II Year B.Tech. II semester

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16ECE 223 PROBABILITY THEORY & STOCHASTIC PROCESS

Course Educational Objectives:

- To provide mathematical background and sufficient experience so that the student can read, write, and understand sentences in the language of probability theory, as well as solve probabilistic problems in signal processing and Communication Engineering.
- To introduce students to the basic methodology of "probabilistic thinking" and to apply it to problems;
- To understand basic concepts of probability theory and random variables, how to deal with multiple random variables, Conditional probability and conditional expectation, joint distribution and independence, mean square estimation..

UNIT-1: Probability

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

UNIT-2: Random Variables

Definition of random variable, Conditions to be a random variable, Types of random variables- Continuous, Discrete & Mixed, PDF, CDF & properties, Conditional PDF and properties, Monotonic and Non monotonic Transformation of random variables – Continuous & Discrete.

UNIT-3: Statistical Parameters of Single & Multiple Random Variables Operations on Single Random Variables:

Moment about origin, Central moments, Characteristic function (CF), Moment Generating Function (MGF), Calculation of statistical parameters for Binomial, Poisson, Uniform, Gaussian, Exponential & Rayleigh random variables.

Operations on Multiple Random Variables:

Joint PDF & CDF, Marginal PDF & CDF, Conditional PDF &CDF, Statistical independence, Joint moment about origin, Central moment, Joint Characteristic function (CF), Joint Moment Generating Function (MGF), Calculation of statistical parameters for multiple random variables, Sum of two random variable & Central limit theorem.

UNIT-4: Stochastic Process – Temporal characteristics

Concept of stochastic process, PDF & CDF of stochastic process, Time averages, Statistical averages, Classification of stochastic process- Deterministic, Non deterministic, Concepts of stationary - strict sense, Wide sense & Ergodicity. Correlation- auto correlation and its properties, cross correlation & properties.

UNIT-5: Stochastic Process Spectral characteristics & LTI System with Random inputs
Stochastic Processes – Spectral Characteristics: Power Spectrum and its Properties, Relationship between Power Spectrum and Autocorrelation Function, Cross-Power Density Spectrum and its Properties, Band pass, Band limited, Narrow band pass process.
LTI System with Random inputs - Response of LTI System to Statistical Averages – Mean, Mean square, Correlation & PSD.

Course Outcomes:
Upon completion of the subject, students will be able to compute:

- ✓ Simple probabilities using an appropriate sample space.
- ✓ Simple probabilities and expectations from probability density functions (pdfs).
- ✓ Simple probabilities and expectations from cumulative distribution functions (cdfs).
- ✓ Analyze the statistical parameters for single & Multiple Random variables and linear systems.

TEXT BOOKS

1. Probability, Random Variables & Random Signal Principles – Peyton Z. Peebles, TMH, 4th Edition, 2001.
2. Probability Theory and Stochastic Processes – Mallikarjuna reddy, Golden era publications,Guntur.1/e 2010.

REFERENCE

1. Theory of Probability and Stochastic Processes – Pradip Kumar Ghosh, University Press
2. Probability and Random Processes with Applications to Signal Processing – Henry Stark and W. Woods, Pearson Education, 3rd Edition.