IINSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE DESCRIPTOR

Course Title	SIGNALS AND SYSTEMS LABORATORY			
Course Code	AECB17			
Programme	B.Tech			
Semester	IV	ECE		
Course Type	Core			
Regulation	IARE - R18			
	Lectures	**Tutorials**	**Practical**	**Credits**
	-	-	2	1
Course Coordinator	Mrs. V.Bindusree, Assistant professor			
Course Faculty	Mr. Sundeep, Assistant professor Mrs. S.Swathi, Assistant professor Mrs. K.C.Koteswaramma, Assistant professor			

I. COURSE OVERVIEW:

The course aims at practical experience with the generation and simulation of basic signals, using standardized environments such as MATLAB. Experiments cover fundamental concepts of basic operation on matrices, generation of various signals and sequences, operation on signals and sequences, convolution, autocorrelation and cross correlation between signals and sequences. The objective of this laboratory is to enable the students to acknowledge with basic signals, and system responses. They can critically analyze the behavior of their implementation, and observe the specific limitations inherent to the computational platform like MATLAB.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites	Credits
UG	AECB08	III	PROBABILITY THEORY AND STOCHASTIC PROCESSES	4

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
SIGNALS AND SYSTEMS LABORATORY	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONALMETHODOLOGIES:

✘	CHALK & TALK	✔	VIVA	✘	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 labassessment.

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 AREASSESSED:

Program Outcomes (POs)		**Strength**	**Proficiency assessedby**
PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Lab related Exercises
PO 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	Lab related Exercises/Mini projects

Program Outcomes (POs)		Strength	Proficiency assessedby
PO 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**.**	2	Term observations
PO 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.	3	Lab related Exercises

3= High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	**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.	2	Lab related exercises.
PSO2	**Problem-Solving Skills:** An ability to solve complex Electronics and communication Engineering problems, using latest hardware and software tools, along with analytical skillsto arrive cost effective and appropriate solutions.	2	Lab related exercises.
PSO3	**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.	2	Lab related exercises-

3= High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES:

The course should enable the students to:	
I	Understand the basics of MATLAB
II	Simulate the generation of signals and operations on them.
III	Illustrate Gibbs phenomenon
IV	Analyze the signals using Fourier, Laplace and Z transforms.

IX. COURSE OUTCOMES(COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Understand the applications of MATLAB and to generate matrices of various dimensions.	CLO 1	Understand Basics of MATLAB syntax, functions and programming.

CO 2	Generate the various signals and sequences and perform operations on signals.	CLO 2	Analyze the generation Various Signals and Sequences in MATLAB
		CLO 3	Perform various operations on the signals including Time shifting, Scaling, Reversal, Amplitude Scaling.
		CLO 4	Verify Gibbs Phenomenon and understand the concept of Fourier series of a signal.
CO 3	Obtain the frequency domain representation of signals and sequences using Fourier transform, Laplace and z-transform.	CLO 5	Compute the Fourier Transform of a given signal and plotting its magnitude and phase spectrum
		CLO 6	Verification of time shifting and time reversal properties of Fourier Transform
		CLO 7	Synthesis the waveform using laplace Transform
		CLO 8	Remember for Locating the Zeros and Poles and plotting the Pole-Zero maps Z-Plane for the given transfer function.
CO 4	Understand the concept of convolution and correlation	CLO 9	Determine the Convolution between Signals and sequences.
		CLO 10	Determine the Correlation between Signals and sequences.
CO 5	Generation of various types of noise and measuring various characteristics of noise.	CLO 11	Generation of Gaussian noise (Real and Complex), Computation of its mean, M.S. Value and its Skew
		CLO 12	Verification of Weiner-Khinchine Relations i.e. Auto Correlation and Power Spectral Density forms Fourier transform pair.
		CLO 13	Draw Distribution and density functions of standard random variables.
		CLO 14	Analyze and synthesize different signals for a wide application range.

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

Course Outcomes (COs)	Program Outcomes (POs)						
	PO1	PO2	PO4	PO5	PSO1	PSO2	PSO3
CO 1	3			3			
CO 2	2	2	3		3		
CO 3		3	2				1

Course Outcomes (COs)	Program Outcomes (POs)						
	PO1	PO2	PO4	PO5	PSO1	PSO2	PSO3
CO 4			2	3			
CO 5	2	2	3	2		2	

3= High; 2 = Medium; 1 = Low

XI. 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
AECB17.01	CLO 1	Understand Basics of MATLAB syntax, functions and programming	PO1 PO5	3
AECB17.02	CLO 2	Analyze the generation Various Signals and Sequences in MATLAB	PO 1, PO2	2
AECB17.03	CLO 3	Perform various operations on the signals including Time shifting, Scaling, Reversal, Amplitude Scaling.	PO2, PSO1	2
AECB17.04	CLO 4	Verify Gibbs Phenomenon and understand the concept of Fourier series of a signal.	PO2 PO4	2
AECB17.05	CLO 5	Compute the Fourier Transform of a given signal and plotting its magnitude and phase spectrum	PO 2 PO 4	3
AECB17.06	CLO 6	Verification of time shifting and time reversal properties of Fourier Transform	PO 2 PO 4	3
AECB17.07	CLO 7	Synthesis the waveform using laplace Transform	PO 4	3
AECB17.08	CLO 8	Remember for Locating the Zeros and Poles and plotting the Pole-Zero maps Z-Plane for the given transfer function.	PO4 PSO3	3
AECB17.09	CLO 9	Determine the Convolution between Signals and sequences.	PO4 PO 5	3
AECB17.10	CLO 10	Determine the Correlation between Signals and sequences.	PO 4	3
AECB17.11	CLO 11	Generation of Gaussian noise (Real and Complex), Computation of its mean, M.S. Value and its Skew	PO2	3
AECB17.12	CLO 12	Verification of Weiner-Khinchine Relations i.e. Auto Correlation and Power Spectral Density forms Fourier transform pair.	PO4 PO5	2
AECB17.13	CLO 13	Draw Distribution and density functions of standard random variables.	PO4	2
AECB17.13	CLO 14	Analyze and synthesize different signals for a wide application range.	PO 1 PO 2	3

3= High; 2 = Medium; 1 = Low

XII. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFICOUTCOMES:

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

3 = High; 2 = Medium; 1 = Low

XIII. ASSESSMENT METHODOLOGIES–DIRECT

CIE Exams	PO 1, PO2,PO4, PO5,PSO1, PSO2,PSO3	SEE Exams	PO 1, PO2,PO4, PO5,PSO1, PSO2,PSO3	Assignments	-	Seminars	-
Laboratory Practices	PO 1, PO2,PO4, PO5,PSO1, PSO2,PSO3	Student Viva	PO 1, PO2,PO4, PO5,PSO1, PSO2,PSO3	Mini Project	-	Certification	-
Term Paper	-						

XIV. ASSESSMENT METHODOLOGIES-INDIRECT:

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

XV. SYLLABUS:

WEEK-1	**BASIC OPERATIONS ON MATRICES**
Review basic operations on matrices by using MATLAB	
WEEK-2	**GENERATIN OF VARIOUS SIGNALS AND SEQUENCE**
Generation of various signals and sequences such as unit impulse, sinc, Gaussian, exponential, saw tooth, triangular, sinusoidal by using MATLAB.	
WEEK-3	**OPERATION ON SIGNALS AND SEQUENCES**
Operation on signals and sequences such as addition, subtraction, multiplication, scaling, shifting, folding by using MATLAB	
WEEK-4	**GIBBS PHENOMENON**
Verification of Gibbs phenomenon by using MATLAB	
WEEK-5	**FOURIER TRANSFORMS AND INVERSE FOURIER TRANSFORM**
Finding the Fourier Transform and inverse Fourier transform of a given signal/sequence and plotting its magnitude and phase spectrum by using MATLAB.	
WEEK-6	**PROPERTIES OF FOURIER TRANSFORMS**
Verifying Time shifting and scaling, time and differentiation properties of Fourier transforms by using MATLAB.	
WEEK-7	**LAPLACE TRANSFORMS**
Finding the Laplace transform of a given signal and locate its zeros and poles in s-plane.	
WEEK-8	**Z-TRANSFORMS**
Finding the z - transform of a given sequence and locate its zeros and poles in z-plane.	
WEEK-9	**CONVOLUTION BETWEEN SIGNALS AND SEQUENCES**
Finding convolution between two signals /sequences by using MATLAB.	
WEEK-10	**AUTO CORRELATION AND CROSS CORRELATION**
Finding auto correlation and cross correlation between signals and sequences by using MATLAB	

WEEK-11	GAUSS IAN NOISE
Generation of Gaussian noise, computation of its mean, M.S. value and its Skew, kurtosis, and PSD, probability distribution function by using MATLAB.	
WEEK-12	**WIENER – KHINCHINE RELATIONS**
Verification of wiener – Khinchine relations using MATLAB.	
WEEK-13	**DISTRIBUTION AND DENSITY FUNCTIONS OF STANDARD RANDOM VARIABLES**
Finding distribution and density functions of standard random variables and plot them by using MATLAB	
WEEK-14	**WIDE SENSE STATIONARY RANDOM PROCESS.**
Checking a random process for stationary in wide sense by using MATLAB.	

Reference Books:

1. S. Varadarajan , M. M. Prasada Reddy , M. Jithendra Reddy , "Signals and systems introduces MATLAB programs", I K International Publishing House Pvt. Ltd, 2016.
2. Scott L. Miller, Donald G. Childers, "Probability and Random Processes: With Applications to Signal Processing and communications", Elsevier, 2004.
3. KristerAhlersten, "An Introduction to Matlab", BookBoon, 2012.
4. K. S. Suresh Kumar, "Electric Circuit Analysis", Pearson Education, 1st Edition, 2013.

Web References:

1. http://in.mathworks.com/help/matlab
2. http://web.mit.edu/acmath/matlab/course16/16.62x/16.62x_Matlab.pdf
3. https://www.probabilitycourse.com/chapter12/Chapter_12.pdf
4. http://www.iare.ac.in

XVI. COURSEPLAN:

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	Generate basic operations on matrices by using MATLAB	CLO 1	R1
2	Generation of various signals and sequences such as unit impulse, sinc, Gaussian, exponential, saw tooth, triangular, sinusoidal by using MATLAB.	CLO 2	R1
3	Operation on signals and sequences such as addition, subtraction, multiplication, scaling, shifting, folding by using MATLAB	CLO 3	R4
4	Verification of Gibbs phenomenon by using MATLAB	CLO 4	R2
5	Finding the Fourier Transform and inverse Fourier transform of a given signal/sequence and plotting its magnitude and phase spectrum by using MATLAB.	CLO 5	R1
6	Verifying Time shifting and scaling, time and differentiation properties of Fourier transforms by using MATLAB.	CLO 6	R3
7	Finding the Laplace transform of a given signal and locate its zeros and poles in s-plane.	CLO 7	R1
8	Finding the z - transform of a given sequence and locate its zeros and poles in z-plane.	CLO 8	R3

9	Finding convolution between two signals /sequences by using MATLAB.	CLO 9	R1
10	Finding auto correlation and cross correlation between signals and sequences by using MATLAB	CLO 10	R3
11	Generation of Gaussian noise, computation of its mean, M.S. value and its Skew, kurtosis, and PSD, probability distribution function by using MATLAB.	CLO 11	R3
12	Verification of wiener – Khinchine relations using MATLAB.	CLO 12	R3
13	Finding distribution and density functions of standard random variables and plot them by using MATLAB	CLO 13	R3
14	Checking a random process for stationary in wide sense by using MATLAB.	CLO 14	R3.

IX. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSIONREQUIREMENTS:

S No	Description	Proposed Actions	Relevance With POs	Relevance With PSOs
1	Verify a Random Process for Stationary in Wide Sense	Laboratory Practices	PO 4	PSO 3
2	Sampling Theorem Verification	Seminars / NPTEL	PO 5	PSO 3

Prepared by:
Mrs. V.Bindusee

HOD, EC