25UMCT401	PROBABILITY, STATISTICS AND NUMERICAL METHOD	Category	L	T	P	R	Credit	Year of Introduction
		BSC	3	0	0	0	3	2025

Preamble: This course introduces students to the modern theory of probability and statistics, covering important models of random variables and techniques of parameter estimation and hypothesis testing. A brief course in numerical techniques familiarizes students with some basic numerical techniques which are especially useful when analytical solutions are hard to find.

Prerequisite: Nil

Course Outcomes: After the completion of the course, the student will be able to:

CO	Course Outcomes	Knowledge Level
CO1	Explain the concept, properties and important models of discrete Random variables and to apply in suitable random phenomena.	K3 Apply
CO2	Explain the concept, properties and important models of continuous Random variables and to apply in suitable random phenomena.	K3 Apply
CO3	Explain the concepts of estimation of population parameters and test hypotheses about population means and proportions.	K3 Apply
CO4	Apply numerical methods to find solutions of linear system of equations, ordinary differential equations and Laplace equations.	K3 Apply

Mapping of course outcomes with program outcomes and program specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	-	-	-	-	-	-	1
CO2	3	3	2	2	-	-	-	-	-	-	1
CO3	3	3	2	2	-	-	-	-	-	-	1
CO4	3	3	2	2		-	-	-	-	-	1
Avg	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

Mapping of course outcomes with Knowledge and Attitude Profile (WK)

	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	*	*	*	*	*			*	
CO2	*	*	*	*	*			*	
CO3	*	*	*	*	*			*	
CO4	*	*	*	*	*			*	

WKs mapped with the course

WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
*	*	*	*	*			*	

Mark Distribution:

Total Marks	CIE Marks	ESE Marks	ESE Duration
100	40	60	2.5 hrs

Continuous Internal Evaluation Pattern:

Attendance : 5 marks
Continuous Assessment Test : 20 marks
Continuous Assessment Assignment : 15 marks

SYLLABUS

Module 1 (11hrs)

Random variable, discrete random variable and their probability distributions, Cumulative distribution function, Expectation, Mean and variance, Binomial distribution, Poisson distribution, Poisson distribution as a limit of the binomial distribution, Joint pmf of two discrete random variables, Marginal pmf, Independent random variables, Expected value of a function of two discrete variables.

[Text1:Relevant topics from sections 3.1to 3.4, 3.6, 5.1, 5.2]

Module 2 (11hrs)

Continuous random variables and their probability distributions, Cumulative distribution function, Expectation, Mean and variance, Uniform, Normal and Exponential distributions, Joint pdf of two Continuous random variables, Marginal pdf, Independent random variables, Expectation value of a function of two continuous variables.

[Text 1: Relevant topics from sections 3.1, 4.1, 4.2, 4.3, 4.4, 5.1, 5.2]

Module 3 (10hrs)

Confidence Intervals, Confidence Level, Confidence Intervals and One-side confidence intervals for a Population Mean for large and small samples (normal distribution and *t*-distribution), Hypotheses and Test Procedures, TypeI and TypeII error, *Z*-Tests for Hypotheses about a Population Mean (for large sample), *t* Test for Hypotheses about a Population Mean (for small sample), Tests concerning a population proportion for large and small samples.

[Text1: Relevant topics from7.1, 7.2, 7.3, 8.1, 8.2, 8.3, 8.4]

Module 4 (10hrs)

Newton-Raphson Method, Gauss Elimination Method ,Gauss - Jordan Method, Numerical solution of ordinary differential equations-Euler's method, Modified, Euler's method, Runge-Kutta method of 2nd Order, Numerical solution of Laplace equation –Jacobi's Method, Curve Fitting by Method of Least Squares - Straight lines, Parabola.

[Text2: Relevant topics from sections 2.5, 4.2, 7.5, 8.4, 8.5, 9.4]

Textbooks

1.Devore, J. L. (2016). *Probability and statistics for engineering and the sciences* (9th ed.). Cengage Learning.

2.Sastry, S. S. (2012). *Introductory methods of numerical analysis* (5th ed.). PHI Learning Pvt. Limited.

Reference Books

1.Papoulis,A., & Pillai, S. U. (2002). *Probability, random variables and stochastic Processes* (4th ed.). McGraw-Hill.

2.Ross, S. M. (2020). *Introduction to probability and statistics for engineers and scientists* (6th ed.). Academic Press.

3.Chapra, S. C., &Canale, R. P. (2021). *Numerical methods for engineers* (8th ed.). Mc Graw-Hill Education.

END SEMESTER EXAMINATION–MODEL QUESTION PAPER
STC (2025 SCHEME)

Course Code	**25UMCT401**
Course Name	**PROBABILITY, STATISTICS AND NUMERICAL METHODS**
Max.Marks:60	**Duration:2.5 Hours**

Part A

(Answer all questions. Each question carries 3 marks)

Qn No.	Question	Marks	CO	BL
1	A discrete random variable X has the probability distribution $(x)=\frac{k}{2^x}, x=0,1,2,3,4$. Find (i) the value of k (ii) P(X≠1)	3	1	L3
2	The joint PMF of two random variables X and Y is given by P(x, y) = c(x + y), x = 0, 1, 2; y = 0, 1, 2, 3. Find c	3	1	L2
3	Find the value of k and Mean for the p d f $f(x)=\begin{cases} k x^2, 0<x<1 \\ 0, otherwise \end{cases}$	3	2	L2
4	If X has uniform distribution in (−a, a), find a such that P(|X| ≤ 1) = P(|X| > 1).	3	2	L3
5	A sample of size 49 is taken from a population with sample mean 35 and sample S.D 11.Find the 99% confidence interval for population mean.	3	3	L3
6	State the null hypotheses, alternate hypotheses and state whether the test is left tailed ,right tailed or two tailed for the following statement ‘ You want to test whether the mean speed of your cable Internet connection is more than 10 Megabits per second’	3	3	L2
7	Solve $x^3=25$ by Newton –Raphson’s method correct to 3 decimal places.	3	4	L2
8	Solve $y' = x + y$, $y(0) = 1$ by Euler’s method to find y(0.4) with h=0.2	3	4	L2

Part B

(*Answer any one full question from each Module. Each carry 9 marks*)

Module I

Qn No.	Question	Marks	CO	BL
9a	A Random variable X has the following probability distribution function x: 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 f(x): a | 3a | 5a | 7a | 9a | 11a | 13a | 15a | 17a Determine (i) the value of 'a' (ii) P(X < 3) (iii)P(X ≥ 3) (iv)P(0 < X < 5)	5	1	L3
b	Six dice are thrown 729 times. How many times do you expect at least three dice to show 5 or 6.	4	1	L2
	OR			
10a	It is known that 2% of the bolts produced by a company are defective. The bolts are supplied in boxes of 200 bolts. What is the probability that a randomly chosen box contains no more than 5 defective bolts? In a consignment of 1000 such boxes, how many can be expected to have more than 5 defective bolts?	5	1	L3
b	Derive the mean and variance of the BinomialDistribution.	4	1	L2
	Module II			
Qn No.	**Question**	**Marks**	**CO**	**BL**
11a	Derive the mean and variance of uniform distribution.	4	2	L2
b	The amount of time that a surveillance camera will run without having to be reset is a random variable having exponential distribution with mean 50 days. Find the probability that such a camera will (a) have to be reset in less than 20 days (b) not have to be reset in at least 60 days.	5	2	L3
	OR			
12a	The joint probability distribution function of two continuous random variable X and Y is: $f(x,y)=\begin{cases}8xy & 0<y<x<1\\ 0 & otherwise\end{cases}$ .Check whether X and Y are independent.	4	2	L2
b	The life times of tube light bulbs produced by a company are normally distributed with mean 1000 hrs and standard deviation 100 hrs. Is this company correct when it claims that 95% of its light bulbs last at least 900 hrs?	5	2	L3
	Module III			
Qn No.	**Question**	**Marks**	**CO**	**BL**
13. a	Ten students are selected at random from a school and their heights are found to be in inches 50, 52, 52, 53, 55, 56, 57, 58, 58 and 59. In the light of these data discuss the suggestion that the mean height of the students of the school	5	3	L3

<table>
<tr><td></td><td>is 54 inches.(use 5% level of significance)</td><td></td><td></td><td></td></tr>
<tr><td>13. b</td><td>A coin is thrown 10,000 times and head turns up 5195 times. Is the die unbiased at 5% level of significance?</td><td>4</td><td>3</td><td>L3</td></tr>
<tr><td colspan="4">OR</td><td></td></tr>
<tr><td>14. a</td><td>Find the least sample size required if the length of the 95% confidence interval for the mean of a normal population with standard deviation 8 should be less than 10</td><td>5</td><td>3</td><td>L3</td></tr>
<tr><td>14. b</td><td>A parcel delivery service claims that at least 80% of their parcels are delivered within 48 hrs of posting. A check on 200 parcels found that 152 were delivered within 48 hrs of posting. Test the delivery service’s claim at 5% level of significance</td><td>4</td><td>3</td><td>L3</td></tr>
<tr><td colspan="5">Module IV</td></tr>
<tr><td>Qn No.</td><td>Question</td><td>Marks</td><td>CO</td><td>BL</td></tr>
<tr><td>15. a</td><td>Solve using Gauss-Jordan elimination with partial pivoting $0.002x+1y-1z=4, 1x+2y+3z=14, 2x-1y+1z=3$</td><td>4</td><td>4</td><td>L3</td></tr>
<tr><td>15. b</td><td>Use modified Euler’s method to find the value of y at x=0.25 and x=0.5 given $\frac{dy}{dx}=2xy, y(0)=1$</td><td>5</td><td>4</td><td>L3</td></tr>
<tr><td colspan="4">OR</td><td></td></tr>
<tr><td>16. a</td><td>Using second order RK method, evaluate y (0.2) given $\frac{dy}{dx}=\sqrt{x+y}$, y(0)=1. Take h=0.1</td><td>5</td><td>4</td><td>L3</td></tr>
<tr><td>16. b</td><td>Fit a straight line of the form $y=ax+b$ to the following data
<table>
<tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>y</td><td>14</td><td>27</td><td>40</td><td>55</td><td>68</td></tr>
</table></td><td>4</td><td>4</td><td>L3</td></tr>
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