RANDOM VARIABLES AND NUMERICAL METHODS

(Common to ECE, EEE)

Course Code: 13BM1107

L	T	P	C
4	1	0	3

Pre requisites:

- ✤ Fundamentals of Set theory.
- ✤ Basic concepts of Probability.
- ✤ Basic concepts of calculus.

Course Educational Objectives:

The objective is to equip students with the basic tools required to build and analyze probabilistic models in both the discrete and continuous context. Also to introduce Numerical techniques to solve the real world applications.

Course Outcomes:

Upon successful completion of the course, the students should be able to

- ✤ Apply concepts of Random variables for a wide range of areas in communications, signal processing, control and other areas of engineering in which randomness has an important role.
- ✤ Solve engineering problems using Numerical techniques.

UNIT-I (12 Lectures)

The Random Variable Concept, Discrete, Continuous, Mixed random variable distribution function, Density function, The Gaussian Random variable, Conditional distribution and density Function, Expected value, Conditional expected value, Moments, Moments about the origin, Central moments,Variance and Skew, Chebychev's inequality, Markov's inequality.

Monotonic and Non monotonic transformations of a continuous random variable, Transformations of a discrete random variable.
(2.1 to 2.4, 2.6, 3.1, 3.2,3.4 of Text book [1])

UNIT-II **(12 Lectures)**

Vector random variables, Joint distribution and its properties, Joint density and its properties, Conditional distribution and density statistical independence distribution and density of a sum of random variables, Central limit theorem (without proof). Expected value of a function of random variables, Joint moments about the origin, Joint central moments.
(4.1 to 4.7, 5.1 of Text book [1])

UNIT-III **(12 Lectures)**

Jointly Gaussian random variables-two random variables, Jointly gaussian random variables-N Random variables. Transformations of multiple random variables- One function, Transformations of multiple random variables- multiple functions, Linear transformation of Gaussian random variables. The Random process concept-classification of processes Deterministic and Nondeterministic processes.
(5.3 to 5.5, 6.1 of Text book [1])

UNIT-IV **(12 Lectures)**

Introduction to Numerical Methods, Solution of algebraic and transcendental equations-Bisection method, Method of false position Newton's method.

Finite differences-Forward differences, Backward differences, Central differences, Differences of a polynomial, Other Difference operators – Shift operator, Average operator, Relations between the operators, Newton's interpolation formulae - Newton's forward interpolation formula Newton's backward interpolation formula.
(28.1 to 28.3, 29.1 to 29.5, 29.6 of Text book [2])

UNIT-V **(12 Lectures)**

INTERPOLATION WITH UNEQUAL INTERVALS:

Lagrange interpolation, Divided differences, Newton's divided difference formula Difference formula, Inverse interpolation. Numerical Integration-Trapezoidal, Simpson's one-third and Simpson's three-eighth rules.

NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS:

Euler's Method, Modified Euler's Method, Runge-Kutta method of order 4.

(29.9 - 29.13, 30.4, 30.6-30.8, 32.4, 32.5, 32.7 of Text book [2])

TEXT BOOKS:

1. Peyton Z . Peebles, Jr., "Probability, Random Variables and Random Signal Principles", Fourth Edition, TMH, 2002.
2. Dr.B.S.Grewal "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, 2012.

REFERENCES:

1. Athanasios Papoulis and S.Unnikrishna Pillai, *"Probability, Random variables and Stochastic processes"*, 4th Edition, PHI, 2002.
2. M.K.Jain, S.R.K.Iyengar and R.K.Jain, *"Numerical Methods form scientific and Engineering Computation"*, 4th Edition, New age International Publishers, 2003.
3. S. S. Sastry, *"Introductory Methods of Numerical Analysis"*, 4th Edition, Prentice Hall India Pvt., Limited, 2005.