EC-206 **SIGNALS AND SYSTEMS** **L T P C**
4 1 - 3

COURSE OBJECTIVES:

1. To understand the characteristics of various signals & systems in time and frequency domain.
2. To understand about an LTI system and the concepts of convolution.
3. To understand correlation functions and different types of noise and their calculations.
4. To understand the concepts of random variables.
5. To understand the concepts of random process.

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. demonstrate knowledge in representation of Fourier series, Fourier transform, convolution, correlation of signals and properties of LTI systems.
2. analyze various continuous and discrete time signals and systems in time and frequency domains.
3. describe various types of noise and their sources.
4. apply the concepts and properties of random variables to real time applications.
5. apply the concepts and properties of random process to real time applications.

UNIT I **(16)**

SIGNAL ANALYSIS : Introduction to signals and systems, Classification of signals, Basic Operations on Signals, Elementary Signals, systems viewed as Interconnection of Operations, Properties of Systems. Approximation of a function by a set of mutually orthogonal functions, Evaluation of mean square error, Representation of a function by a closed or complete set of mutually Orthogonal functions, Orthogonality in complex functions, Trigonometric and Exponential Fourier series, Relationship between Trigonometric and Exponential Fourier series, Representation of a periodic function by the Fourier series over the entire interval, Convergence of Fourier series, Alternate form of Trigonometric series, Symmetry conditions, Complex Fourier spectrum.

UNIT II **(14)**

Representation of an arbitrary function over the entire interval: Fourier transform, Fourier transform of some useful functions, Singularity Functions, Fourier transform of periodic function, Some Properties of Fourier transforms, Energy Density spectrum.

Time Domain Representations for LTI systems: Convolution, Impulse response Representation for LTI systems, Properties of Impulse response representation for LTI systems, Impulse and Frequency response of LTI system, Conditions for Distrotionless Transmission, Ideal low pass filter, Frequency and Impulse response of ideal low pass filter, Paley-Wiener criterion, sampling theorem.

UNIT III **(13)**

Signal Comparison: Correlation and convolution, some properties of correlation functions, Correlation functions for Non finite energy signals.

NOISE: Shot Noise in Semiconductor Diode, Thermal Noise, Noise calculation, Multiple sources - Superposition of power spectra, Noise calculations in Passive circuits, Equivalent noise bandwidth, Noise-Figure of an amplifier, Power density and available power density, Effective noise temperature, Noise Figure in terms of available gain, Cascaded stages.

UNIT IV **(13)**

PROBABILITY & RANDOM VARIABLES: Probability Definition, Axioms of probability, Joint probability, Conditional probability, Total probability, Bayes' theorem, Independent events, Random variables, discrete and continuous, Probability Distribution Function, Probability Density Function, Guassian Random variable, Conditional distribution and density functions, Mean ,Variance and standard deviation of a random variable.

UNIT V **(13)**

RANDOM PROCESSES : Random process concept, stationary and independence, correlation functions, Gaussian random process, power density spectrum and its properties, relationship between power spectrum and autocorrelation function.

LEARNING RESOURCES:

TEXT BOOK(s):

1. B P Lathi, Signals, Systems and Communications, BSP, 2003
2. P.Z Peebles, Jr, Probability, random variables and random signal principles, TMH, 2002

REFERENCE BOOK(s):

1. Tarun Kumar and Rawat - SIGNALS AND SYSTEMS, Oxford Publications, 2010.
2. A.V Oppenheim, A. S. Wilsky and S. H. Nawab - Signals and Systems, 2nd Edition. PHI.,

WEB RESOURCES:

1. www.nptel.ac.in/courses/117104074
2. http:/walrandpc.eecs.berkeley.edu/126notes.pdf