2/4 B.Tech - THIRD SEMESTER

EC3T2 Probability Theory and Stochastic Process Credits: 3

Lecture: 3 periods/week **Internal assessment: 30 marks**
Tutorial: 1 period /week **Semester end examination: 70 marks**

Prerequisite: Engineering Mathematics-I (EC1T1), Engineering Mathematics-II (EC 2T1)

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 modeling sample spaces.
- Construct the probability distribution of a random variable, based on a real-world situation, and use it to compute expectation and variance
- Solve the problems involving multiple random variables.
- Apply the concepts of random process in communication and signal processing
- 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, Distribution and Density functions, Properties, Types, Examples, Conditional Distribution and Density, Properties.
Operations on One Random Variable: Expectation, Moments, Chebychev's Inequality, Marcov's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable

UNIT- III

Multiple Random Variables: Vector Random Variables, Joint Distribution Function, Properties, Conditional Distribution and Density, Statistical Independence, Sum of Random Variables, Central Limit Theorem.

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- IV

Random Processes –Temporal Characteristics: The Random Process Concept, Classification, Distribution and Density Functions, Stationarity and Independence, Time Averages and Ergodicity, Correlation Functions and their Properties, Covariance Functions, Gaussian Random Process, Poisson Random Process.
Spectral Characteristics: The Power Spectrum: Properties, The Cross-Power Density Spectrum, Properties, Relationship between Power Spectrum and Correlation Functions.

UNIT- V

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.

References:

1. Probability, Random Variables and Stochastic Processes – A. Papoulis and S. Unnikrishna Pillai, PHI, 4th ed., 2002.
2. Statistical Theory of Communication - S.P. Eugene Xavier, New Age Publications, 2003.
3. Probability Methods of Signal and System Analysis. George R. Cooper, Clave D. MC Gillem, Oxford, 3rd ed., 1999
4. Signals, Systems & Communications - B.P. Lathi, B.S. Publications, 2003.
5. Communication Systems Analog & Digital – R.P. Singh and S.D. Sapre, TMH, 1995.