22EC201 PROBABILITY THEORY AND STOCHASTIC PROCESSES

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Hours Per Week :

L	T	P	C
3	2	0	4

PREREQUISITE KNOWLEDGE: Knowledge of calculus.

COURSE DESCRIPTION AND OBJECTIVES:

The objective of the course is to enable the students to learn probability theory, random variables, random processes and analysis of random process and applications in the communication systems.

MODULE-1

UNIT-1 **9L+6T+0P=15Hours**

FUNDAMENTALS OF PROBABILITY THEORY:

Statistics: Basics of descriptive Statistics and Simple linear regression

Probability Theory: Introduction to probability, set theory, axioms of probability, sample space, Joint probability, Conditional probability, Total probability and Bayes' theorems, Bernoulli trails and independent events.

UNIT-2 **15L+10T+0P=25 Hours**

SINGLE RANDOM VARIABLE:

Definition of a random variable, Conditions for a function to be a random variable, Classifications of random variables, Density and distribution functions, Properties of random variables, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional distribution, Methods of defining conditioning event, Conditional density and distribution functions, Properties, Operations on Random variables - Introduction, Expected value of a random variable, Function of a random variable, Moments about the origin, Central moments, Variance, Characteristic function, Moment generating function, Monotonic transformations for a continuous and discrete random variables.

PRACTICES:

- Develop a regression model for any general problem.
- Apply total probability theorem.
- Apply Bayes theorem.
- Use probability density and distribution functions to solve a given problem.
- Solving any general probability problem with the help of standard distributions.
- Use the significance of moments to analize a given random variable.
- Transformation of random variables.

MODULE - 2

UNIT-1 **9L+6T+0P=15Hours**

MULTIPLE RANDOM VARIABLES:

Joint distribution function and its properties, Marginal distribution functions, Conditional distribution and density functions, Statistical Independence, Sum of two Random variables, Central limit theorem.

SKILLS:

- ✓ *Able to model linear regression model for any given problem.*
- ✓ *Able to find individual, joint and conditional probabilities for any given problem.*
- ✓ *Able to transform any analog/ digital random variable to another random variable.*
- ✓ *Able to compute the moments for any given problem and understand the behavior of the probability distribution.*
- ✓ *Able to find the response of linear system for random input.*

UNIT -2 **15L+10T+0P=25 Hours**

RANDOM PROCESSES:

Temporal characteristics, Random process concept, Classification of processes, Distribution and density functions, Concept of stationary and statistical independence, Wide sense stationary, Time averages and ergodicity, Autocorrelation and cross correlation, Gaussian random process, Poisson random process.

Random signal response of linear systems, System response – Convolution, Mean and Mean square value, Autocorrelation function; Cross-correlation functions of input and output, Spectral characteristics of system response, Power density spectrum, Relation between power spectral density and autocorrelation.

PRACTICES:

- Use joint and marginal probability distribution functions to solve multivariable random variables.
- Check whether given random variables are independent or not
- Check the level of stationarity for the given random process
- Identify the type of ergodicity for the given random process
- Observe the response of linear system for random inputs
- Relate power spectral density and auto correlation functions

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Devise a linear regression model for any general problem to predict the parameters.	Analyze	1	2,9
2	Apply the total probability, Bayes theorems and standard probability distributions to find individual, joint and conditional probabilities of general problems	Apply	1,2	1,9
3	Discover the nature of probability distributions with the help of moments	Apply	1	1,9
4	Categorize the given random process falls into which level of stationarity and which type of ergodic random process	Analyze	2	2
5	Analyze the response of linear time invariant system for random inputs	Analyze	2	2

TEXT BOOKS:

1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, 4th edition, 2017, TMH.
2. Probability, Random Variables and Stochastic Processes –Athanasios Papoulis and Unnikrishna Pillai, 4th ed., TMH, 2017.

REFERENCE BOOKS:

1. Principles of Communication systems–H.Taub, Donald.L.Schilling, Goutam Saha, 3rd ed., 2007, TMH.
2. Theory of Probability and Stochastic Processes- Pradip Kumar Gosh, University Press, 2010
3. Probability and Random Processes with Application to Signal Processing –Henry Stark and John W.Woods, 3rd ed., Pearson Education, 2001.
4. H. Kobayashi, B. L. Mark, and W. Turin, Probability, Random Processes, and Statistical Analysis, Cambridge, 2012.
5. R. Gallager, Stochastic Processes: Theory for Applications, Cambridge, 2014.