



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

II Year-I Semester		L	T	P	C
		3	1	0	3
RANDOM VARIABLES AND STOCHASTIC PROCESSES					

Course Objectives:

- To give students an introduction to elementary probability theory, in preparation to learn the concepts of statistical analysis, random variables and stochastic processes.
- To mathematically model the random phenomena with the help of probability theory Concepts.
- To introduce the important concepts of random variables and stochastic processes.
- To analyze the LTI systems with stationary random process as input.

UNIT I

THE RANDOM VARIABLE: Introduction, Review of Probability Theory, Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Conditional Density, Properties.

UNIT II

OPERATION ON ONE RANDOM VARIABLE-EXPECTATIONS: Introduction,

Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Non-monotonic Transformations of Continuous Random Variable.

UNIT III

MULTIPLE RANDOM VARIABLES: Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem: Unequal Distribution, Equal Distributions.

OPERATIONS ON MULTIPLE RANDOM VARIABLES: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variables case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

UNIT IV

RANDOM PROCESSES –TEMPORAL CHARACTERISTICS: The Random Process Concept, Classification of Processes, Deterministic and Non deterministic Processes, Distribution and Density Functions, Concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second-order and Wide-Sense Stationarity, Nth-order and Strict-Sense Stationarity, Time Averages and Ergodicity, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

UNIT V

RANDOM PROCESSES -SPECTRAL CHARACTERISTICS: The Power Density Spectrum: Properties, Relationship between Power Density Spectrum and Auto correlation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Density Spectrum and Cross-Correlation Function.

LINEAR SYSTEMS WITH RANDOM INPUTS: Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, Auto correlation Function of Response, Cross-Correlation Functions of Input and Output, Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectra of Input and Output, Bandpass, Band-Limited and Narrow band Processes, Properties.

TEXTBOOKS:

1. Probability, Random Variables & Random Signal Principles, Peyton Z. Peebles, TMH, 4th Edition, 2001.
2. Probability, Random Variables and Stochastic Processes, Athanasios Papoulis and S. Unnikrishna, PHI, 4th Edition, 2002.
3. Probability and Random Processes with Applications to Signal Processing, Henry Stark and John W. Woods, Pearson Education, 3rd Edition, 2001.

REFERENCE BOOKS:

1. Schaum's Outline of Probability, Random Variables, and Random Processes, 1997.
2. An Introduction to Random Signals and Communication Theory, B.P. Lathi, International Textbook, 1968.
3. Probability Theory and Random Processes, P. Ramesh Babu, McGrawHill, 2015.

Course Outcomes:

After completion of the course, the student will be able to

- Mathematically model the random phenomena and solve simple probabilistic problems.
- Identify different types of random variables and compute statistical averages of the random variables.
- Characterize the random processes in the time and frequency domains.
- Analyze the LTI systems with random inputs.