CBCS SCHEME

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BCS/BAD/BAI/BDS301

Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Mathematics – III for Computer Science Stream

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Mathematics Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

<table>
<tr><th colspan="3">Module – 1</th><th>M</th><th>L</th><th>C</th></tr>
<tr><td>Q.1</td><td>a.</td><td>A random variable x has the following prob. density function for various values of x.
<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>
Find the value of k and evaluate $P(x < 6)$, $P(3 < x \le 6)$ and $(x \ge 6)$.</td><td>07</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>Derive the mean and variance of Poisson distribution.</td><td>06</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>In a certain town the duration of a shower is exponentially distributed with mean 5 minutes. What is the probability that a shower will last for?
(i) less than 10 minutes (ii) more than 10 minutes and (iii) between 10 and 12 minutes.</td><td>07</td><td>L3</td><td>CO2</td></tr>
<tr><th colspan="6">OR</th></tr>
<tr><td>Q.2</td><td>a.</td><td>The probability density function of
$$f(x) = \begin{cases} Kx^2, & -3 < x < 3 \\ 0, & \text{elsewhere} \end{cases}$$
Find the value of K and evaluate (i) $P(x < 2)$, $P(x > 1)$ (ii) $P(1 \le x \le 2)$</td><td>07</td><td>L3</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>When a coin is tossed 4 times, find the probability of getting (i) exactly one head (ii) atleast three heads and (iii) less than two heads.</td><td>06</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>The marks of 1000 students in an examination follows a normal distribution with mean > 0 and S.D 5. Find the number of students whose marks will be (i) less than 65 (ii) more than 75 and (iii) between 65 and 75.</td><td>07</td><td>L2</td><td>CO2</td></tr>
<tr><th colspan="6">Module – 2</th></tr>
<tr><td>Q.3</td><td>a.</td><td>If the joint probability distribution of x and y is given by
$$f(x, y) = \frac{1}{30}(x+y), \text{ for } x = 0, 1, 2, 3; \ y = 0, 1, 2$$
Find (i) $P(x \le 2, y = 1)$ (ii) $P(x > y)$</td><td>07</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>b.</td><td>Find the unique fixed probability vector of
$$P = \begin{bmatrix} 0 & 1 & 0 \\ 1/6 & 1/2 & 1/3 \\ 0 & 2/3 & 1/3 \end{bmatrix}$$
18
13
21</td><td>06</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>c.</td><td>Three boys A, B and C are throwing a ball to each other. A always throw the ball to B. B always throw the ball to A and C is just as likely to throw the ball to A as to B. Find the probability that C has the ball after three throws, if C starts the game.</td><td>07</td><td>L3</td><td>CO3</td></tr>
</table>

OR

Q.4 a. The joint prob. distribution for the following data, find E(x) and E(y). **[07] [L2] [CO2]**

X \ Y	-2	-1	4	5
1	0.1	0.2	0.0	0.3
2	0.2	0.1	0.1	0

b. Show that the matrix **[06] [L2] [CO3]**

$$P = \begin{bmatrix} 0 & 0 & 1 \\ 1/2 & 0 & 1/2 \\ 0 & 1 & 0 \end{bmatrix}$$ is a regular stochastic matrix.

c. A gambler's luck follows pattern. If he wins a game the prob. of winning the next game is 0.6. However, if he loses a game, the prob. of losing the next game is 0.7. There is an even chance of the gambler winning the first game. What is the prob. of he winning the second game. **[07] [L3] [CO3]**

Module – 3

Q.5 a. Define (i) Null hypothesis (ii) A statistic (iii) Standard error (iv) Level of significance (v) Test of significance. **[07] [L1] [CO4]**

b. A coin was tossed 400 times and head turned up 216 times. Test the hypothesis that the coin is unbiased at 5% LOS. **[06] [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 proportions significant at 5% significance level? **[07] [L3] [CO5]**

OR

Q.6 a. Explain the following terms: **[07] [L1] [CO4]**
(i) Type-I and Type-II errors
(ii) Statistical hypothesis
(iii) Critical region
(iv) Alternate hypothesis

b. The average marks in Engg. Maths of a sample of 100 students was 51 with S.D 6 marks. Could this have been a random sample from a population with average marks 50? **[06] [L2] [CO5]**

c. One type of aircraft is found to develop engine trouble in 5 flights out of a total of 100 and another type in 7 flights out of a total of 200 flights. Is there a significance difference in the two types of aircrafts so far as engine defects are concerned? Test at 0.05 significance level. **[07] [L3] [CO4]**

Module – 4

Q.7 a. State central limit theorem. Use the theorem to evaluate $P(50 < \bar{x} < 56)$ where $\bar{x}$ represents the mean of a random sample of size 100 from an infinite population with mean $\mu = 53$ and variance $\sigma^2 = 400$. **[07] [L2] [CO4]**

b. Suppose that 10, 12, 16, 19 is a sample taken from a normal population with variance 6.25. Find 95% confidence interval for the population mean. Given that Z(0.15) = 0.0596. **[06] [L2] [CO5]**

c. Fit a Poisson distribution to the following data and test for goodness of fit at 5% LOS. **[07] [L3] [CO5]**

x	0	1	2	3	4
f	419	352	154	56	19

OR

Q.8	**a.**	Height of a random sample of 50 college student showed a mean of 174.5 cms and a S.D 6.9 cms. Construct 99% confidence limits for the mean height of all college students.	**07**	**L2**	**CO4**
	b.	A random sample of 10 boys had the following I.Q : 70, 120, 110, 101, 88, 83, 95, 98, 107, 100. DO these data support the assumption of a population mean I.Q of 100 (at 5% LOS)?	**06**	**L3**	**CO5**
	c.	The theory predicts the propositions of beans in the four groups, G_1 , G_2 , G_3 , G_4 should be in the ratio 9 : 3 : 3 : 1. In experiment with 1600 beans the numbers in the groups were 882, 313, 287 and 118. Does the experimental support the theory.	**07**	**L3**	**CO5**

Module – 5

Q.9 a. The varieties of wheat A, B, C were shown in four plots each and the following yields in quintals per acre were obtained. **10 L3 CO6**

A	8	4	6	7
B	7	6	5	3
C	2	5	4	4

Test the significance of difference between the yields of varieties, given that 5% tabulated value of F = 4.26 with (2, 9) d.f. Set up one-way ANOVA and using direct method.

b. Present your conclusion after doing ANOVA to the following results of the Latin-square design conducted in respect of five fertilizers which were used on plots of different fertility. **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)

OR

Q.10 a. Set up two-way ANOVA table for the data given below, using coding method subtracting 40 from the given numbers. **10 L3 CO6**

Pieces of land	Treatment			
	A	B	C	D
P	45	40	38	37
Q	43	41	45	38
R	39	39	41	41

b. There are three main brands of a certain power. A set of its 120 sales is examined and found to be allocated among four groups (A, B, C, D) and brands (I, II, III) as follows: **10 L3 CO6**

Brands	Groups			
	A	B	C	D
I	0	4	8	15
II	5	8	13	6
III	18	19	11	13

Is there any significant difference in brands preference? Answer at 5% level, using one-way ANOVA. Take 10 as the code value to subtract it from all given values.

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