INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE DESCRIPTOR

Course Title	**ANALOG COMMUNICATIONS LABORATORY**				
Course Code	AECB16				
Programme	B. Tech				
Semester	IV	ECE			
Course Type	Core				
Regulation	IARE - R18				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	-	-	-	3	1.5
Chief Coordinator	Mr. G Kiran Kumar, Assistant Professor				
Course Faculty	Dr.P.Munasamy, Professor Mrs. G Ajitha, Assistant Professor Mrs.P.Saritha, Assistant Professor				

I. COURSE OVERVIEW:

The main objective of this lab is to understand basic theories of analog communication system to design and implement analog modulator and demodulator and understand the applications of analog modulator and demodulator circuits, and to investigate signals in time and frequency domain. Students construct and analyze circuits on analog communication transmitter and receiver. Students conduct experiments to understand the signals available at different stages of AM and FM receivers. The objective of this course is to familiarize the students with different blocks in digital communication by constructing and then testing different digital modems and codec.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
-	-	-	-	-

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Analog Communications Laboratory	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✘	Chalk & Talk	✘	Quiz	✘	Assignments	✘	MOOCs
✔	LCD / PPT	✔	Seminars	✘	Mini Project	✔	Videos
✔	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day to day performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being Internal Examiner and the other being External Examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS.

The emphasis on the experiments is broadly based on the following criteria:

20 %	To test the preparedness for the experiment.
20 %	To test the performance in the laboratory.
20 %	To test the calculations and graphs related to the concern experiment.
20 %	To test the results and the error analysis of the experiment.
20 %	To test the subject knowledge through viva – voce.

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Table 1: Assessment pattern for CIA

Component	Laboratory		Total Marks
Type of Assessment	Day to day performance	Final internal lab assessment	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):

One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

Preparation	Performance	Calculations and Graph	Results and Error Analysis	Viva	Total
2	2	2	2	2	10

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Calculations of the observations
PO2	**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	2	Lab Exercises/ Student Viva
PO5	**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.	2	Design Exercises

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	Professional Skills: An ability to understand the basic concepts in Electronics & Communication Engineering and to apply them to various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of complex systems.	3	Lab related Exercises
PSO 2	Problem-Solving Skills: An ability to solve complex Electronics and communication Engineering problems, using latest hardware and software tools, along with analytical skills to arrive cost effective and appropriate solutions.	-	-

	Program Specific Outcomes (PSOs)	Strength	Proficiency assessed by
PSO 3	Successful Career and Entrepreneurship: An understanding of social-awareness & environmental-wisdom along with ethical responsibility to have a successful career and to sustain passion and zeal for real-world applications using optimal resources as an Entrepreneur.	-	-

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES :

The course should enable the students to:	
I	Study various modulation techniques in communications.
II	Visualize various spectrums using spectrum analyzer.
III	Observe receiver characteristics.
IV	Understand the importance of AGC and VCO.

IX. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AECB16.01	CLO 1	Generation of amplitude modulation and demodulation using hardware and MATLAB	PO1, PO2	3
AECB16.02	CLO 2	Generation of AM-Double Side Band Suppressed Carrier (DSB-SC) signal using Balanced Modulator.	PO1, PO2	3
AECB16.03	CLO 3	To generate AM-Double Side Band Suppressed Carrier (DSB-SC) signal using Ring Modulator.	PO1, PO2	3
AECB16.04	CLO 4	Generation of single side band suppressed carrier modulation and demodulation using hardware and MATLAB	PO1, PO2	3
AECB16.05	CLO 5	Verification of sampling theorem for under, perfect, over sampling cases using hardware and MATLAB.	PO1, PO5	2
AECB16.06	CLO 6	Generation of frequency modulation and demodulation using hardware and MATLAB	PO1, PO2	2
AECB16.07	CLO 7	Verification of pre-emphasis and de-emphasis to boost high frequency modulating signal using hardware and MATLAB	PO5	1
AECB16.08	CLO 8	Generation of the frequency division multiplexing and demultiplexing circuit and to verify its operation	PO1, PO2	2
AECB16.09	CLO 9	To study the theoretical and practical values of	PO1, PO2	2

		capture range and lock range of phase locked loop.		
AECB16.10	CLO 10	To study the operation of frequency synthesizer using PLL.	PO1, PO2	2
AECB16.11	CLO 11	To study the operation of Time-Division multiplexing	PO1, PO5	3
AECB16.12	CLO 12	To study the AGC Characteristics and obtain the mixer characteristics of a super heterodyne receiver.	PO1, PO2	1
AECB16.13	CLO 13	To obtain the mixer characteristics of a super heterodyne receiver.	PO1, PO2	2
AECB16.14	CLO 14	To study the spectral analysis Of AM and FM signals using spectrum analyzer	PO1, PO2	2

3= High; 2 = Medium; 1 = Low

X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	3	3											3		
CLO 2	3	3											3		
CLO 3	3	3											3		
CLO 4	3	3											3		
CLO 5	3				2								2		
CLO 6	2	2											2		
CLO 7		2			1								2		
CLO 8		2			2								2		
CLO 9	3	2											2		
CLO 10		2											2		
CLO 11	3				3								2		
CLO 12	1	1											3		
CLO 13	2	2											3		
CLO 14	2	2											3		

3 = High; 2 = Medium; 1 = Low

XI. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	-	SEE Exams	-	Lab Exercises	PO 1, PO 2, PO 5	Seminars	PO 5
Laboratory Practices	-	Student Viva	-	Mini Project	-	Certification	-

XII. ASSESSMENT METHODOLOGIES – INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✘	Assessment of Mini Projects by Experts		

XIII. SYLLABUS

WEEK-1	**AMPLITUDE MODULATION AND DEMODULATION**
Generation of amplitude modulation and demodulation using hardware and MATLAB.	
WEEK-2	**DSB-SC MODULATOR & DETECTOR**
Generation of AM-Double Side Band Suppressed Carrier (DSB-SC) signal using Balanced Modulator.	
WEEK-3	**GENERATION OF DSBSC USING RING MODULATION OBSERVATION OF OUTPUT WAVEFORM**
To generate AM-Double Side Band Suppressed Carrier (DSB-SC) signal using Ring Modulator.	
WEEK-4	**SSB-SC MODULATOR & DETECTOR (PHASE SHIFT METHOD)**
Generation of single side band suppressed carrier modulation and demodulation using hardware and MATLAB.	
WEEK-5	**SAMPLING THEOREM VERIFICATION**
Verification of sampling theorem for under, perfect, over sampling cases using hardware and MATLAB.	
WEEK-6	**FREQUENCY MODULATION AND DEMODULATION**
Generation of frequency modulation and demodulation using hardware and MATLAB.	
WEEK-7	**PRE-EMPHASIS & DE-EMPHASIS**
Verification of pre-emphasis and de-emphasis to boost high frequency modulating signal using hardware and MATLAB.	
WEEK-8	**FREQUENCY DIVISION MULTIPLEXING & DE MULTIPLEXING**
Generation of the frequency division multiplexing and demultiplexing circuit.	
WEEK-9	**TIME DIVISION MULTIPLEXING & DE MULTIPLEXING**
To study the operation of Time-Division multiplexing and demultiplexing circuit.	
WEEK-10	**AGC CHARACTERISTICS AND CHARACTERISTICS OF MIXER**
To study the AGC Characteristics and obtain the mixer characteristics of a super heterodyne receiver.	
WEEK-11	**PHASE LOCKED LOOP AND FREQUENCY SYNTHESIZER**
To compare the theoretical and practical values of capture range and lock range of phase locked loop and study the operation of frequency synthesizer using PLL.	
WEEK-12	**SPECTRAL ANALYSIS OF AM AND FM SIGNALS USINGSPECTRUM ANALYZER**
To study the spectral characteristics of AM and FM using spectrum analyzer.	

TEXT BOOKS:
1. S. S. Haykin, "Communication Systems", Wiley Eastern, 2nd Edition, 2006. 2. Taub, Schilling, "Principles of Communication Systems", Tata McGraw Hill, 4th Edition, 2013.
REFERENCE BOOKS:
1. B.P. Lathi, "Communication Systems‖, BS Publication", 2nd Edition, 2006. 2. John G. Proakis, Masond, Salehi, "Fundamentals of Communication Systems", PEA, 1st Edition, 2006. 3. George Kennedy, Bernard Davis, "Electronics and Communication System", Tata McGraw Hill, 5th Edition, 2011.
WEB REFERENCES:
1. http://www.web.eecs.utk.edu 2. https://everythingvtu.wordpress.com 3. http://nptel.ac.in/ 4. http://www.iare.ac.in

XIV. COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

Week No.	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Generation of amplitude modulation and demodulation using hardware and MATLAB.	CLO 1	T1,T2
2	Generation of AM-Double Side Band Suppressed Carrier (DSB-SC) signal using Balanced Modulator.	CLO 2	T1,T2
3	To generate AM-Double Side Band Suppressed Carrier (DSB-SC) signal using Ring Modulator.	CLO 3	T1,T2
4	Generation of single side band suppressed carrier modulation and demodulation using hardware and MATLAB.	CLO 4	T1,R1
5	Verification of sampling theorem for under, perfect, over sampling cases using hardware and MATLAB.	CLO 5	T1,R1
6	Generation of frequency modulation and demodulation using hardware and MATLAB.	CLO 6	T1,T2
7	Verification of pre-emphasis and de-emphasis to boost high frequency modulating signal using hardware and MATLAB.	CLO 7	T1,T2,R1, R2
8	Generation of the frequency division multiplexing and demultiplexing circuit.	CLO 8	T1,T2
9	To study the operation of Time-Division multiplexing and demultiplexing circuit.	CLO 9	T1,T2,R1, R2
10	To study the AGC Characteristics and obtain the mixer characteristics of a super heterodyne receiver.	CLO 10	T1,T2
11	To compare the theoretical and practical values of capture range and lock range of phase locked loop and study the operation of frequency synthesizer using PLL.	CLO 11	T1,T2,R1, R3
12	To study the spectral characteristics of AM and FM using spectrum analyzer.	CLO 12	T1,T2,R1, R3

XV. GAPS IN THE SYLLABUS-TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S.No	Description	Proposed Actions	Relevance With PO's	Relevance With PSO's
1.	Simulation of analog modulation and demodulation schemes using NI LABVIEW	Laboratory Sessions	PO 5	PSO 1
2.	Observe the receiver frequency domain representation using spectrum analyzer.	Laboratory Sessions	PO 1, PO 2	-

Prepared by: **HOD, ECE**

Mr. G Kiran Kumar, Assistant Professor