SCHEME OF COURSE WORK

Course Details:

Course Title	**Random Variables and Numerical Methods**		
Course Code	**15BM1107**	**L T P C**	**4 1 0 3**
Program:	**B.Tech.**		
Specialization:	**Information Technology**		
Semester	**IV Semester**		
Prerequisites	• Fundamentals of Set theory and calculus. • Basic concepts of Probability and Discrete Random Variables. • Basic concepts of calculus		
Courses to which it is a prerequisite	**Signal and Systems**		

PROGRAM OUTCOMES:

A graduate of Information Technology will be

1. A graduate of Information Technology will be able to apply the knowledge of mathematics, science, engineering fundamentals to solve complex Information Technology problems.
2. A graduate of Information Technology will be attain the capability to identify, formulate and analyse problems related to Electronics and Communication Engineering.
3. A graduate of v will be in a position to design solutions for mechanical system components and processesthatmeetthespecifiedneedswithappropriateconsiderationforpublichealthandsafety.
4. A graduate of Information Technology will be able to conduct experiments, perform analysis and interpretation of data by using research methods such as design of experiments to synthesize the information and to provide valid conclusions.
5. A graduate of Information Technology will be able to select and apply appropriate techniques from the available resources and current Mechanical Engineering and software tools.
6. A graduate of Information Technology will be able to carry out their professional practice in Mechanical Engineering by appropriately considering and weighing the issues related tosociety.
7. A graduate of Information Technology will be able to understand the impact of the professional engineering solutions on environmental safety and legal issues.
8. A graduate of Information Technology will be transform into responsible citizens by resorting to professional ethics and norms of the engineering practice.
9. A graduate of Information Technology will be able to function effectively in individual capacity as well as a member in diverse teams and in multidisciplinary streams.
10. A graduate of Information Technology will be able to communicate fluently with the engineering community and society, and will be able to prepare reports and make presentations effectively.
11. A graduate of Information Technology will be able to apply knowledge of the engineering and management principles to managing projects and finance in multidisciplinary environments.

12. A graduate of Information Technology will be engage themselves in independent and life-long learning to continuing professional practice in their specialized areas of Information Technology.

Course Outcomes (COs): At the end of the Course, Student will be able to

1	Explain various concepts of discrete and continuous random variables and calculate moments about origin and mean, conditional expected values. Discuss transformations of random variables.
2	Calculate joint distribution function, density function, moments about origin and mean of multiple random variables.
3	Explain the properties of Jointly Gaussian Random Variables. Discuss transformations of Multiple Random Variables.
4	Calculate a root of algebraic and transcendental equations. Explain relation between the finite difference operators. Compute interpolating polynomial for a given data.
5	Compute definite integrals using numerical techniques. Solve ordinary differential equations numerically using Euler's and RK methods.

Course Outcome versus **Program Outcomes:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	3	2										
CO-2	3	2										
CO-3	3	2		2								
CO-4	3	2			2							
CO-5	3	2			2							

S - Strongly correlated, *M* - *Moderately* correlated, *Blank* - *No correlation*

Assessment Methods:	Assignment / Quiz / Seminar / Mid-Test / End Exam

Teaching-Learning and Evaluation

Week	Topic / Contents	Course Outcomes	Sample Questions	Teaching-Learning Strategy	Assessment Method & Schedule
1	The Random Variable Concept, Discrete, continuous, mixed random variable Distribution Function, Density Function, properties	**CO-1**	If $f(x) = \frac{1}{18}(2x+3),\ for\ 2 \leq x \leq 4$ is density function, find $P(2 \leq X \leq 3)$	Lecture / Problem solving	Assignment (Week 3 - 4)/ Quiz -I (Week -8)/ Mid-Test 1 (Week 9)
2	The Gaussian Random Variable, problems Conditional Distribution and Density Function, problems	**CO-1**	In a Normal distribution, 7 % of the items are under 35 and 89% are under 63 . Determine the mean and variance of the distribution.	Lecture / Problem solving	Assignment (Week 3 - 4)/ Quiz -I (Week -8)/ Mid-Test 1 (Week 9)
3	Conditional Distribution and Density Function, problems, Expectation, Expected value, Conditional Expected value, Moments, Moments about the origin, Central moments, Variance and Skew, Chebychev's Inequality, Markov's Inequality	**CO-1**	Find the mean and variance of uniform distribution	Lecture / Problem solving	Mid-Test 1 (Week 9)/ Assignment (Week 3 - 4)/ Quiz -I (Week -8)
4	Monotonic and Non monotonic Transformations of a continuous random variable, Transformations of a Discrete random variable.	**CO-1**	Show that linear transformation of a Gaussian random variable is Gaussian	Lecture / Problem solving	Mid-Test 1 (Week 9)/ Quiz -I (Week -8)
5	Vector Random Variables, Joint Distribution and its Properties Joint Density and its Properties	**CO-2**	If the Joint sample space S_j has only three possible elements (1, 1), (2, 1) and (3, 3) and their probabilities be 0.2, 0.3 and 0.5, find $F_{X,Y}(x, y)$ and the marginal distributions $F_X(x)$ and $F_Y(y)$.	Lecture / Problem solving	Mid-Test 1 (Week 9) / Quiz -I (Week -8)
6	Conditional Distribution and Density Statistical Independence	**CO-2**	Show that two un correlated Gaussian random variables are independent	Lecture / Problem solving	Mid-Test 1 (Week 9)/ Quiz -I (Week -8)
7	Distribution and Density of a sum of Random Variables, Central Limit Theorem (without proof). Expected Value of a Function of Random Variables	**CO-2**	The random variables *X and Y* have the joint density What is the expected value the function $g(X,Y) = (XY)^2$	Lecture / Problem solving	Mid-Test 1 (Week 9)/ Quiz -I (Week -8)
8	Joint moments about the origin, Joint central moments	**CO-2**	Find the Covariance C_{UV} of the random variables U, V where $U = X + Y, V = X - Y$ if X, Y are any two random variables with $\sigma_{X_2} = 2, \sigma_{Y^2} = 1$	Lecture / Problem solving	Mid-Test 1 (Week 9)/ Quiz -I (Week -8)

9	**Mid-Test 1**				
10	Jointly Gaussian Random Variables- two Random variables Jointly Gaussian Random Variables-N Random variables	**CO-3**	Write the properties of Joint Gaussian random variables.	Lecture / Problem solving	Mid-Test 2 (Week 18) / Assignment -II (Week -17)/ Assignment (113-14)
11	Transformations of Multiple Random Variables- One function, transformations of Multiple Random Variables- Multiple functions	**CO-3**	Two independent random variables X and Y have mean values E(X) =2, E(Y) =4 and their 2nd moments are $E(X^2)$ =8, E (Y^2) =25. Find (i) Mean value (ii) 2^{nd} moment (iii) Variance of the random variable W=3X-Y	Lecture / Problem solving	Assignment (Mid-Test 2 (Week 18) / Assignment -II (Week -17)/ Assignment (13-14)
12	The Random Process Concept- Classification of processes, Deterministic and Nondeterministic processes	**CO-3**	Discuss about classification of random Processes.	Lecture / Problem solving	Mid-Test 2 (Week 18) / Assignment -II (Week -17)/ Assignment (13-14)
13	Solution of algebraic and transcendental equations: bisection method, method of false position, Newton's method.	**CO-4**	Find the real root of the equation $cosx = xe^x$ using the regular falsi method corrected to four decimal places.	Lecture / Problem solving	Mid-Test 2 (Week 18) / Quiz -II (Week -17)
14	Finite differences: Forward differences, Backward differences, Central differences, Differences of a polynomial, Other Difference operators,	**CO-4**	Form a table of difference for the function $f(x) = x^3 + 5x - 7$ for x= -1, 0, 1, 2, 3, 4, 5. Continue the table to obtain f(6).	Lecture / Problem solving	Mid-Test 2 (Week 18) / Quiz -II (Week -17)
15	Relations between the operators, Newton's interpolation formulae- Newton's forward interpolation formula Newton's backward interpolation formula,	**CO-4**	Using Newton's interpolation formula find the value of the f(1.2) up to three decimals, given that f(1)=3.49, f(1.4)=4.82, f(1.8)=5.96, f(2.2)=6.5.	Lecture / Problem solving	Mid-Test 2 (Week 18) / Quiz -II (Week -17)
16	Interpolation with un equal intervals: Lagrange interpolation, Divided differences, Newton's divided difference formula Difference formula, Inverse interpolation. Numerical Integration – Newton-cote's quadrature formula	**CO-5**	Use the Lagrange's formula to find the form of f(x) for the given data x: 0, 2, 3, 6 f(x): 648, 704, 729, 792	Lecture / Problem solving	Mid-Test 2 (Week 18) / Quiz -II (Week -17)
17	Trapezoidal rule Simpson's $1/3^{rd}$ rule Simpson's $3/8^{th}$ rule, Weddle's rule. Numerical solutions of Ordinary differential equations: Euler's Method, Modified Euler's Method, Runge-Kutta method of order 4	**CO-5**	Apply the fourth order Runge-Kutta method to find an approximate value of y when x=1.2 in steps of 0.1, given that $\frac{dy}{dx} = x^2 + y^2$ and y (1) = 1.5.	Lecture / Problem solving	Mid-Test 2 (Week 18) / Quiz -II (Week -17)
18	**Mid-Test 2**				
19/20	**END EXAM**				