum of DSB-FC and DSB-SC signal and show their bandwidth.	3
6.	**Design** 98.3MHz FM using indirect method	5
7.	**Evaluate** SNR of various AM and FM signal	5
8.	**Design** a FM Transmitter using IC 8038	6
9.	**Design** a FM demodulator using PLL	6
10.	**Design** a PLL using IC-565, whose free running frequency is 54 kHz (where $R_1 = 5.6$ kΩ) & draw the VCO linearity curve..	6

iii) Unit Layout

Unit	Lecture Hours	Tutorials	Laboratory hours
Mod-1 Introduction to Analog Communication	10 HRS	2 HR.	3 HR
Mod-2 Generation & Detection of Amplitude Modulation	9 HRS	2 HR.	12 HR
Mod-3 Angle Modulation	8 HRS	2HR.	9 HR
Mod - 4 Multiplexing Random Signals and Noise in Communication System	9 HRS	2 HR.	
Total	36 HRS	8 HR	24 HRS

iv)Textbooks

1. Taub and Schilling , "Principles of Communication Systems", 2nd ed., Mc-Graw Hill
2. B.P.Lathi -Communication Systems- BS Publications
3. V Chandra Sekar – Analog Communication- Oxford University Press

Reference Books:

4. Carlson—Communication System,4/e , Mc-Graw Hill
5. Proakis &Salehi Fundamentals of Communication Systems- Pearson
6. Singh & Sapre—Communication Systems: 2/e, TMH
7. P K Ghosh- Principles of Electrical Communications- University Press
8. L.W.Couch Ii, "Digital and Analog Communication Systems", 2/e, Macmillan Publishing
9. S Sharma, Analog Communication Systems- Katson Books

(v) Evaluation Scheme

1) Theory

Evaluation Criteria	Marks
Internal Exam*	15
QUIZ	10
Attendance	5
University Exam	70
Total	100

* Two internal examinations are conducted; based on those two tests, average of them are considered in a scale of 15.

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%

2) Laboratory

Evaluation Criteria	Marks
Internal Exam*	40
University Exam	60
Total	100

***** Internal Evaluation will be based on daily lab performance as per the following schedule:

Expt. No.	Experiment Name	Schedule	Marks
EXP1	Measurement of modulation index of an AM signal.	3 HRS	40
EXP2	Measurement of output power with varying modulation index an AM signal (for both DSB- & SSB).	3 HRS	40
EXP3	Measurement of distortion of the demodulated output with varying modulation index of an AM signal (for both DSB-SC & SSB).	3 HRS	40
EXP4	Generation of FM signal and measurement of Bandwidth	3 HRS	40
EXP5	Design a PLL using VCO & to measure the lock frequency	3 HRS	40
EXP6	Design a FM demodulator using PLL	3 HRS	40
EXP7	Measurement of selectivity ,sensitivity, fidelity of a superhetrodyne receiver	3 HRS	40
EXP 8	Measurement of SNR of a RF amplifier	3 HRS	40
EXP 9	Study of waveforms of various functional points (output of RF,IF & video) of a B/W TV receiver	3 HRS	40
EXP10	Study of the vertical & horizontal sweep of the time base unit of a B/W TV	3 HRS	40
EXP11	One innovative experiment	3 HRS	40

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

Overall Course Attainment Target (70% of university and 30% of the internal exam) will be = Attainment Level 3

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.

(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.		
EC501.1	2	2	0	0	0	0	0	0	0	0	0	0	2	0		
EC501.2	2	2	0	0	0	0	0	0	2	0	0	0	2	1		
EC501.3	2	2	0	0	0	0	0	0	2	0	0	0	2	2		
EC501.4	2	2	0	0	0	0	0	0	2	0	0	0	2	2		
EC501.5	2	2	0	0	0	0	0	0	2	0	0	0	2	2		
EC501.6	2	2	0	0	0	0	0	0	2	0	0	0	2	2		
EC501	2	2	0	0	0	0	0	0	2	0	0	0	2	1.8		

Justification:

- CO1 to co6partially satisfies with the application of knowledge of mathematics, science, engineering fundamentals to the solution of complex engineering problems (PO1).
- CO1, to co6 partially satisfies with Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and Electronics & Communication engineering sciences. (PO2).
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CO3 to co6 partially satisfies with the Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings (PO9)

(vii) Delivery Methodology

Outcome	Method	Supporting Tools	Demonstration
EC 501.1	Structured (partial ally Supervised)	Video Lecture, NPTEL materials	**Explain** the block diagram of basic communication, needs of modulation in a communication system and find the relation between antenna height and frequency.
EC 501.2	Structured (partial ally Supervised)	Video Lecture, NPTEL materials	**Explain** the types of AM system. **Application** of various AM systems.
EC 501.3	Structured (partial ally Supervised)	Video Lecture, NPTEL materials	**Explain** the types of FM system. Application of various FM systems.

EC 501.4	Structured (partial ally Supervised)	Video Lecture, NPTEL materials	**Evaluate** F.O.M of different AM and FM system.
EC 501.5	Structured (Partially Supervised Independent work)	hardware Based	**Generation** & detection of AM and measure the Modulation index. **Design** a FM Transmitter using IC 8038.
EC 501.6	Structured (Partially Supervised Independent work)	hardware Based	**Design** a FM receiver using PLL.

(viii) Assessment Methodology

Outcome	Assessment Tool	Specific Question / activity aligned to the Outcome
EC 501.1	Internal Test	1. explain the basic block diagram of communication 2. why modulation is needed in a communication system
	QUIZ	1.The length of the antenna to transmit a signal must be at least a) 1/3 wavelength b)1/4 wavelength c)2/3 wavelength d) 3/4 wavelength 2.
	University Exam	1. What are the basic components of a communication System? 2. Describe why modulation is necessary for Communication.
EC 501.2	Internal Test	1 A carrier signal $A_c \cos w_c t$ is amplitude modulated by a message signal $A_m \cos w_m t$ where $A_m < A_c$. Write down the expression for the modulated signal. Write down the expression for carrier component and side band components 2 What is envelope detector? Explain (with circuit diagram)? What is diagonal clipping? **3. Explain** the term quadrature-null effect? 4. **Calculate** SNR_0 in DSB-SC system
	QUIZ	1. The detection of an AM waveform in an Envelope – a.)One side band and full amplitude carrier are needed b.) Both side bands and full amplitude carrier are needed c). Only two side bands are needed d). Upper side band and part of carriers are needed 2 Noise figure is calculated as? a) i/p signal to noise ratio X o/p signal to noise ratio b) i/p S/N Ratio / O/P S/N Ratio c) i/p S/N Ratio / O/P S/N Ratio X 100 d) i/p S/N Ratio + O/P S/N Ratio 3. In AM transmission the frequency, which is not transmitted is (a) carrier frequency (b) audio frequency (c) upper side frequency (d) lower side frequency

	University Exam	1. Prove that the efficiency for a single tone AM is 33·33 % for perfect modulation. What will be the efficiency if the Value of modulation index is 0·5 ? 2. s (t) = 12 sin [6 × 108t + 5 sin 1250 t]. Calculate : (i) carrier frequency (ii) modulating frequency (iii) modulation index (iv) frequency deviation (v) Power dissipated in 10 Ohm resistor. 3. Define SNR and Noise Figure. Why is the noise performance of the first stage of a cascade receiver so important? If each stage of a two-stage cascade amplifier has a gain of 10 dB and noise figure of 10 dB, calculate the total noise figure in dB
EC 501.3	Internal Test	1. **Explain** with block diagram the Armstrong method of FM generation. **2.**. A single tone FM signal is given by $e_{FM} = 10 \sin (16\pi \times 10^6 t + 20 \sin 2\pi \times 10^3 t)$ volts. **Determine** modulation index, frequency deviation, bandwidth and carrier swing.
	QUIZ	1An FM radio receiver is tuned to a 90.6 MHz broadcast station. It will receive an image frequency of - a) 110 MHz b) 112 Hz c) 114 MHz d) 120 MHz 2. In a FM receiver, the channel bandwidth is around- a.) 10 KHz b.) 20 KHz c.) 75 KHz d.) 200 KHz 3. An FM transmitter has maximum frequency deviation of 75 KHz and reproduces audio signal up to 15 KHz. Minimum channel width required, in KHz is (a) 180 (b) 120 (c) 90
	University Exam	1. Explain with suitable block diagram the generation of FM signal using Armstrong method. 2. a) What is angle modulation ? b) Show that FM and PM are basically same 3. Explain FM demodulation scheme using PLL. Mention the advantages of PLL demodulator
EC 501.4	Internal Test	**1. Draw** and explain the block diagram of super-heterodyne receiver. What is image frequency?

		2.**explain** the characteristics of a super-heterodyne receiver
	QUIZ	1. An FM radio receiver is tuned to a 90.6 MHz broadcast station. It will receive an image frequency of - a) 110 MHz b) 112 Hz c) 114 MHz d) 120 MHz 2. In a FM receiver, the channel bandwidth is around- a.) 10 KHz b.) 20 KHz c.) 75 KHz d.) 200 KHz 3. In commercial FM broadcasting, the maximum frequency deviation is normally a. 5 KHz b. 15 KHz c. 75 KHz d. 200 KHz
	University Exam	1.**Draw** the block diagram of a super heterodyne receiver and explain the function of each block. 2. For a broadcast super heterodyne AM receiver having no RF amplifier, the loaded quality factor Q of the antenna coupling circuit is 100. Now if the intermediate frequency is 455 kHz, then determine the image frequency and its rejection ratio at an incoming frequencyof1MHz. 3.Write short notes on noise performance in FM system
EC 501.5	LAB	**1.Generate** AM signal and Measure the modulation index of a given modulated signal AM. (At least 5 different M.I. to be measured). Which type of demodulator is used to receive DSB-FC signal and why 2. **Draw** the sensitivity response curve of the super heterodyne receiver(using trainer kit ST-2202). Write the advantages of a super heterodyne receiver over TRF receiver
EC 501.6	LAB	**1. Design** a PLL using IC-565, whose free running frequency is 54 kHz (where R_1 = 5.6 kΩ) & draw the VCO linearity curve. Draw & explain the block diagram of PLL. **2**. **Design** a FM modulator using IC8038 and measure the modulation index and band width (BW) of the modulated signal applying a appropriate modulating signal from the function generator. Write the difference between NBFM &WBFM **3.Design** a PLL using IC-565, whose free running frequency is 54 kHz (where R_1 = 5.6 kΩ) & find the lock range & capture range and verify the observed value with calculated (theoretical) value .Define Lock range & Capture range

(ix) A. Weekly Lesson Plan

Week	Lectures	Tutorial	Laboratory
1	Elements of communication system. Modulation, its needs and types of modulation Double side band suppressed carrier (DSBSC) modulation	Review of signal and its spectrum.	Familiarization with spectrum analyzer
2	Synchronous detection for AM-SC. Amplitude modulation (AM-DSB/TC): Time domain	Calculation the height of antenna for different frequency and numerical. effect on synchronous demodulator in AM	Measurement of modulation index of an AM signal
3	Modulation index of AM, band width, calculation of transmitted power, AM-FC generation (Switching Modulator) and detection (envelope detector) using diode circuit.	Calculation of TRANSMISION power. Envelope detector and condition of avoid diagonal clipping.	Measurement of output power with varying modulation index an AM signal (for both DSB- & SSB).
4	FDM multiplexing, SSB-SC generation and detection .SSB-C Modulation, Basic concept of VSB modulation and applications. Numerical discussion on AM modulation.	Percentage of power saving of DSB-SC and uses of non linear devices and distortion due to synchronization.	Measurement of distortion of the demodulated output with varying modulation index of an AM signal (for both DSB-SC & SSB).
5	Super heterodyning principle, intermediate frequency, operation image frequency, numerical discussion on AM system. Multiplexing Angle modulation, Generation of FM direct and indirect (Armstrong) method.	Numerical discussion on AM modulation,	Generation of FM signal and measurement of Bandwidth
6	Demodulation of FM, Concept of frequency discriminators, Phase Locked Loop, FM Radio receiver, numerical discussion on angle modulation.	Super heterodyning receiver, image frequency calculation.	Design a PLL using VCO & to measure the lock frequency

7	Noise in Communication systems Noise performance in Analog Communication systems: SNR calculation for DSB-SC, SSB-SC,SSB-C	Design different carrier frequency for indirect method FM	Design a FM demodulator using PLL
8	Noise performance in DSB-FC and FM system.	Thermal noise, noise figure calculation for two port network.	Measurement of selectivity ,sensitivity, fidelity of a superhetrodyne receiver
9	Discussion of WBUT question papers, revision & doubt clpearing		Measurement of SNR of a RF amplifier
10	Discussion of WBUT question papers		Study of waveforms of various functional points (output of RF,IF & video) of a B/W TV receiver
11	Discussion of WBUT question papers		Study of the vertical & horizontal sweep of the time base unit of a B/W TV
12	Discussion of WBUT question papers		One innovative experiment

B. Daily Lesson Plan

UNIT: 1 Title: **Introduction to Analog communication** Day 1, Date: 03.08.2016 [10.50am to 11.40am]Wednesday
CONTENTS Discussion on course objectives and outcome, text & reference books, evaluation scheme and weekly lesson plan. Introduction to communication systems
Unit Objectives: Broad Objectives of the chapter/topic are: 1. To identify and differentiate the various types of communication systems 2. To recognize the various application areas of the course in diverse disciplines
Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities with Levels of Bloom's Taxonomy): 1. Define Signal and System, analog communication and digital communication [L1] 2. Identify the application areas of communication system. [L1]
Remarks, if any
Day 1, Date: 03.08.2016, Wednesday 03.00pm – 03.50pm (GR-A1)1L and 03.50pm – 04.40pm (GR-A2)1L
Tutoria1: 1. Explain different types of signal? 2. What is spectrum? How spectrum is formed? Find the Fourier transform of double-sided exponential function $e^{-a\|t\|}$ and draw its spectrum 3. What is unit-step signal and find the Fourier transform of its 4. Power of in the signal x(t)=8 cos(20Лt- Л/2) + 4 sin (15Лt) is (a) 40 (b) 41 (c) 42 (d) 82

UNIT: 1 Title: Introduction to Analog communication Day 2, Date: **04.08.2016** Thursday [11.40am – 1.20pm] (2L)
CONTENTS Elements of communication system -Transmitters, Transmission channels & receivers, Concept of

Modulation, its needs and types of modulation.

Unit Objectives:

Broad Objectives of the chapter/topic are:

1. To recognize, use, and analyze analog signal transmit ion over various elementary blocks of communication system.
2. To understand need for modulation of a communication system

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities with Levels of Bloom's Taxonomy):

1. Define continuous and discrete time signal. [L1]
2. What do you understand by wired communication and wireless communication? [L2]
3. What is the point to point communication and broadcasting? [L1]
4. Identify the application areas of analog communication system [L2]
5. Why modulation is needed in a communication system [L2]

Remarks, if any

UNIT: 1

Title: Introduction to Analog communication

Day 3, Date: 10.08.2016 [10.50am – 11.40am] Wednesday

CONTENTS:. Double side band suppressed carrier (DSBSC) modulation: generation and Detection with block diagram, time and frequency domain expressions, and bandwidth calculation.

Topic/Unit/Chapter Objectives:

Broad Objectives of the chapter/topic are:

1. To understand need for modulation of a communication system and suppressed carrier modulation

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities with Levels of Bloom's Taxonomy):

1. explain DSB-SC system [L2]
2. Identify the side band frequencies and carrier frequencies. [L3]

Remarks, if any

Day 3, Date: 10.08.2016, Wednesday 03.00pm – 03.50pm (GR-A1)1L and 03.50pm – 04.40pm (GR-A2)1L

Tutoria2:

1. Why different height of antenna is being required for transmission of various kind of signal?
2. To transmit 5 kHz information signal, what should be the size of antenna?
3. Explain co-herent and non coherent demodulation?
4. What effect on synchronous demodulator in AM if transmitted generated carrier signal are not identical with receiver generated carrier signal.

UNIT: 2
Title: Generation & Detection of Amplitude Modulation
Day 4, Date: 11.08.2016 Thursday [11.40am – 1.20pm] (2L)

CONTENTS
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, Calculation of Transmitted power & sideband power & Efficiency; concept of under, over and critical modulation of AM-DSB-TC and AM-SC.

Unit Objectives:
Broad Objectives of the chapter/topic are:
1. To understand the time domain and frequency domain nature of tone AM and how much power is being required to transmit AM signal.

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities with Levels of Bloom's Taxonomy):
1. Deduce the expression of transmission efficiency. [L1]
2. How much power is being wastage for transmission of carrier signal? [L2]
3. What is range of modulation index? [L1]
4. Describe AM modulation [L1]
5. Deduce the expression for single tone AM signal [L2]

Remarks, if any

UNIT: 2
Title: Generation & Detection of Amplitude Modulation
Day 5, Date: 17.08.2016 [10.50am to 11.40am]Wednesday

CONTENTS: AM-FC generation using diode circuit (Switching Modulator).

Unit Objectives:
Broad Objectives of the chapter/topic are:
1. To understand the generation and detection of AM using diode circuit.

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities with Levels of Bloom's Taxonomy):
1. What is switching modulator? [L1]
2. How AM can be generated using non linear device? [L1]

Remarks, if any

Day5, Date: 17.08.2016, Wednesday 03.00pm – 03.50pm (GR-A1)1L and 03.50pm – 04.40pm (GR-A2)1L

Tutoria3:

Tutorial 3: Calculation of power of various AM signal.

1. Calculate the transmission efficiency of an AM signal when the signal is modulated in a depth of 50% and

100%.

2. How much power is being wastage for transmission of carrier signal? Draw the spectrum of AM signal in variation of different modulation index.
3. Numerical discussion on AM .

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UNIT: 2
Title: Generation & Detection of Amplitude Modulation
Day 6, Date: 18.08.2016 Thursday [11.40am – 1.20pm] (2L)

CONTENTSAM-SC generation using diode circuit. (Balanced Modulator) ,Demodulation of AM signals: Detection of AM by envelope detector , Multiplexing, Frequency Division Multiplexing

Unit Objectives:
Broad Objectives of the chapter/topic are:

1. To understand the asynchronous demodulation process of AM signal& multiple signal transmission over common channel.
2. To understand the generation of AM using diode circuit

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities with Levels of Bloom's Taxonomy):
1. What is asynchronous demodulation? [L2]
2. What is the advantage of asynchronous demodulation over synchronous demodulation? [L2]
3. What is FDM system? [L2]
4. What is balanced modulator? Why is called balanced? [L2]
5. explain the operation of modulator [L2]

Remarks, if any

UNIT: 2
Title: Generation & Detection of Amplitude Modulation
Day 7, Date: 24.08.2016 [10.50am to 11.40am]Wednesday

CONTENTS
Single side band modulation (SSB) both TC & SC. Generation of SSB: Filter method

Unit Objectives:
Broad Objectives of the chapter/topic are:
1. Understand the generation of single side band

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities with Levels of Bloom's Taxonomy):
1. what is SSB-SC and SSB-TC[L2]
2. advantage of SSB-SC over other AM modulation[L1]

3. What is selective filtering method? [L2]

Remarks, if any

Day7, Date: 24.08.2016, Wednesday 03.00pm – 03.50pm (GR-A1)1L and 03.50pm – 04.40pm (GR-A2)1L

Tutorial 4:

: Percentage of power saving of DSB-SC and uses of non linear devices and distortion due to synchronization.

1. Calculate the % of power saving of a DSB-SC signal when the signal is modulated in a depth of 50% and 100%.
2. What is balanced modulator? Why is it called balanced?
3. Why nonlinear device produce DSB-FC signal.
4. What is envelope detection? What is diagonal clipping? Find the value of RC to avoid diagonal clipping

UNIT: 2
Title: Generation & Detection of Amplitude Modulation
Day 8, Date: 18.08.2016 Thursday [11.40am – 1.20pm] (2L)

CONTENTS Generation of SSB: Phase shift method, Basic concept of VSB, Spectra and band-width and power calculation.

Unit Objectives:
Broad Objectives of the chapter/topic are:
1. Understand the basic concept vestigial side.

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities with Levels of Bloom's Taxonomy):
1. Define VSB [L1]
2. Why is VSB used for TV broadcasting? [L2]

Remarks, if any

UNIT: 2
Title: Generation & Detection of Amplitude Modulation
Day 9, Date: 24.08.2016 [10.50am to 11.40am]Wednesday

CONTENTS Super heterodyning principle, intermediate frequency, Local oscillator frequency, image frequency

Unit Objectives:
Broad Objectives of the chapter/topic are:
1. Understand the selectivity, sensitivity, [L1]
2. Understand the mixing [L1] 3. Understand the IF and Image frequency. [L1]

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities with Levels of Bloom's Taxonomy):

1. What is mixing? [L1]
2. which block are responsible for selectivity and sensitivity.[L2]

Remarks, if any

Day9, Date: 24.08.2016, Wednesday 03.00pm – 03.50pm (GR-A1)1L and 03.50pm – 04.40pm (GR-A2)1L

Tutorial 5:

Tutorial 5:Numerical discussion on AM modulation

1. In AM system carrier power is 400mw and total power is 600mw. Calculate the modulation index.
2. A single tone AM wave has a modulation in due of 100% what is the saving in power if the carrier component is removed to yield DSB-SC signal
   a.31.25% b.75.81 c.50% d. 66.67%

3.A modulating signal is given by $V_m = 2 \sin (2\pi \times 600\, t)$ amplitude modulates a carrier signal given by $V_C = 5 \sin (2\pi \times 100\, t)$. Determine

i) Modulation index ii) Frequency present in the modulated signal iii) Total transmission power iv) Band width.

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UNIT: 3

Title: Angle modulation

Day 10, Date: 31.08.2016 [10.50am to 11.40am]Wednesday

CONTENTS Frequency Modulation (FM) and Phase Modulation (PM): Time and Frequency domain representations, Spectral representation of FM for a single tone

Generation of FM : Basic block diagram representation of generation of FM ,NBFM

Unit Objectives:

Broad Objectives of the chapter/topic are:

1. understand about narrowband FM and identify side band frequency

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities with Levels of Bloom's Taxonomy):

1. What NBFM? [L1]
2. Define FM signal. [L1]
3. Conversion between FM and PM [L2].

Remarks, if any

Day10, Date: 31.08.2016, Wednesday 03.00pm – 03.50pm (GR-A1)1L and 03.50pm – 04.40pm (GR-A2)1L

Tutorial 6:

Tutorial 6: Super heterodyning receiver, image frequency calculation.

1. Compare TRF receiver with super heterodyning receiver.
2. What is IF?
3. What is image frequency? How to reject image frequency.
4. What is the propose of the AGC circuit in the receiver?
5. What type of coupling is used in the RF & IF section of the Super-het-Receiver?

UNIT: 3 Title: Angle modulation **Day 11, Date: 01.09.2016 Thursday [11.40am – 1.20pm] (2L)**
CONTENTS Single tone FM and PM, Wide-band angle modulation, Bessel's functions and Fourier series. Generation of FM: direct method (VCO), Generation of FM: indirect method.
Unit Objectives: Broad Objectives of the chapter/topic are: 1. Understand about single tone FM and PM.
Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities with Levels of Bloom's Taxonomy): 1. Find the relation between FM and PM. [L3] 2. what is frequency deviation **[L2]** 3. Explain Armstrong Method. [L3] 4. Convert NBFM to WBFM. [L3]
Remarks, if any

UNIT: 3 Title: Angle modulation **Day 12, Date 07.09.2016 [10.50am to 11.40am]Wednesday**
CONTENTS Demodulation of FM, slope detection method, Concept of frequency discriminators .
Unit Objectives: Broad Objectives of the chapter/topic are: 1. Understand the extracting of demodulated signal using slope detection and discriminators.
Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities with Levels of Bloom's Taxonomy): 1. what is slope detection method[L3] 2. what is nonlinear distortion [L2]
Remarks, if any
Day12, Date: 07.09.2016, Wednesday 03.00pm – 03.50pm (GR-A1)1L and 03.50pm – 04.40pm (GR-A2)1L
Tutorial 7: Design different carrier frequency for indirect method FM 1. Explain with block diagram the Armstrong method of FM generation.

2. Design radio HIGH FM using indirect method. Where deviation Δf_1 = 25 Hz, carrier f_{c1}=200 KHz are given of a NBFM signal.
3. When the modulating frequency in an FM system is 500 Hz, the modulating voltage is 2.4 volt, β = 50, calculate the frequency deviation. What will be the modulation index when modulating frequency is reduced to 250 Hz & modulating voltage is raised to 4 volt
4. Consider a single tone FM signal with peak frequency deviation of 5 kHz and frequency modulation sensitivity $k_f = 10^4$ Hz/Volt. Let the modulating signal frequency be 1 kHz and the carrier frequency be 100 kHz. a) Obtain the FM index β, b) What is the FM transmission bandwidth? C) Is this NBFM or WBFM? Why

UNIT: 3
Title: FM demodulation
Day 13, Date: 08.09.2016 Thursday [11.40am – 1.20pm] (2L)

CONTENTS
Discriminator, foster-seeley discriminator. Phase Locked Loop ,demodulation of FM using PLL, FM Radio receiver

Unit Objectives:
Broad Objectives of the chapter/topic are:
1 Understand the demodulation of FM signal using phase shift discriminator and PLL .

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities with Levels of Bloom's Taxonomy):

1. What is the discriminator? [L1]
2. Explain the foster seeley discriminator. [L2]
3. Advantage of discriminator over slope detector. [L2]
4. what is free running frequency, [L1]
5. What is lock range, capture range? [L2]
6. How FM can be demodulated using PLL? [L2]

Remarks, if any

UNIT: 4
Title: Random signal and noise in communication system
Day 14, Date 14.09.2016 [10.50am to 11.40am]Wednesday

CONTENTS: Basic concepts with block diagrams, Noise in Communication systems – Internal & External noise, Noise Temperature, Signal-to-Noise ratio, White noise, thermal noise, Figure of Merit

Unit Objectives:
Broad Objectives of the chapter/topic are:
1. Understand the various type of noise.

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities with Levels of Bloom's Taxonomy):
1. What noise?. [L1]
2. What is white noise? Thermal noise? [L2]
3.waht is noise temperature [L2]

Day14, Date: 14.09.2016, Wednesday 03.00pm – 03.50pm (GR-A1)1L and 03.50pm – 04.40pm (GR-A2)1L

Tutorial 8:

Tutorial 8: Thermal noise, noise figure calculation for two port network.

1. In a radio receiver an RF amplifier and mixer are connected in cascade mode. The amplifier has a noise figure of 10db and the power gain of 15 db. The noise figure of the mixer stage is 20 db .calculate overall noise figure referred to the input.

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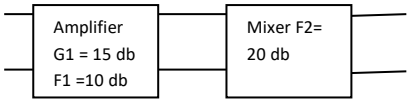


2. Explain the effect of R-C low pass filter on noise

UNIT: 4
Title: Random signal and noise in communication system

Day 15, Date: 15.09.2016 Thursday [11.40am – 1.20pm] (2L)

CONTENTS
Noise performance in Analog Communication systems: SNR calculation for DSB-SC and SSB-SC .

Unit Objectives:
Broad Objectives of the chapter/topic are:
1. Knowledge on SNR calculation for DSB-SC,

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities with Levels of Bloom's Taxonomy):
1. What do you mean by Gaussian noise? [L1]
2. What is band pass noise? [L1]
3. Calculate SNR & F.O.M of coherent DSBSC system. [L5]

Remarks, if any

UNIT: 4
Title: Random signal and noise in communication system
Day 16, Date 21.09.2016 [10.50am to 11.40am]Wednesday

CONTENTS
Noise performance in Analog Communication systems: SNR calculation for DSB-FC

Unit Objectives:
Broad Objectives of the chapter/topic are:
1. Knowledge on SNR calculation for SSB-FC and SSB-SC system.

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities with Levels of Bloom's Taxonomy):
1. What do you mean by theresold effect of envelope detection? [L1]
2. Calculate SNR & F.O.M of non-coherent DSBFC and co-herent SSB-SC system [L1]

Remarks, if any

Day14, Date: 21.09.2016, Wednesday 03.00pm – 03.50pm (GR-A1)1L and 03.50pm – 04.40pm (GR-A2)1L

Tutorial 9:

Tutorial 9: University question paper discussion on Various Communication

UNIT: 4
Title: Random signal and noise in communication system
Day 15, Date: 15.09.2016 Thursday [11.40am – 1.20pm] (2L)

CONTENTS
Noise performance in Analog Communication systems: CNR calculation for FM.

Unit Objectives:
Broad Objectives of the chapter/topic are:
1. Knowledge on random variable & process

Once the student has completed this topic/ chapter he/she will be able to answer following questions/perform the following activities with Levels of Bloom's Taxonomy):
1. What do you mean by carrier to noise ratio? [L1]
2. Write short notes on Pre-emphasis and De-emphasis. [L1]
3. Explain effect on noise in FM system for low CNR case. [L2]

Remarks, if any

(x) Teaching Strategy/Method

1. **Real-World" Learning**
2. Learning by memorizing and understanding
3. Solving numerical
4. Interactive sessions.

(xa) Strategy to support weak students

1. Frequently asked Question
2. mentor to student
3. Merging of weak students with bright students.
4. Doubt clear session

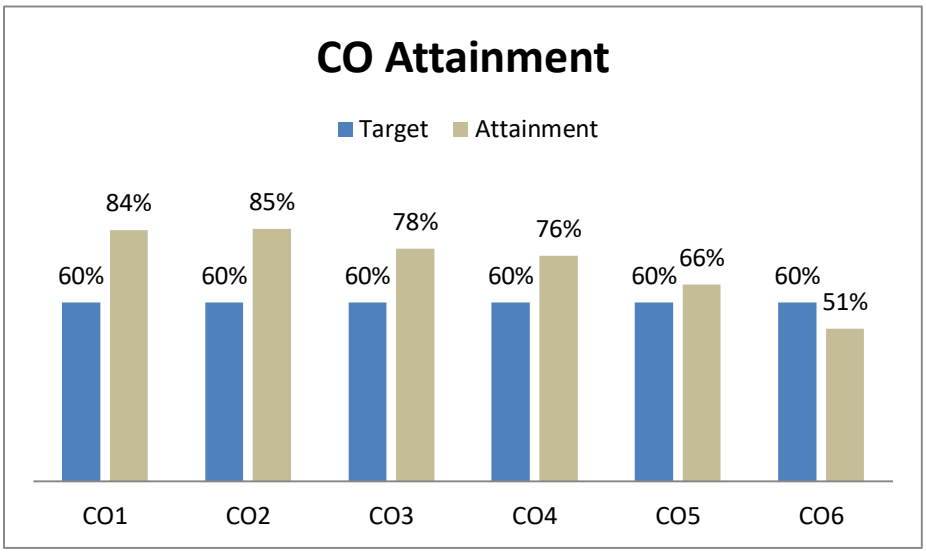
(xb) Strategy to encourage bright students

1. Award to good student.(References books are given to good students)
2. Motivate for higher study..
3. Complex numerical discuss on completion of each module
4. Encourage students to participate in different tech fest.

(xc) Efforts to keep students engaged

1. Assign them for class presentation.
2. Searching of real life application from the internet after discussion of each topic/unit.
3. Motivate student to prepare GATE Exam.

(xi) Analysis of Students performance in the course (Internal Results)

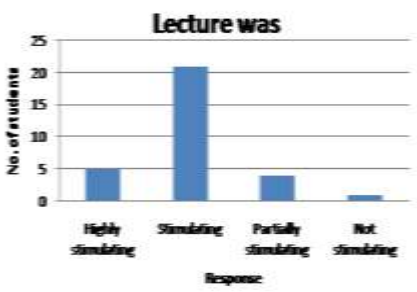


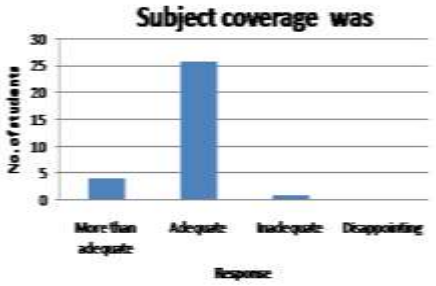
- 84% students have attained the set target of 60% marks for CO1
- 85% students have attained the set target of 60% marks for CO2
- 78% students have attained the set target of 60% marks for CO3
- 76% students have attained the set target of 60% marks for CO4
- 66% students have attained the set target of 60% marks for CO5
- 51% students have attained the set target of 60% marks for CO6

(xii) Analysis of Students performance in the course (University Results)

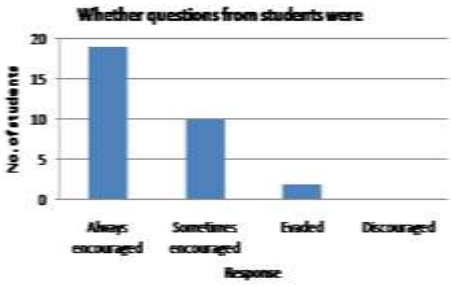
As per NBA SAR Example given in 3.2.2: Record of Attainment Level of A Course through University and Internal Assessments					
	Target Course Outcome%	**TOTAL STUDENTS**	**TOTAL STUDENT WHO ATTAINED OUTCOME**	**% STUDENTS WHO ATTAINED THE OUTCOME**	**Attainment Level**
University	65%	41	35	84%	3
Overall Attainment of Course Outcome=70% University +30% Internals					3.0

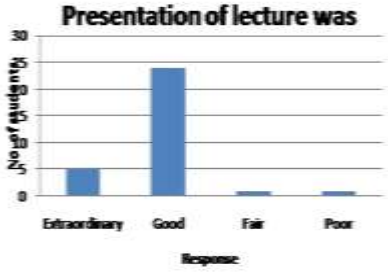
(xiii) Analysis of Student Feed Back

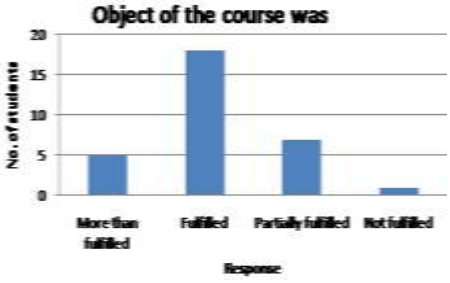

Lecture was
No. of students
25
20
15
10
5
0
Highly stimulating
Stimulating
Partially stimulating
Not stimulating
Response


Subject coverage was
No. of students
30
25
20
15
10
5
0
More than adequate
Adequate
Inadequate
Disappointing
Response


Nature of Delivery was
No. of students
20
15
10
5
0
Very clear
Clear
Difficult to follow
Impossible to follow
Response


Whether questions from students were
No. of students
20
15
10
5
0
Always encouraged
Sometimes encouraged
Evaded
Discouraged
Response


Presentation of lecture was
No. of students
30
25
20
15
10
5
0
Extraordinary
Good
Fair
Poor
Response


Object of the course was
No. of students
20
15
10
5
0
More than fulfilled
Fulfilled
Partially fulfilled
Not fulfilled
Response

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

From the graphical analysis of the results obtained it can be seen that most of the course outcome have been achieved successfully by the students. More prominence should be given to clear the concepts related to frequency domain analysis and concept of filer to understand the analog communication system.

(xv) Recommendations/Suggestions for improvement by faculty

1. Mat lab program should be included in Lab to understand the modulated signal and their spectrum to understand analog communication.
2. Pulse type analog modulation should be included in Analog communication to understand Digital communication

Evaluation Number	Subject	Schedule	Marks
EXP1	Measurement of modulation index of an AM signal.	3 HRS	5
EXP2	Measurement of output power with varying modulation index an AM signal (for both DSB- & SSB).	3 HRS	5
EXP3	Measurement of distortion of the demodulated output with varying modulation index of an AM signal (for both DSB-SC & SSB).	3 HRS	5
EXP4	Generation of FM signal and measurement of Bandwidth	3 HRS	5
EXP5	Design a PLL using VCO & to measure the lock frequency	3 HRS	6
EXP6	Design a FM demodulator using PLL	3 HRS	7
EXP7	Measurement of selectivity ,sensitivity, fidelity of a superhetrodyne receiver	3 HRS	7

INTERNAL ASSESMENT RECORD

Subject with code: Analog communication (EC- 501) Semester : 5th sem, 2016

Discipline: ELECTRONICS & COMMUNICATION ENGINEERING

Sl. No.	Roll No.	Attendance		Internal exam Marks				Quiz (10)	Total (30)
		Total (%)	Marks (5)	1st Internal (30)	2nd Internal (30)	Average (30)	Internal marks (15)		
1	**ABHIJEET KUMAR**	0%	1	0	0	0	0	0	1
2	AMBIKA CHAKRABORTY	82%	5	20	11	15.5	7.75	9	21.75
3	ANASUYA BHATTACHARJEE	89%	5	16	20	18	9	6	20
4	ANKITA SAHA	79%	5	30	26	28	14	8	27
5	ANKUR CHAKRABORTY	89%	5	20	21	20.5	10.25	6	21.25
6	ARNAB DAS	96%	5	19	19	19	9.5	8	22.5
7	ARPAN SARKAR	89%	5	19	23	21	10.5	8	23.5
8	BHISHMA DEB ROY	0%	1	0	0	0	0	0	1
9	BISHAL JAIN	75%	5	22	20	21	10.5	10	25.5
10	CHAMPA PAUL	89%	5	25	24	24.5	12.25	8	25.25
11	GAUTAM CHANDRA DEY	75%	5	22	22	22	11	10	26
12	JAYANTIKA MITRA	86%	5	24	24	24	12	9	26
13	JUI GHOSH	96%	5	23	21	22	11	8	24
14	KAJAL KUMARI	93%	5	29	26	27.5	13.75	10	28.75

15	KARAN SAHA	86%	5	23	21	22	11	7	23
16	KOUSIK PURKAIT	86%	5	24	22	23	11.5	8	24.5
17	MEGHNA KARMAKAR	89%	5	27	20	23.5	11.75	8	24.75
18	PARTHA PROTIM SARKAR	0%	1	0	0	0	0	0	1
19	PIYALI PAUL	76%	5	0	22	11	5.5	10	20.5
20	PRITHIRAJ DUTTA	79%	5	22	20	21	10.5	9	24.5
21	PRIYANKA BHADRA	89%	5	22	22	22	11	9	25
22	RAJDEEP BHATTACHARJEE	76%	5	24	0	12	6	8	19
23	RATUL PAUL	76%	5	21	19	20	10	7	22
24	RISHAV MAZUMDER	76%	5	20	22	21	10.5	7	22.5
25	ROMITA CHOWDHURY	83%	5	20	24	22	11	7	23
26	RUNNU KUMARI	86%	5	21	19	20	10	8	23
27	SARANSH CHOUDHARY	75%	5	30	26	28	14	10	29
28	SARITA KUMARI	79%	5	24	20	22	11	9	25
29	SAYAN KUNDU	86%	5	21	23	22	11	9	25
30	SAYANTANY ROY	93%	5	20	21	20.5	10.25	9	24.25
31	SHUBHAM CHAKRABARTY	79%	5	16	22	19	9.5	8	22.5
32	SIRSHA DAS	82%	5	29	18	23.5	11.75	9	25.75
33	SOUMYA CHATTERJEE	89%	5	22	23	22.5	11.25	6	22.25
34	SOUMYADEV BANDOPADHYAY	93%	5	19	21	20	10	8	23
35	SOURODIP DEY	89%	5	18	23	20.5	10.25	7	22.25
36	SUBHRA PAL	82%	5	17	21	19	9.5	8	22.5
37	SUBRATA SARKAR	82%	5	19	20	19.5	9.75	9	23.75

38	SWAPNIL PRADHAN	86%	5	26	20	23	11.5	8	24.5
39	SWETA MITRA	86%	5	21	26	23.5	11.75	10	26.75
40	VAIBHAV SINGH	76%	5	19	21	20	10	8	23
41	PINAK PRODHAN	0%	1	0	0	0	0	0	1

ATTENDANCE SHEET (Lecture)

Hard copy to be submitted

Subject with code:_____ Date:_____ Section:_____

S.No.	Name	Roll No.																				
1.																						
2.																						
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35.																						

LIST OF PRACTICALS

Subject with code: Analog communication (EC- 501) Semester : 5th sem, 2016

Discipline: ELECTRONICS & COMMUNICATION ENGINEERING

Sl.	Details of Experiment(s)	Hours allotted
EXP1	Measurement of modulation index of an AM signal.	3 HRS
EXP2	Measurement of output power with varying modulation index an AM signal (for both DSB- & SSB).	3 HRS
EXP3	Measurement of distortion of the demodulated output with varying modulation index of an AM signal (for both DSB-SC & SSB).	3 HRS
EXP4	Generation of FM signal and measurement of Bandwidth	3 HRS
EXP5	Design a PLL using VCO & to measure the lock frequency	3 HRS
EXP6	Design a FM demodulator using PLL	3 HRS
EXP7	Measurement of selectivity ,sensitivity, fidelity of a superhetrodyne receiver	3 HRS

ATTENDANCE SHEET (Practical)

Subject with code: Analog communication (EC- 501) Semester : 5th sem, 2015

Discipline: ELECTRONICS & COMMUNICATION ENGINEERING

ATTENDANCE SHEET (Practical)

Subject with code: Analog Communication Lab (EC591) Sem: 5th sem ECE Group: GRA

S.No.	Name	Roll No.	1	2	3	4	5	6	7	8	9	TOTAL= 9
1.	ANKITA SINGH	11900313002	1	1	1	1	1	1	1			7
2.	APURBA ROY	11900313003	1	1	1	1	1	1	1			7
3.	ARNAV GHOSH	11900313004	1	1	1	1	1	1	1			7
4.	ARUNDHUTEE DUTTA	11900313005	1	1	1	1	1	1	1			7
5.	AVEEK SAHA	11900313006	1	1	1	1	1	1	1			7
6.	AVERI RAY	11900313007	1	1	1	1	1	1	1			7
7.	AYANTIKA DEY	11900313008	1	1	1	1	1	1	1			7
8.	BIKKY ROKA	11900313009	1	1	1	1	1	1	1			7
9.	BIKRAM CHAKRABORTY	11900313010	1	1	1	0	1	1	1			6
10.	DEBABRATA BANERJEE	11900313011	1	1	1	1	1	1	1			7
11.	DEBASHISH MUKHERJEE	11900313012	1	1	1	1	1	1	1			7
12.	DHRITIKANA DAS	11900313014	1	1	1	1	1	1	1			7
13.	DIBAKAR SAHA	11900313015	1	1	0	1	1	1	1			7
14.	DIPAYAN BHATTACHARYA	11900313016	1	1	1	1	1	1	1			7
15.	DISHA MANDAL	11900313017	1	1	1	1	1	1	1			7

16.	KUNDAN KUMAR CHOURASIA	11900313019	1	1	1	1	1	1	1			7
17.	MANORANJAN KUMAR	11900313020	1	1	1	1	1	1	1			7
18.	MAYANK KUMAR	11900313021	1	1	1	1	1	1	1			7
19.	MD NASIR KHAN	11900313022	1	1	1	1	1	1	1			7
20.	MONA	11900313023	1	1	1	1	1	1	1			7
21.	MUNNA PRASAD KOIRI	11900313024	1	1	1	1	1	1	1			7
22.	NAVIN KUMAR	11900313025	1	1	1	1	1	1	1			7
23.	NIDHI PRIYA	11900313026	1	1	1	1	1	1	1			7
24.	PANKAJ GUPTA	11900313028	1	1	1	1	1	1	1			7
25.	PARTHA SARMA	11900313029	1	1	1	1	1	1	1			7
26.	PRADYUT DATTA	11900313030	1	1	1	1	1	1	1			7
27.	PRAGATI KUMARI	11900313031	1	1	1	1	1	1	1			7
28.	PRAGYA ROY CHOWDHURY	11900313032	1	1	1	1	1	1	1			7
29.	PRANOY DAS	11900313033	1	1	1	1	1	1	1			7
30.	PRAVEEN KUMAR OJHA	11900313034	1	1	1	1	1	1	1			7
31.	Souvik Bose	11900314044	0	1	0	1	0	1	1			4

LAB PERFORMANCE RECORD

Subject with code: Analog communication (EC- 501) Semester : 5th sem, 2015

Discipline: ELECTRONICS & COMMUNICATION ENGINEERING

LAB PERFORMANCE RECORD

Subject Analog Communication Lab Code EC591

Semester 5th sem GR A Discipline ECE

S.No.	Name	Roll No.	Marks in experimentation								
			1	2	3	4	5	6	7		TOTAL (40)
1.	ANIRBRATA DAS	11900313001									
2.	ANKITA SINGH	11900313002	3	2	4	3	2	4	4		22
3.	APURBA ROY	11900313003	2	2	1	1	3	3	3		15
4.	ARNAV GHOSH	11900313004	2	1	2	1	3	3	3		15
5.	ARUNDHUTEE DUTTA	11900313005	4	4	4	3	4	3	3		25
6.	AVEEK SAHA	11900313006	4	4	4	4	4	3	3		26
7.	AVERI RAY	11900313007	5	5	6	6	6	5	5		38
8.	AYANTIKA DEY	11900313008	4	4	5	5	4	4	4		30
9.	BIKKY ROKA	11900313009	4	3	4	4	3	3	3		24
10.	BIKRAM CHAKRABORTY	11900313010	5	4	5	x	5	4	4		27
11.	DEBABRATA BANERJEE	11900313011	5	5	6	6	5	5	5		37
12.	DEBASHISH MUKHERJEE	11900313012	2	3	3	2	3	2	3		18
13.	DHRITIKANA DAS	11900313014	4	4	5	4	6	5	2		30
14.	DIBAKAR SAHA	11900313015	3	4	4	3	5	4	4		27
15.	DIPAYAN BHATTACHARYA	11900313016	4	4	5	5	3	5	4		30

16.	DISHA MANDAL	11900313017	5	4	5	4	5	6	5		34
17.	KUNDAN KUMAR CHOURASIA	11900313019	4	4	4	4	4	4	4		28
18.	MANORANJAN KUMAR	11900313020	4	4	5	5	4	4	4		30
19.	MAYANK KUMAR	11900313021	4	4	5	5	4	4	5		31
20.	MD NASIR KHAN	11900313022	3	3	4	3	5	3	3		25
21.	MONA	11900313023	4	4	5	4	5	5	3		30
22.	MUNNA PRASAD KOIRI	11900313024	4	4	4	5	5	4	4		30
23.	NAVIN KUMAR	11900313025	5	5	6	6	5	6	5		38
24.	NIDHI PRIYA	11900313026	4	4	3	4	4	3	3		25
25.	PANKAJ GUPTA	11900313028	5	5	5	5	6	6	6		38
26.	PARTHA SARMA	11900313029	3	3	3	3	3	3	2		20
27.	PRADYUT DATTA	11900313030	5	5	5	5	6	6	6		38
28.	PRAGATI KUMARI	11900313031	4	4	5	5	5	3	4		30
29.	PRAGYA ROY CHOWDHURY	11900313032	5	5	5	5	5	4	4		33
30.	PRANOY DAS	11900313033	4	4	5	5	5	3	3		29
31.	PRAVEEN KUMAR OJHA	11900313034	5	5	5	5	6	6	6		38
32.	Souvik Bose	11900314044	X	4	X	5	X	6	5		20

Records of Quiz

Subject with code: Analog communication (EC- 501)

Semester : 5th sem, 2015

Discipline: ELECTRONICS & COMMUNICATION ENGINEERING

S.No.	Name	Roll No.	QUIZ
1.	ANKITA SINGH	11900313002	1
2.	APURBA ROY	11900313003	1
3.	ARNAV GHOSH	11900313004	1
4.	ARUNDHUTEE DUTTA	11900313005	1
5.	AVEEK SAHA	11900313006	1
6.	AVERI RAY	11900313007	1
7.	AYANTIKA DEY	11900313008	1
8.	BIKKY ROKA	11900313009	1
9.	BIKRAM CHAKRABORTY	11900313010	1
10.	DEBABRATA BANERJEE	11900313011	1
11.	DEBASHISH MUKHERJEE	11900313012	1
12.	DHRITIKANA DAS	11900313014	1
13.	DIBAKAR SAHA	11900313015	1
14.	DIPAYAN BHATTACHARYA	11900313016	1
15.	DISHA MANDAL	11900313017	1

16.	KUNDAN KUMAR CHOURASIA	11900313019	1
17.	MANORANJAN KUMAR	11900313020	1
18.	MAYANK KUMAR	11900313021	1
19.	MD NASIR KHAN	11900313022	1
20.	MONA	11900313023	1
21.	MUNNA PRASAD KOIRI	11900313024	1
22.	NAVIN KUMAR	11900313025	1
23.	NIDHI PRIYA	11900313026	1
24.	PANKAJ GUPTA	11900313028	1
25.	PARTHA SARMA	11900313029	1
26.	PRADYUT DATTA	11900313030	1
27.	PRAGATI KUMARI	11900313031	1
28.	PRAGYA ROY CHOWDHURY	11900313032	1
29.	PRANOY DAS	11900313033	1
30.	PRAVEEN KUMAR OJHA	11900313034	1
31.	Souvik Bose	11900314044	1

TUTORIAL RECORD

Subject with code: Analog communication (EC- 501) Semester : 5th sem, 2016

Discipline: ELECTRONICS & COMMUNICATION ENGINEERING

TUTORIAL PERFORMANCE RECORD

Subject Analog Communication Code EC501

Semester 5th sem Discipline ECE

S.No.	Name		Tutorial class									
			T1	T 2	T 3	T 4	T 5	T 6	T 7	T8	T9	Total =8
1	**ABHIJEET KUMAR**		0	0	0	0	0	0	0	0	0	0
2	AMBIKA CHAKRABORTY		1	1	1	1	1	0	1	1	1	8
3	ANASUYA BHATTACHARJEE		1	1	1	1	1	1	1	1	1	9
4	ANKITA SAHA		1	1	1	1	1	1	1	1	1	9
5	ANKUR CHAKRABORTY		1	1	1	1	1	1	1	1	0	8
6	ARNAB DAS		1	1	1	1	1	1	1	1	0	8
7	ARPAN SARKAR		1	1	1	1	1	0	1	1	0	7
8	BHISHMA DEB ROY		0	0	0	0	0	0	0	0	0	0
9	BISHAL JAIN		1	1	0	1	1	1	0	1	1	7
10	CHAMPA PAUL		1	1	1	1	1	1	1	1	1	9
11	GAUTAM CHANDRA DEY		1	1	1	1	0	0	1	1	1	7
12	JAYANTIKA MITRA		1	1	1	1	1	1	1	1	0	8
13	JUI GHOSH		1	1	1	1	1	1	1	1	1	9
14	KAJAL KUMARI		1	1	1	1	1	1	1	1	1	9
15	KARAN SAHA		1	1	1	0	1	1	1	0	1	7

16	KOUSIK PURKAIT		1	1	1	1	1	1	1	1	1	9
17	MEGHNA KARMAKAR		1	1	1	1	1	1	1	1	0	8
18	PARTHA PROTIM SARKAR		0	0	0	0	0	0	0	0	0	0
19	PIYALI PAUL		1	1	1	1	1	1	1	0	1	8
20	PRITHIRAJ DUTTA		1	1	1	1	1	1	1	1	1	9
21	PRIYANKA BHADRA		1	1	1	1	1	1	1	1	1	9
22	RAJDEEP BHATTACHARJEE		1	1	1	1	1	1	1	1	1	9
23	RATUL PAUL		1	1	1	0	1	1	0	0	1	6
24	RISHAV MAZUMDER		1	1	0	1	1	1	1	0	0	6
25	ROMITA CHOWDHURY		0	1	1	1	1	0	1	1	1	7
26	RUNNU KUMARI		0	1	1	1	1	1	1	0	1	7
27	SARANSH CHOUDHARY		1	1	1	1	1	1	1	1	1	8
28	SARITA KUMARI		1	1	1	1	1	1	0	0	1	6
29	SAYAN KUNDU		1	1	1	1	1	1	1	1	1	8
30	SAYANTANY ROY		0	1	1	1	1	1	0	1	0	6
31	SHUBHAM CHAKRABARTY		1	0	1	0	1	1	1	1	1	7
32	SIRSHA DAS		1	1	1	1	1	1	1	1	1	9
33	SOUMYA		0	1	1	1	1	1	0	1	0	6

	CHATTERJEE											
34	SOUMYADEV BANDOPADHYAY		0	1	1	1	1	1	0	1	1	7
35	SOURODIP DEY		0	1	1	1	1	1	0	1	0	6
36	SUBHRA PAL		0	1	1	1	1	1	0	1	0	6
37	SUBRATA SARKAR		0	1	1	1	1	1	1	1	1	8
38	SWAPNIL PRADHAN		1	1	1	1	1	1	1	1	1	9
39	SWETA MITRA		0	1	1	1	1	1	0	1	1	7
40	VAIBHAV SINGH		0	1	1	1	1	1	1	1	1	8
41	PINAK PRODHAN		0	0	0	0	0	0	0	0	0	0

NAME WITH ROLL Nos. OF STUDENT WHOSE ACADEMIC PERFORMANCE IS NOT SATISFACTORY			
Sl.	**Name of Student**	**Roll No**	**Remedial measures taken by teacher**
1.	ABHIJEET KUMAR	11900314001	• Additional doubt clearing sessions • Providing extra time to students with poor attendance. • Guiding them through previous question papers • Highlighting important and frequently asked questions
2.	RAJDEEP BHATTACHARJEE	11900314024	
3.	PARTHA PROTIM SARKAR	11900314020	
4.	PINAK PRODHAN	11900315066	
5.	BHISHMA DEB ROY	11900314008	

CERTIFICATE

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

Sl. No.	Semester	Subject with Code	Total Units	Remarks
1.	5th	**Analog communication (EC- 501)** & **Analog communication** Lab. (EC591)	04	

Date :	**Signature of Faculty**

Submitted to HOD

Certificate by HOD

I, the undersigned, certify that **Prof.Sudip kumar Ghosh** & ***Aritra De*** has completed the course work allotted to him satisfactorily / not satisfactorily.

Date :	**Signature of HOD**

Submitted to Director

Date :	Director Siliguri Institute of Technology **Signature of Director**