CBCS SCHEME

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BCS/BAD/BAI301

Third Semester B.E./B.Tech. Degree Supplementary Examination, June/July 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. Statistical tables and Mathematics Formula Hand Book are permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	A random variable X has the following probability function for various values of x. <table><tr><td>X</td><td>-3</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>P(X = x)</td><td>k</td><td>2k</td><td>3k</td><td>4k</td><td>3k</td><td>2k</td><td>k</td></tr></table>i) Find the value of k. ii) Find mean and variance and standard deviation.	06	L2	CO1
	b.	During a laboratory experiment, the average number of radioactive particles passing through a counter in 1 milli second is 4, using Poisson distribution, find the probability that : i) 6 particles enter the counter in a given millisecond ii) at least 2 particles enter the counter in a given millisecond iii) at most 3 particles enter the counter in a given millisecond.	07	L2	CO2
	c.	The life of a tube manufactured by a company is known to have mean 200 months. Assuming that the life of tube has an exponential distribution, find the prob that the life of a tube manufactured by a company is i) less than 200 months ii) between 100 and 300 months iii) more than 200 months.	07	L3	CO2
		OR			
Q.2	a.	A random variable X has the p.d.f $f(x) = \begin{cases} K(1-x^2) & \text{for } 0 < x < 1 \\ 0 & \text{otherwise} \end{cases}$ i) Find K ii) Find $P(0.1 < x < 0.2)$ iii) $P(x > 0.5)$	06	L2	CO1
	b.	Find mean and variance of Binomial distribution.	07	L2	CO1
	c.	A manufacturer of air-mail envelopes knows from experience that the weight of the envelopes is normally distributed with mean 1.95gm and S.D 0.05gm. About how many envelops weighing. i) 2 gm or more ii) 2.05 gm or more iii) between 2 and 2.5 gm. In a lot of 100 envelops (Given A(1) = 0.3413 , A(2) = 0.4772)	07	L3	CO2
		Module – 2			
Q.3	a.	The joint distribution of two r.vs X and Y is as follows : <table><tr><td>X \ Y</td><td>-4</td><td>2</td><td>7</td></tr><tr><td>1</td><td>1/8</td><td>1/4</td><td>1/8</td></tr><tr><td>5</td><td>1/4</td><td>1/8</td><td>1/8</td></tr></table>Compute the following : i) E(X) and E(Y) ii) E(XY) iii) COV(X, Y)	06	L2	CO2

	b.	Prove that the Markov chain whose t.p.m. is $P = \begin{bmatrix} 0 & 2/3 & 1/3 \\ 1/2 & 0 & 1/2 \\ 1/2 & 1/2 & 0 \end{bmatrix}$ is irreducible. Find the corresponding stationary probability vector.	07	L2	CO3
	c.	A standard study habits are as follows. If he studies one night, he is 70% sure not to study the next night.. On the other hand if he does not study one night, he is 60% sure not study the next night. In the long run how often does he study?	07	L3	CO3
		OR			
Q.4	a.	Suppose X and Y are independent random variables, X takes values 2, 5, 7 with probability ½ , ¼ , ¼ respectively. Y takes values 3, 4, 5 with probability 1/3, 1/3, 1/3. i) Find the joint probability distribution of X and Y. ii) Show that COV(X, Y) is equal to zero.	06	L2	CO1
	b.	Explain Regular Stochastic matrix. Show that the matrix $\begin{bmatrix} 1 & 1 & 0 \\ 1/2 & 0 & 1/2 \\ 1/2 & 1/4 & 1/4 \end{bmatrix}$ is a regular stochastic matrix.	07	L2	CO3
	c.	A gambler's luck follows a pattern. If he wins a game, the probability of winning the next game is 0.6. However if he loses a game, the probability of losing the next game is 0.7. There is an even chance of gambler winning the first game. If so, i) What is the probability of he winning the second game. ii) What is the probability of he wining the third game.	07	L3	CO3
		Module – 3			
Q.5	a.	Explain the following terms: i) Null hypothesis ii) Hypothesis iii) Level of significance	06	L1	CO2
	b.	A die is thrown 9000 times and a throw of 3 or 4 was observed 3240 times. Show that the die cannot be regarded as an unbiased one at 5% l.o.s.	07	L3	CO3
	c.	A machine part out 16 defective articles in a sample of 500. After the machine is repaired, it put out 3 defective articles in a sample of 100. Has the machine been improves? Test at hypothesis level of significance.	07	L3	CO3
		OR			
Q.6	a.	Define : i) Test of significance ii) Critical region of a statistical test iii) Confidence interval	06	L1	CO4
	b.	A sample of 100 days is taken from metrological records of a certain district and 10 of them are found to be foggy. What are the probable limits of the percentage of foggy days in the district? Test at 1% significance level.	07	L3	CO4
	c.	In a city A, 20% of a random sample of 900 school boys had a certain slight physical defect. In another city B, 18.5% of a random sample of 1600 school boys had the same defect. Is the difference between the proposing significant? Test at 5% significance level.	07	L3	CO4
		Module – 4			
Q.7	a.	An unknown distribution has a mean of 45 and a S.D. of 8, samples at size 30 are drawn randomly from the population. Find the probability that the sample mean is between 42 and 50. (Given A(2.053) = 0.4798, A(3.42) = 0.4997)	06	L2	CO5

b. A group of boys and girls are given an intelligence test. The mean score, S.D. score and no. in each group are as follows: **07 | L3 | CO5**

	Boys	Girls
Mean	124	121
S.D	12	10
n	18	14

Is the mean score of boys significantly different from that of girls?
(Given $t_{0.05}$ (df = 30) = 2.04)

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: **07 | L3 | CO4**

x	1	2	3	4	5	6
Frequency	15	6	4	7	11	17

Test the hypothesis that the die is unbiased. Given $\chi^2_{0.05}(df = 5) = 11.07$

OR

Q.8 a. A random sample of 1000 men from North India shows that their mean wage is Rs. 5 per day with a S.D of Rs.1.50. A sample of 1500 men from South India gives a mean wage of Rs. 4.50 per day with a S.D of Rs.2. Does the mean rate of wages varies as between the two regions. (Test at 5% l.o.s.) **06 | L2 | CO5**

b. A certain stimulus administered to each of the 12 patients resulted in the following change in blood pressure 5, 2, 8, -1, 3, 0, 6, -2, 1, 5, 0, 4. Can it be concluded that the stimulus will increase the blood pressure?
($t_{0.05}$ for 11 d.f = 2.201) **07 | 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 and 91 inches respectively. Can these be required as drawn from the same normal population? ($F_{8,7}$ = 3.73). **07 | L2 | CO4**

Module – 5

Q.9 a. Three samples each of size 5 were drawn from three uncorrelated normal populations with equal variances. Test the hypothesis that the population means are equal at 5% level. **10 | L3 | CO6**

Sample 1	10	12	9	16	13
Sample 2	9	7	12	11	11
Sample 3	14	11	15	14	16

Apply one-way ANOVA using 0.05 significance level.

b. Present your conclusions after doing analysis of variance to the following results of the Latin – square design experiment conducted in respect of five fertilizers which were used on plots of different fertilizers. **10 | L3 | CO6**

A 16	B 10	C 11	D 9	E 9
E 10	C 9	A 14	B 12	D 11
B 15	D 8	E 8	C 10	A 18
D 12	E 6	B 13	A 13	C 12
C 13	A 11	D 10	E 7	B 14

<table>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.10</td><td>a.</td><td>Set an analysis of variance table for the following data at 5% significant level.
<table><tr><td>A</td><td>6</td><td>7</td><td>3</td><td>8</td></tr><tr><td>B</td><td>5</td><td>5</td><td>3</td><td>7</td></tr><tr><td>C</td><td>5</td><td>4</td><td>3</td><td>4</td></tr></table></td><td>10</td><td>L3</td><td>CO6</td></tr>
<tr><td></td><td>b.</td><td>Perform a two-way ANOVA on the data given below.
<table><tr><td>Plot of land</td><td colspan="4">Treatment</td></tr><tr><td></td><td>A</td><td>B</td><td>C</td><td>D</td></tr><tr><td>I</td><td>38</td><td>40</td><td>41</td><td>39</td></tr><tr><td>II</td><td>45</td><td>42</td><td>49</td><td>36</td></tr><tr><td>III</td><td>40</td><td>38</td><td>42</td><td>42</td></tr></table>i) Is there any significant difference between the treatment?
ii) Is there any significant difference between the plots?</td><td>10</td><td>L3</td><td>CO6</td></tr>
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