| II B. TECH I SEMESTER | L | T | P | INTERNAL MARKS | EXTERNAL MARKS | TOTAL MARKS | TOTAL CREDITS |
|---|---|---|---|---|---|---|---|
| | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| SUB CODE: R23EC2101 | PROBABILITY THEORY AND STOCHASTIC PROCESS | | | | | | |

**COURSE OBJECTIVES:**

1. Illustrate and formulate fundamental probability distribution and density functions,
2. Explain the concepts of expectation and conditional expectation, and describe their properties.
3. Explain the concepts of joint distribution, marginal distribution and statistical independence and their properties.
4. Analyze continuous and discrete-time random processes
5. Explain the concepts of stationary and wide-sense stationarity,

**COURSE OUTCOMES:**

After completion of this course the student should able to

CO1. Understanding of concept of random variable.

CO2.Calculate the expectation of different random variables.

CO3.Calculate the operations of multiple random variables.

CO4.Understanding types of random processes.

CO5.Understanding of random processes and its spectral characteristics.

**SYLLABUS:**

**UNIT-I: PROBABILITY AND RANDOM VARIABLE**

Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Bay's Theorem, Independent Events. 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.

## UNIT-V: RANDOM PROCESSES – SPECTRAL CHARACTERISTICS

The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function.

**TEXT BOOKS:**

1. PeytonZ. Peebles, "Probability, Random Variables & Random Signal Principles", TMH, 4th Edition, 2001.
2. Athanasios Papoulis and S.Unnikrisha, "Probability, Random Variables and Stochastic Processes", PHI, 4th Edition, 2002.

**REFERENCES:**

1. B. Prabhakara Rao, "Probability Theory and Stochastic Processes", Oxford University Press.
2. Henry Stark and John W. Woods, "Probability and Random Processes with Applications to Signal Processing", Pearson Education, 3rd Edition.
3. George R. Cooper, Clave D. Mc Gillem, "Probabilistic Methods of Signal & System Analysis", Oxford, 3rd Edition, 1999.
4. S. P. Eugene Xavier, "Statistical Theory of Communication", New Age Publications, 2003.
5. B.P. Lathi, "Signals, Systems & Communications", B.S. Publications, 2003.