SIGNALS AND SYSTEMS

Course Code	23EE4501A	Year	III	Semester	I
Course Category	Professional Elective - I	Branch	EEE	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Engineering Mathematics, ECA
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	**Understand** the characteristics and classifications of signals and systems, and perform basic operations on signals (L2)
CO2	**Apply** Fourier, Laplace, and Z-transforms to evaluate the frequency response of continuous and discrete-time signals. (L3)
CO3	**Analyze** signals in the frequency domain using Fourier series, Fourier transform, Laplace transform, and Z-transform techniques.(L4)
CO4	**Illustrate** correlation properties, energy and power spectral densities, and apply sampling theorem for signal reconstruction.(L3)
CO5	**Analyze** systems using Fourier, Laplace, and Z-transforms to study signal behavior and system response in frequency domain (L4)

CO-PO and CO-PSO Mapping Matrix (3 = High, 2 = Medium, 1 = Low)

CO \ PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	–	–	2	–	–	–	–	–	1	3	2
CO2	3	3	–	–	2	–	–	–	–	–	2	3	3
CO3	3	3	–	–	2	–	–	–	–	–	2	3	3
CO4	3	2	–	2	2	–	–	–	–	–	1	3	2
CO5	3	3	–	2	3	–	–	–	–	–	2	3	3

SYLLABUS		
Unit No.	**Contents**	**Mapped CO**
I	**INTRODUCTION:** Definition of Signals and Systems, Classification of Signals, Classification of Systems, Operations on signals: time-shifting, time-scaling, amplitude-	**CO1**

	shifting, amplitude-scaling. Problems on classification and characteristics of Signals and Systems, Complex exponential and sinusoidal signals, Singularity functions and related functions: impulse function, step function signum function and ramp function.	
II	**FOURIER SERIES AND FOURIER TRANSFORM:** Fourier series representation of continuous time periodic signals, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Relation between Trigonometric and Exponential Fourier series, Complex Fourier spectrum. Deriving Fourier transform from Fourier series, Fourier transform of standard signals, properties of Fourier transforms, Fourier transforms involving impulse function and Signum function. Related problems.	**CO2 CO3 CO5**
III	**CORRELATION:** Auto-correlation and cross-correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between Convolution and correlation, Detection of periodic signals in the presence of noise by correlation. **SAMPLING THEOREM:** Graphical and analytical proof or Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Aliasing, Related problems.	**CO4**
IV	**LAPLACE TRANSFORMS:** Introduction**,** Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.T's, Inverse Laplace transform, Relation between L.T's, and F.T. of a signal. Laplace transform of certain signals using waveform synthesis.	**CO2 CO3 CO5**
V	**Z–TRANSFORMS:** Concept of Z-Transform of a discrete sequence. Region of convergence in Z- Transform, constraints on ROC for various classes of signals, Inverse Z-transform, properties of Z-transforms, Distinction between Laplace, Fourier and Z transforms.	**CO2 CO3 CO5**

Learning Resources
Text Books:
1. Signals, Systems & Communications-B.P.Lathi, BS Publications, 2003. 2. Signals and Systems-A.V. Oppenheim, A.S. Willsky and S.H. Nawab,PHI,2ndEdn,1997 3. Signals & Systems-Simon Haykin and VanVeen,Wiley,2nd Edition,2007
Reference Books:
1. Principles of Linear Systems and Signals– BP Lathi, Oxford University Press, 2015 2. Signals and Systems– TK Rawat, Oxford University press, 2011.
E-Resources: 1. http://www.stanford.edu/~boyd.ee102 2. Video Lectures | Signals and Systems | Electrical Engineering and Computer Science | MIT OpenCourseWare 3. Lecture 2, Signals and Systems: Part I | Signals and Systems | Electrical Engineering and Computer Science | MIT OpenCourseWare

Course Coordinator Module Coordinator