

THE KAVERY ENGINEERING COLLEGE
(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV/DEC 2025

Fourth Semester

Artificial Intelligence and Data Science

MA3391 - Probability and Statistics

(All statistical tables are permitted and Graph sheet should be Provided)

Regulations - 2021

Duration : 3 Hrs

Maximum : 100 Marks

PART - A (ANSWER ALL QUESTIONS) (Marks 10*2=20)

Q.No	Questions	BLT	CO	Marks										
1.	State Baye's theorem.	L1	1	2										
2.	A continuous random variable X has the probability density function $f(x) = kx^4, -1 < x < 0$. Find the value of k .	L2	1	2										
3.	If X and Y are independent random variables with variance 2 and 3 respectively, find the variance of $(3X+4Y)$.	L2	2	2										
4.	State central limit theorem.	L1	2	2										
5.	Define unbiased estimator with example.	L1	3	2										
6.	Define point estimate of population mean.	L1	3	2										
7.	Calculate the sum of rank of Group 1 using U test:	L2	4	2										
	<table border="1" style="margin-left: 40px;"> <tr> <td>Group 1</td><td>80</td><td>75</td><td>90</td><td>85</td></tr> <tr> <td>Group 2</td><td>95</td><td>92</td><td>88</td><td>76</td></tr> </table>	Group 1	80	75	90	85	Group 2	95	92	88	76			
Group 1	80	75	90	85										
Group 2	95	92	88	76										
8.	What is the Test Statistic of Kolmogorov test?	L2	4	2										
9.	The total number of defects in 20 pieces of cloth is 220. Find the upper control limit and lower control limit.	L2	5	2										
10.	What are control limits for p-Chart?	L1	5	2										

PART - B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)

Q.No	Questions	BLT	CO	Marks																		
11.	a i A random variable X has the following probability function:	L3	1	8																		
	<table><tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>$P(X)$</td><td>0</td><td>k</td><td>$2k$</td><td>$2k$</td><td>$3k$</td><td>k^2</td><td>$2k^2$</td><td>$7k^2+k$</td></tr></table>	X	0	1	2	3	4	5	6	7	$P(X)$	0	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$7k^2+k$			
X	0	1	2	3	4	5	6	7														
$P(X)$	0	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$7k^2+k$														
	Calculate																					
	(i) the value of k .																					
	(ii) $P[X < 6] \& P[X \geq 6]$.																					
	(iii) $P[X < 2] \& P[X > 3]$																					
	(iv) $P[1 < X < 5]$																					
	ii Identify the moment generating function, mean and variance of a random variable of Poisson distribution.	L3	1	8																		

Or

- b i Identify the moment generating function, mean and variance of a random variable of Binomial distribution. L3 1 8
- ii A continuous random variable X that can assume any value between $x=2$ and $x=5$ has a density function given by $f(x) = k(1+x)$. Calculate $P[X < 4]$. L3 1 8

12. a i The joint probability mass function of (X, Y) is given by $P(X, Y) = K(2x + 3y)$, $x = 0, 1, 2$; $y = 1, 2, 3$. Identify all the marginal and conditional probability distributions. Also calculate the probability distribution of $(X + Y)$ and $P[(X + Y) > 3]$. L3 2 8
- ii If two random variables X and Y have probability density function $f(x, y) = ke^{-(2x+y)}$ for $x, y > 0$. Find the value of k . L3 2 8

Or

- b i Identify the correlation coefficient for the following data: L3 2 8

X	65	66	67	67	68	69	70	72
Y	67	68	65	68	72	72	69	71

- ii Two random variables X and Y have the joint density $f(x, y) = \begin{cases} 2-x-y, & 0 < x < 1, 0 < y < 1, \\ 0, & \text{Otherwise} \end{cases}$. Show that $Cov(X, Y) = \frac{-1}{144}$. L3 2 8

13. a Explain the Likelihood Estimation method with example. L3 3 16

Or

- b A random sample of two elements is drawn with replacement with unknown mean μ . The measures of these units are X_1 and X_2 . The following two estimators are suggested for μ . L4 3 16

i) $\frac{X_1 + X_2}{2}$

ii) $\frac{2X_1 + 3X_2}{5}$

Are both these estimators unbiased? Which of the two is more efficient?

14. a Using sign Test evaluate the effectiveness of a new exercise program on blood pressure comparing pre and post treatment data given below: L3 4 16

Patient	Pre-Treatment	Post Treatment
1	120	115
2	130	125
3	110	105
4	125	130
5	115	110

Or

- b Using U test compare final grades for three teaching methods, student's grades are given below: L4 4 16

	Method A	Method B	Method C
Grades	85	92	95
	90	88	91
	78	76	89

15. a Draw the appropriate control chart for the following data and comment on state of control: L4 5 16

Day	1	2	3	4	5	6	7	8	9	10
Inspected	150	184	181	196	180	174	210	210	195	210
Defective	25	10	3	14	6	15	43	28	39	25

Or

- b The following table gives the sample means and ranges for 10 samples each of size 6 in the production of certain component. Construct the control charts for mean and range a comment on the nature of control: L4 5 16

Sam ple	1	2	3	4	5	6	7	8	9	10
$\bar{X}$	37.3	49.8	51.5	59.2	54.7	34.7	51.4	61.4	70.7	75.3
R	9.5	12.8	9.1	9.1	7.8	5.8	14.5	2.8	3.7	8.0