Register No : ___________________

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV /DEC 2024

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.	Define discrete random variable with an example.	RE	1	2
2.	List the limitations of Poisson distribution?	AN	1	2
3.	Construct the equations of two regression lines. What is the angle between them?	AP	2	2
4.	Let X and Y be independent random variables with $var(X) = 9\ and\ var(Y) = 3$. Find $var(4X - 2Y + 6)$.	AP	2	2
5.	Discover an unbiased estimator and give an example.	AN	3	2
6.	Examine the properties of maximum likelihood estimators.	AN	3	2
7.	List the advantages of non-parametric test.	AN	4	2
8.	Can we apply Kolmogorov test for discrete distribution in non-parametric test? justify.	AP	4	2
9.	List the control charts of attributes.	AN	5	2
10.	Compare lower control limits and upper control limits of c-chart?	EV	5	2

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

Q.No		Questions	BLT	CO	Marks
11.	a	If the density function of a continuous random variable x is given by $$f(x) = \begin{cases} ax & ,0 \le x \le 1 \\ a & ,1 \le x \le 2 \\ 3a - ax & ,2 \le x \le 3 \\ 0 & ,otherwise \end{cases}$$ i) Find the value of a. ii) Find the cumulative distribution function of x. iii) If $x_1, x_1, and\ x_3$ are 3 independent observations of x, what is the probability that exactly one of these 3 is greater than 1.5?	AP	1	16

Or

	b	i	The number of monthly breakdowns of a computer is a random variable having a Poisson distribution with mean equal to 1.8. Find the probability that this computer will function for a month. i) Without a breakdown ii) With only one breakdown and iii) With at least one breakdown	AP	1	8
		ii	State and prove the memory less property of exponential distribution.	UN	1	8
12.	a	i	Two random variables X and Y have the jointly density $(x, y) = \begin{cases} 2 - x - y & , \quad 0 < x < 1 \ ,0 < y < 1 \\ 0 & \quad otherwise \end{cases}$ Construct $cov(X, Y) = -\frac{1}{144}$.	AP	2	8
		ii	The two lines of regression are $8x - 10y + 66 = 0$ $40x - 18y - 214 = 0$ The variance of x is 9. Apply the above i) Find mean value of x and y ii) Correlation coefficient between x and y.	AP	2	8
			Or			
	b	i	If X and Y are independent random variables with P.d.f $e^{-x}, x \geq 0; e^{-y}, y \geq 0$ respectively. Find the density function of $U = \dfrac{X}{X+Y}$ and $V = X + Y$. U and V are independent.	AP	2	8
		ii	A coin is tossed 10 times. What is the probability of getting 3 or 4 or 5 heads. Applying central limit theorem.	AP	2	8
13.	a	i	Let $x_1, x_2, x_3, \dots, x_n$ be random samples on a Bernoulli variable taking the value I with probability θ and the value with 0 with Probability$(1 - \theta)$. Show that $\frac{\tau(\tau-1)}{n(n-1)}$ is an unbiased estimate of θ^2.Where$\tau = \sum_{i=1}^{n} x_i$.	AN	3	8
		ii	If $x_1, x_2, x_3, \dots, x_n$ are the values of a random sample from an exponential population, Examine the maximum likelihood estimator of the parameter θ.	AN	3	8
			Or			
	b	i	Independent random sample of size $n_1 = 16, n_2 = 25$ from normal population with $\sigma_1 = 4.8 \ and \ \sigma_2 = 3.5$ have the means $\overline{x_1}$ =18.2 and $\overline{x_2}$ = 23.4. find a 95% confidence interval for $\mu_1 - \mu_2$.	AN	3	8
		ii	In 16 test runs the gasoline consumption of tan experiment engine has a standard deviation of 2.2 gallons. Assume a 99% confidence interval for σ^2, which measures the true variability of the gasoline consumption of the engine.	AN	3	8

14.	a	i	The following Data constitute a random sample of measurements of the octane rating of certain kind of gasoline 99.0 102.3 99.8 100.5 99.7 96.2 99.1 102.5 103.3 97.4 100.4 98.9 98.3 98.0 101.6 Test the null hypothesis $\tilde{\mu} = 98.0$ against the alternative hypothesis $\tilde{\mu} > 98.0$ at the 0.01 level of significance.	EV	4	8
		ii	The following are the two types of emergency flares on the basis of burning 4time (rounded to the nearest 10^{th} of the minutes. Brand A : 14.9 11.3 13.2 16.6 17.0 14.1 15.4 13.0 16.9 Brand B : 15.2 19.8 14.7 18.3 16.2 21.2 18.9 12.2 15.3 19.4 Use the U –Test at 0.05 level of significance whether the 2 samples come from identical continuous populations are whether the average burning time of Brand A is less than Brand B flares.	EV	4	8
			Or			
	b		Use the kruskal-Wall'S test to test for difference in mean among the three samples. If $\alpha = 0.01$. What is your conclusion Sample 1: 95 97 99 98 99 99 99 94 95 98 Sample 2: 104 102 102 105 99 102 111 103 100 103 Sample 3: 119 130 132 136 141 172 145 150 144 135	EV	4	16
15.	a		Demonstrate an $\overline{X} - R$ chart for the following data that give the height of the fragmentation bomb. Draw also the Engineering specification tolerance limit of 0.830 ± 0.010 cm in the same graph infer your conclusion.	EV	5	16

Group	Items				
No	1	2	3	4	5
1	0.831	0.829	0.836	0.840	0.826
2	0.834	0.826	0.831	0.831	0.831
3	0.836	0.826	0.831	0.822	0.816
4	0.833	0.831	0.835	0.831	0.833
5	0.830	0.831	0.831	0.833	0.820
6	0.829	0.828	0.828	0.832	0.841
7	0.835	0.833	0.829	0.830	0.841
8	0.818	0.838	0.835	0.834	0.830
9	0.841	0.831	0.831	0.833	0.832
10	0.832	0.828	0.836	0.832	0.825

Or

	b		The data given below are the number of defectives in 10 samples of 100 item each. Illustrate a p-chart and np chart and comment on the results.	EV	5	16

Sample	1	2	3	4	5	6	7	8	9	10
Defectives	6	16	7	3	8	12	7	11	11	4