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BCS/BAD/BAI/BDS301

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024
Mathematics III for CSE Stream

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2 VTU Formula Hand Book is permitted..
3. M : Marks , L: Bloom's level , C: Course outcomes.
4. Statistical tables and mathematics Formula handbooks are allowed.

		Module – 1	M	L	C
Q.1	a.	For what value of K the following represents a valid probability distribution? X : −2 −1 0 1 2 3 P(x) : 0.1 K 0.2 2k 0.3 k Find i) $P(x < 1)$ ii) $P(-1 < x \leq 2)$ iii) Mean iv) Variance.	6	L2	CO1
	b.	A communication channel receives independent pulses at the rate of 12 pulses per micro second. The probability of transmission error is .001 for each micro second. Compute the probabilities of i) No errors during a micro second ii) One error per micro second iii) Two error per micro second iv) At least one error v) At most two errors.	7	L3	CO2
	c.	The weekly wages of workers in a company are normally distributed with mean on Rs. 700 and S.D of Rs.50. Find the probability that the weekly wage of a randomly chooses worker is i) between Rs. 650 and Rs. 750 ii) More than Rs. 750 [A(1) = .3413 form normal table].	7	L3	CO2
		OR			
Q.2	a.	If x is an exponential variate with mean 3, find i) $P(x > 1)$ ii) $P(x < 3)$.	6	L2	CO2
	b.	Find the mean and variance of Binomial distribution.	7	L2	CO2
	c.	The number of accidents per day (x) are recorded in a textile industry over a period of 400 day is given. Fit a Poisson distribution for the data and calculate the theoretical frequencies. x : 0 1 2 3 4 5 f : 173 168 37 18 3 1	7	L3	CO2
		Module – 2			
Q.3	a.	The joint probability distribution of 2 random variables X and Y are given below : Y \ X: −2, −1, 4, 5 1: 0.1, 0.2, 0, 0.3 2: 0.2, 0.1, 0.1, 0 Determine : i) Marginal distribution of X and Y ii) E(x), E(y), E(xy)	6	L2	CO2

	b.	Find the unique fixed probability vector for the regular statistic matrix $P = \begin{bmatrix} 0 & 1 & 0 \\ 1/6 & 1/2 & 1/3 \\ 0 & 2/3 & 1/3 \end{bmatrix}$	7	L2	CO3
	c.	A students study habits are as follows : If he studies one night, he is 60% sure not to study the next night; on the other hand if he does not study one night, he is 80% sure next to study the next night. In the long run how next often does he study?	7	L3	CO3
		OR			
Q.4	a.	Define the following terms : i) Markov chain ii) Stochastic matrix iii) Probability matrix iv) Regular Stochastic matrix v) Transient state of Markov chain vi) Absorbing state of Markov chain	6	L2	CO3
	b.	The distribution of two stochastically independent random variable X and Y defined on the sample space are given by the following tables : X : 0 1 Y : 1 2 3 P(x) : 0.2 0.8 P(y) : 0.1 0.4 0.5 Find the joint distribution of X and Y Also evaluate Cov (X, Y)	7	L2	CO2
	c.	Three boy A, B and C are throwing a ball to each other. A always throws the ball to B and B always throws the ball to C, But C is just as likely to throw the ball to B as to A. If C was the first person to throw the ball, find the probabilities that for the three throw i) A has the ball ii) B has the ball iii) C has the ball.	7	L3	CO3
		Module – 3			
Q.5	a.	Explain the following terms i) Null Hypothesis ii) Type I and Type II errors iii) Significance level iv) Confidence intervals v) Test of significance.	6	L2	CO5
	b.	A die was thrown 1200 times and the number 6 was obtained 236 times. Can the die be considered fair at 0.01 level of significance? [$Z_{0.01} = 2.58$].	7	L3	CO4
	c.	In a city A, 20% of a random sample of 900 school boys had a certain physical defect. In another city B, 18.5% of the random sample of 1600 school boys had the same defect. Is the difference between to proportions significant? Test at 5% of significance [$Z_{0.05} = 1.96$].	7	L3	CO4
		OR			
Q.6	a.	Explain : i) The objective of sampling ii) The testing of hypothesis iii) One-tail and two-tail tests.	6	L2	CO5

	b.	A coin was tossed 400 times and head turned up 216 times. Can we infer that the coin is unbiased at 1% level of significance? [$Z_{0.01} = 2.58$].	7	L3	CO4
	c.	In an exit poll enquiry it was revealed that 600 voters in one locality and 400 voters from another locality favoured 55% and 48% respectively a particular party, test the hypothesis that there is a deference party, test the hypothesis that there is a difference in the locality in respect of the opinion at 5% level of significance.	7	L3	CO4
		Module – 4			
Q.7	a.	The average zinc concentration recovered from a sample of measurement taken in 36 different locations in a river is found to be 2.6gms per millimeter. Find the 95% and 99% confidence intervals for the mean zinc concentration in the river. Assume that the population standard deviation is 0.3 gm per mm ($Z_{0.05} = 1.96$ and $Z_{0.01} = 2.58$).	6	L3	CO5
	b.	Two types of batteries are tested for their length of life and the following results are obtained : Battery A : $n_1 = 10$ $\bar{x}_1 = 500$ hrs $\sigma_1^2 = 100$ Battery B : $n_2 = 10$ $\bar{x}_2 = 560$ hrs $\sigma_2^2 = 121$ Compute students t and test whether there is a significant difference in the two means, where $t_{0.05}$ (for $\gamma = 18$) = 2.10.	7	L3	CO5
	c.	Two samples of sizes 9 and 8 give the sum of squares of deviations from their respective means equal to 160 inches^2 and 94 ionches^2 respectively. Can these be regarded as drawn from the same normal population? Given $F_{0.05} = 3.73$ for $\gamma_1 = 8$, $\gamma_2 = 7$.	7	L3	CO5
		OR			
Q.8	a.	Let the observed value of the mean $\bar{X}$ of a random sample of size 20 from a normal distribution with mean μ and variance $\sigma^2 = 80$ be 81.2. Find a 90% and 95% confidence interval for μ. ($Z_{0.10} = 1.64$, $Z_{0.05} = 196$).	6	L3	CO4
	b.	A group of boys and girls were given an intelligence test. The mean score, D.D score and numbers in each groups are as follows : Boys: Mean 74, SD 8, n 12 — Girls: Mean 70, SD 10, n 10 Is the difference between the means of the two groups significant at 5% level and significance ($t_{0.05}$= 2.086 for 20 d.f).	7	L3	CO4
	c.	A die is thrown 60 times and the frequency distribution for the number appearing on the face x is given by the following table X: 1 2 3 4 5 6 Observed frequency: 15 6 4 7 11 17 Test the hypothesis that the die is unbiased given that $\chi^2_{0.01}(5) = 15.09$	7	L3	CO4

Module – 5

Q.9 **a.** To test the significance of variations in the retail prices of a commodity in three principal cities Mumbai, Kolkata and Delhi, four shops were chosen at random in each city and the prices observed in rupees were as follows : **10** **L3** **CO6**

Mumbai	:	16	8	12	14
Kolkota	:	14	10	10	6
Delhi	:	4	10	8	8

Do the data indicate that the price in the 3 cities are significantly different? [$F_{0.05}$ (2, 9) = 4.26].

b. The following table gives the number of refrigerators sold b 4 salesman in 3 months : **10** **L3** **CO6**

Month	Salesman			
	A	B	C	D
May	50	40	48	39
June	46	48	50	45
July	39	44	40	39

Is there a significant difference in the sales made by the four salesmen? Is there a significant difference in the sales during different moths? [$F_{0.05}$ ($d.f_1 = 3$, $df_2 = 6$) = 4.75 and $F_{0.05}$ ($df_1 = 2$, $df_2 = 6$) = 5.14]

OR

Q.10 **a.** A study investigated the perception of corporate ethical values among individuals specializing in marketing. Using X = 0.05 and the following data, test for significant differences in perception among three groups. **10** **L3** **CO6**

Marketing manger	Marketing Research	Advertising
6	5	6
5	5	7
4	4	6
5	4	5
6	5	6
4	4	6

[F for $df_1 = 2$, $df_2 = 15$ and X = 0.05 is 3.68]

b. To study the performance of three detergents and three, different water temperatures, the following 'whiteness' reading were obtained with specially designed equipment : **10** **L3** **CO6**

Water Temperature	Detergent A	Detergent B	Detergent C
Cold water	57	55	67
Warm water	49	52	68
Hot water	54	46	58

Perform a two – way analysis of variance, using 5% level of significance. [F = 6.94 for $df_1 = 2$, $df_2 = 4$ and $\alpha = 0.05$

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