**2/4 B.Tech - THIRD SEMESTER**

**EC3T2 Probability Theory and Stochastic Process Credits: 4**

**Lecture : 4 periods/week** **Internal assessment: 30 marks**
**Tutorial: 1 period /week** **Semester end examination: 70 marks -------**
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**Course Objectives:**

- To acquire the fundamental knowledge in probability concepts
- To manage situations involving more than one random variable and functions of random variables in engineering applications.
- To understand the principles of random signals and random processes
- To be acquainted with systems involving random signals and to analyze the response of random inputs to linear time invariant systems

**Learning Outcomes:**

After successful completion of the course, Graduates shall be able to

- Define probability and interpret probability by modelling sample spaces.
- Construct the probability distribution of a random variable, based on a real-world situation, and use it to compute expectation and variance
- Can handle the problems involving multiple random variables.
- Understand Stationary and Ergodic process
- Evaluate response of a linear system to Random Process.

**UNIT- I**

**Probability** : Probability introduced through Sets and Relative Frequency, Experiments and Sample Spaces, Types, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, Baye's Theorem, Independent Events, Bernouli Trails.

**UNIT- II**

**The Random Variable :** Definition of a Random Variable, Types, Conditions for a Function to be a Random Variable, Distribution and Density functions, Properties, Types, Examples, Conditional Distribution, Methods of defining Conditioning Event, Conditional Density, Properties.

**UNIT- III**

**Operation On One Random Variable – Expectations** : Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Chebychev's Inequality, Marcov's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable

**UNIT- IV**

**Multiple Random Variables** : Vector Random Variables, Joint Distribution Function, Properties , Marginal Distribution Functions, Conditional Distribution and Density – Point Conditioning, Interval conditioning, Statistical Independence, Sum of Random Variables, Central Limit Theorem.

**UNIT- V**

**Operations On Multiple Random Variables**: Expected Value of a Function of Random Variables, Joint Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

**UNIT- VI**

**Random Processes – Temporal Characteristics:** The Random Process Concept, Classification of Processes, Distribution and Density Functions, concept of Stationarity and Independence, Time Averages and Ergodicity, Autocorrelation Function and Properties, Cross-Correlation Function and Properties, Covariance Functions, Gaussian Random Process, Poisson Random Process.

**UNIT- VII**

**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.

**UNIT- VIII**

**Linear Systems With Random Inputs:** Random Signal Response of Linear Systems, Spectral Characteristics of System Response, Band pass, Band-Limited and Narrowband Processes, Properties, Modeling of Noise Sources.

## Learning Resources

**Text Books:**


1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH, 4th Edition, 2001.
2. Probability, Random Variables and Stochastic Processes – A. Papoulis and S. Unnikrishna Pillai, PHI, 4th Edition, 2002.


**References:**


1. Statistical Theory of Communication ,S.P. Eugene Xavier, New Age Publications, 2003.
2. Probability Methods of Signal and System Analysis. George R. Cooper, Clave D. MC Gillem, Oxford, 3rd Edition, 1999
3. Signals, Systems & Communications, B.P. Lathi, B.S. Publications, 2003.
4. Communication Systems: Analog & Digital – R.P. Singh and S.D. Sapre, TMH, 1995.