<table>
<tr><td></td><td>b</td><td>A coin is tossed 1000 times and head turns up 540 times. Decide on the hypothesis that the coin is unbiased at 1% level of significance.</td><td>7</td><td>L3</td><td>CO3</td></tr>
<tr><td></td><td>c</td><td>One type of air craft 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 air craft's so far as engine defects are concerned? Test at 5% significance level.</td><td>7</td><td>L3</td><td>CO3</td></tr>
<tr><td colspan="3">Module-4</td><td></td><td></td><td></td></tr>
<tr><td>Q. 07</td><td>a</td><td>An unknown distribution has a mean of 90 and a standard deviation of 15. Samples of size $n = 25$ are drawn randomly from the population.
Find the probability that the sample mean is between 85 and 92.</td><td>6</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>b</td><td>The heights of a random sample of 50 college students showed a mean of 174.5 centimeters and a standard deviation of 6.9 centimeters. Construct a 99% confidence interval for the mean height of all college students.</td><td>7</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>c</td><td>A die was thrown 60 times and the following frequency distribution was observed:
<table>
<tr><td>Faces</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>frequency</td><td>15</td><td>6</td><td>4</td><td>7</td><td>11</td><td>17</td></tr>
</table>
Test whether the die is unbiased at 5% significance level.</td><td>7</td><td>L3</td><td>CO4</td></tr>
<tr><td colspan="3">OR</td><td></td><td></td><td></td></tr>
<tr><td>Q. 08</td><td>a</td><td>In a recent study reported on the Flurry Blog, the mean age of tablet users is 34 years. Suppose the standard deviation is 15 years. Take a sample of size $n = 100$. Using central limit theorem, find the probability that the sample mean age is more than 30 years.</td><td>6</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>b</td><td>Suppose that 10, 12, 16, 19 is a sample taken from a normal population with variance 6.25. Find a 95 percent confidence interval for the population mean.</td><td>7</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>c</td><td>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% level of significance)?</td><td>7</td><td>L3</td><td>CO4</td></tr>
<tr><td colspan="3">Module-5</td><td></td><td></td><td></td></tr>
<tr><td>Q. 09</td><td>a</td><td>Three types of fertilizers are used on three groups of plants for 5 weeks. We want to check if there is a difference in the mean growth of each group. Using the data given below apply a one-way ANOVA test at 0.05 significant level
<table>
<tr><td>Fertilizer-1</td><td>6</td><td>8</td><td>4</td><td>5</td><td>3</td><td>4</td></tr>
<tr><td>Fertilizer-2</td><td>8</td><td>12</td><td>9</td><td>11</td><td>6</td><td>8</td></tr>
<tr><td>Fertilizer-3</td><td>13</td><td>9</td><td>11</td><td>8</td><td>7</td><td>12</td></tr>
</table></td><td>10</td><td>L3</td><td>CO5</td></tr>
</table>

	b	Find the unique fixed probability vector for the regular stochastic matrix $A = \begin{bmatrix} 0 & 1 & 0 \\ \frac{1}{6} & \frac{1}{2} & \frac{1}{3} \\ 0 & \frac{2}{3} & \frac{1}{3} \end{bmatrix}$	**7**	**L2**	**CO2**
	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 the gambler winning the first game. (i) What is the probability of he winning the second game? (ii) What is the probability of he winning the third game? (iii) In the long run, how often he will win?	**7**	**L3**	**CO2**
OR					
Q.04	a	Determine the value of k so that the function $f(x, y) = k\|x - y\|, for\ x = -2, 0, 2; y = -2, 3$ represents joint probability distribution of the random variables X and Y. Also determine $Cov(X, Y)$.	**6**	**L2**	**CO2**
	b	Show that the matrix $\begin{bmatrix} 0 & 0 & 1 \\ \frac{1}{2} & 0 & \frac{1}{2} \\ 0 & 1 & 0 \end{bmatrix}$ is a regular stochastic matrix	**7**	**L2**	**CO2**
	c	Three boys A, B and C are throwing a ball to each other. A is just as likely to throw the ball to B as to C. B always throws 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 now A has the ball.	**7**	**L3**	**CO2**
Module-3					
Q. 05	a	Explain the following terms (i) Standard error (ii) Statistical hypothesis (iii) Critical region of a statistical test (iv) Test of significance	**6**	**L1**	**CO3**
	b	In 324 throws of a six faced die, an odd number turned up 181 times. Is it reasonable to think that the die is unbiased one at 5% level of significance?	**7**	**L3**	**CO3**
	c	In an examination given to students at a large number of different schools the mean grade was 74.5 and S.D grade was 8. At one particular school where 200 students took the examination the mean grade was 75.9. Discuss the significance of this result at both 5% and 1% level of significance.	**7**	**L3**	**CO3**
OR					
Q. 06	a	Define (i) Alternative hypothesis (ii) A statistic (iii) Level of significance and (iv) Two-tailed test	**6**	**L1**	**CO3**

different in their mean speed. Given at 5% level $F_{2,12}$= 3.89.

b Set up ana analysis of variance table for the following per acre production data for three varieties of wheat, each grown on 4 plots and state if the variety differences are significant.

Plot of Land	Per acre production data		
	A	B	C
1	6	5	5
2	7	5	4
3	3	3	3
4	8	7	4

Use ANOVA, given at 5% level $F_{2,9}$ = 4.26.

L3 10

OR

Q.10 a Set up an analysis of variance table for the following two-way design results: per acre production data of wheat in metric tons;

Varieties of fertilizers	Varieties of seeds		
	A	B	C
W	6	5	5
X	7	5	4
Y	3	3	3
Z	8	7	4

Also state whether variety differences are significant at 5% level. Given that $F_{2,6}$ = 5.14 and $F_{3,6}$ = 4.76.

L3 10

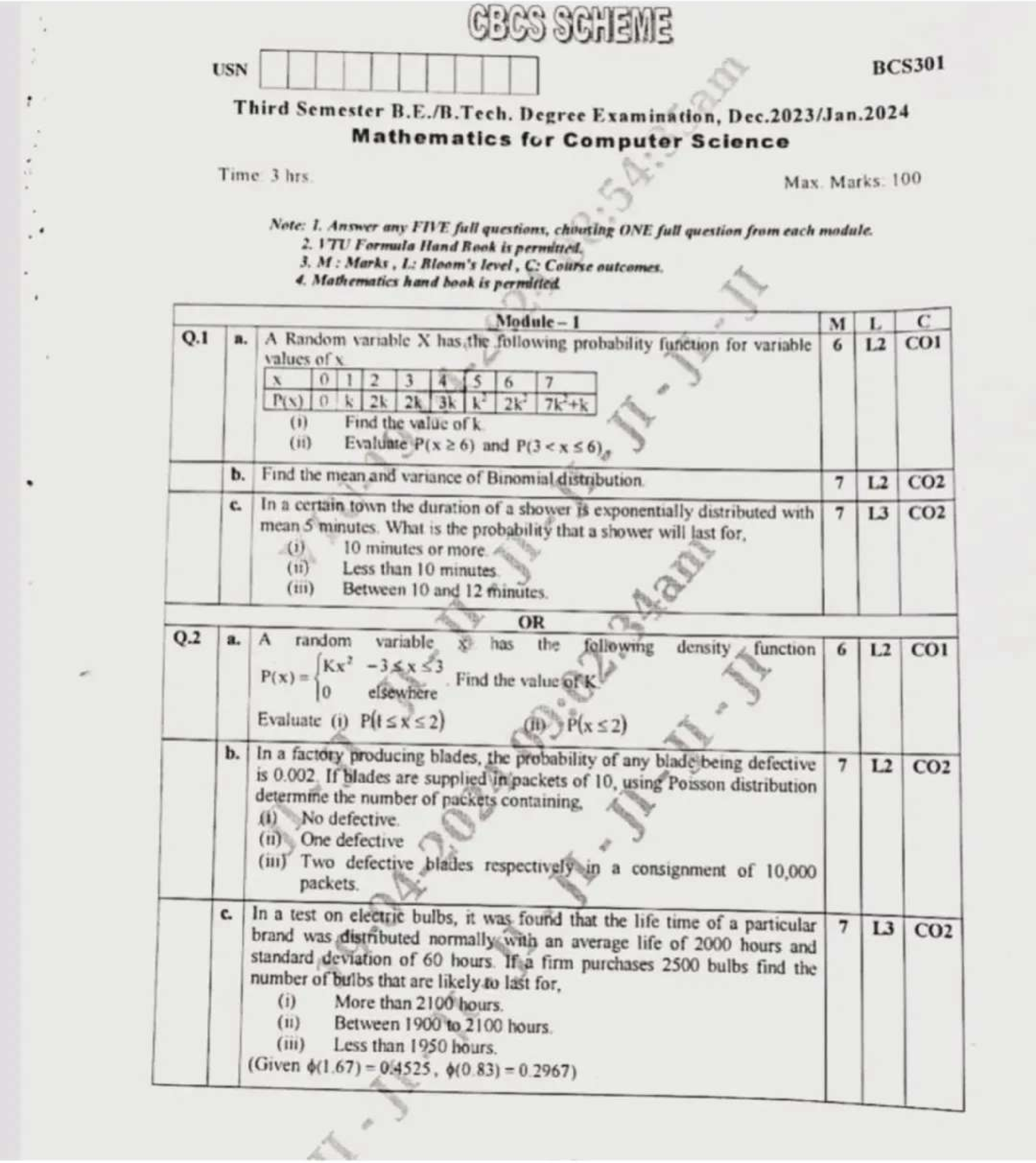
b Analyze the variance in the following table Latin square of yields in kgs of Paddy where A, B, C, D denotes the different methods of cultivation.

D-122	A-121	C-123	B-122
B-124	C-123	A-122	D-125
A-120	B-119	D-120	C-121
C-122	D-123	B-121	A-122

Examine whether the different methods of cultivation have given significantly different is given that F_3 = 4.76.

L3 10

mohsin_alii_14



CBCS SCHEME

USN | | | | | | | | | | |

BCS301

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024

Mathematics for Computer Science

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. Mathematics hand book is permitted.

Module – 1

M | L | C

Q.1 a. A Random variable X has the following probability function for variable values of x — 6 | L2 | CO1

x	0	1	2	3	4	5	6	7
P(x)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2+k$

(i) Find the value of k

(ii) Evaluate $P(x \geq 6)$ and $P(3 < x \leq 6)$.

b. Find the mean and variance of Binomial distribution. — 7 | L2 | CO2

c. 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, — 7 | L3 | CO2

(i) 10 minutes or more.

(ii) Less than 10 minutes.

(iii) Between 10 and 12 minutes.

OR

Q.2 a. A random variable x has the following density function — 6 | L2 | CO1

$$P(x) = \begin{cases} Kx^2 & -3 \leq x \leq 3 \\ 0 & \text{elsewhere} \end{cases}$$

. Find the value of K.

Evaluate (i) $P(1 \leq x \leq 2)$ (ii) $P(x \leq 2)$

b. In a factory producing blades, the probability of any blade being defective is 0.002. If blades are supplied in packets of 10, using Poisson distribution determine the number of packets containing. — 7 | L2 | CO2

(i) No defective.

(ii) One defective

(iii) Two defective blades respectively in a consignment of 10,000 packets.

c. In a test on electric bulbs, it was found that the life time of a particular brand was distributed normally with an average life of 2000 hours and standard deviation of 60 hours. If a firm purchases 2500 bulbs find the number of bulbs that are likely to last for, — 7 | L3 | CO2

(i) More than 2100 hours.

(ii) Between 1900 to 2100 hours.

(iii) Less than 1950 hours.

(Given $\phi(1.67) = 0.4525$, $\phi(0.83) = 0.2967$)

		OR			
Q.4	a.	Define probability vector, regular stochastic matrix, fixed prob vector.	06	L1	CO3
	b.	The joint probability distribution of two discrete random variables X and Y is $f(x, y) = k(2x + y)$, where x and y are integers such that $0 \leq x \leq 2$, $0 \leq y \leq 3$. i) Find the value of the constant k. ii) Show that the random variables X and Y are dependent iii) Find $P(X \geq 1, Y \leq 2)$.	07	L3	CO2
	c.	A fair coin is tossed thrice. The random variables X and Y are defined as X = 0 or 1 according as head or tail occurs on the first toss, y-number of heads. Compute c(X, Y)	07	L3	CO2
		Module – 3			
Q.5	a.	Define statistical hypothesis, null hypothesis, Type-I error and Type-II error.	06	L1	CO4
	b.	In 324 throws of a six faced die an even number turned up 181 times. Is it reasonable to think that the 'die' is an unbiased one at 99% level?	07	L2	CO4
	c.	Before an increase in excise duty on tea, 800 people out of sample of 1000 were consumers of tea. After the increase in duty, 800 people were consumers of tea in a sample of 1200 persons. Find whether there is significant decrease in the consumption of tea after the increase in duty at 1%. (One tailed test at 1% is 2.33).	07	L3	CO4
		OR			
Q.6	a.	A coin is tossed 1000 times and head turns up 540 times. Decide on the hypothesis that the coin is unbiased.	06	L2	CO4
	b.	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 to come to power. Test the hypothesis that there is a difference in the locality in respect of the opinion.	07	L3	CO4
	c.	A random sample for 1000 workers in company has mean wage of Rs.50 per day and standard deviation of Rs.15. Another sample of 1500 workers from another company has mean wage of Rs.45 per day and standard deviation of Rs.20. Does the mean rate of wages varies between the two companies at 95% confidence limit?	07	L3	CO4
		Module – 4			
Q.7	a.	The mean life time of a sample of 25 bulbs is found as 1550 hrs with standard deviation of 120 hours. The company manufacturing the bulbs claims that the average life of their bulbs is 1600 hrs. Is the claim acceptable at 5% level of significance?	06	L3	CO4
	b.	The two independent samples of eight and seven items respectively had the following values of the variable: Sample 1 9 11 13 11 15 9 12 14 Sample 2 10 12 10 14 9 8 10 Do the two estimates of population variance differ significantly at 5% level of significance? F at 5% $(V_1 = 7, V_2 = 6) = 4.21$.	07	L3	CO4
	c.	Table gives the number of aircraft accidents that occurred during the various days of a week. Test whether the accidents are uniformly distributed over the week. $\chi^2_{5\%}(\gamma = 5) = 11.07$. Day Mon Tue Wed Thur Fri Sat Number of accidents 15 19 13 12 16 15	07	L3	CO4

USN

Third Semester B.E Degree Examination

MATHEMATICS FOR CS ENGINEERING STREAM (BCS301)

TIME: 03 Hours **Max.Marks:10**

Note: (i) Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**
(ii) Statistical tables and Mathematics Formula handbooks are allowed.

<table>
<tr><th colspan="3">Module -1</th><th>M</th><th>L</th><th>C</th></tr>
<tr><td>Q.01</td><td>a</td><td>A random variable X has the following probability 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>
(i) Find the value of k
(ii) Evaluate $P[X < 6]$, $P[0 < X < 5], and\ P[X \geq 6]$</td><td>6</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b</td><td>Find the mean and variance of Poisson distribution.</td><td>7</td><td>L2</td><td>CO</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) 10 minutes or more (ii) less than 10 minutes (iii) between 10 and 12 minutes.</td><td>7</td><td>L3</td><td>CO</td></tr>
<tr><td colspan="3">OR</td><td></td><td></td><td></td></tr>
<tr><td>Q.02</td><td>a</td><td>Determine the value k, so that the function $f(x) = k(x^2 + 4), for\ x = 0, 1, 2, 3$ can serve as a probability distribution of the discrete random variable X:
Also, find (i) $P[0 < X \leq 2]$ & (ii) $P[X \geq 1]$</td><td>6</td><td>L2</td><td>CO</td></tr>
<tr><td></td><td>b</td><td>Out of 800 families with 5 children each, how would you expect to have
(i) 3 *boys*
(ii) At least one boy
(iii) At most two boys, assuming equal probabilities for boys and girls.</td><td>7</td><td>L3</td><td>CO</td></tr>
<tr><td></td><td>c</td><td>In a normal distribution, 31% of the items are under 45 and 8% are over 64. Find the mean and Variance of the distribution.</td><td>7</td><td>L3</td><td>CO</td></tr>
<tr><td colspan="3">Module-2</td><td></td><td></td><td></td></tr>
<tr><td>Q. 03</td><td>a</td><td>If the joint probability distribution of X and Y is given by
$$f(x, y) = \frac{x + y}{30}\ , for\ x = 0, 1, 2, 3; y = 0, 1, 2$$
Find (i) $P[X \leq 2, Y = 1]$, (ii) $P[X > 2, Y \leq 1]$ (iii) $P[X > Y]$</td><td>6</td><td>L2</td><td>CO</td></tr>
</table>

USN ☐☐☐☐☐☐☐☐☐☐

Third Semester B.E. Degree Examination

Mathematics for Computer Science

TIME: 03 Hours **Max. Marks: 100**

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.
02. Statistical tables and Mathematics formulae handbooks are allowed

<table>
<tr><th colspan="3">Module -1</th><th>Bloom's Taxonomy Level</th><th>Marks</th></tr>
<tr><td>Q.01</td><td>a</td><td>The probability distribution function of variate X is given by the following table;
<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></tr>
<tr><td>P(x)</td><td>k</td><td>3k</td><td>5k</td><td>7k</td><td>9k</td><td>11k</td><td>13k</td></tr>
</table>
i) Find the value of k, ii) $P(x \geq 5)$ & iii) $P(3 < x \leq 6)$.</td><td>L2</td><td>6</td></tr>
<tr><td></td><td>b</td><td>If the probability of a bad reaction from a certain injection is 0.001, determine the chance that more than two of 2000 individuals will have a bad reaction.</td><td>L3</td><td>7</td></tr>
<tr><td></td><td>c</td><td>Find the mean and standard deviation of Poisson's distribution.</td><td>L2</td><td>7</td></tr>
<tr><td colspan="3">OR</td><td></td><td></td></tr>
<tr><td>Q.02</td><td>a</td><td>The probability of a pen manufactured by a factory be defective is 1/10. If 12 such pens are manufactured, what is the probability that i) exactly 2 are defective, ii) at least 2 are defective, iii) none of them are defective.</td><td>L3</td><td>6</td></tr>
<tr><td></td><td>b</td><td>Determine the value of k, so that the function $f(x) = k(x^2 + 4)$ for x = 0, 1, 2, 3 can serve as a probability distribution of the discrete random variable X: Also find i) $P(0 < x \leq 2)$ and ii) $P(x \geq 1)$.</td><td>L2</td><td>7</td></tr>
<tr><td></td><td>c</td><td>Find the mean and standard deviation of Binomial distribution.</td><td>L2</td><td>7</td></tr>
<tr><td colspan="3">Module-2</td><td></td><td></td></tr>
<tr><td>Q.03</td><td>a</td><td>The joint probability distribution of discrete random variables X & Y are as follows;
<table>
<tr><td>X\Y</td><td>-3</td><td>2</td><td>4</td></tr>
<tr><td>1</td><td>0.1</td><td>0.2</td><td>0.2</td></tr>
<tr><td>2</td><td>0.3</td><td>0.1</td><td>0.1</td></tr>
</table>
Then i) determine marginal distribution of X & Y, ii) show that X & Y are dependent.</td><td>L2</td><td>6</td></tr>
<tr><td></td><td>b</td><td>Determine the value of k so that the function $f(x, y) = k|x - y|$, for $x = -2, 0, 2$; $y = -2, 3$ represents joint probability distribution of the random variables X and Y. Also determine $\text{cov}(X, Y)$.</td><td>L2</td><td>7</td></tr>
<tr><td></td><td>c</td><td>Three boys X, Y, Z are throwing a ball to each other. X always throws the ball to Y & Y always throws the ball to Z. But Z is just as likely to throw the ball to Y or as to X. Write TPM if Z is the first person to throw the ball, find the probability that X has the ball after fourth throw.</td><td>L3</td><td>7</td></tr>
<tr><td colspan="3">OR</td><td></td><td></td></tr>
</table>

<table>
<tr><td>Q.04</td><td>a</td><td>Given the following joint distribution of the random variable X & Y.
<table>
<tr><td>X\Y</td><td>−2</td><td>−1</td><td>4</td><td>5</td></tr>
<tr><td>1</td><td>0.1</td><td>0.2</td><td>0</td><td>0.3</td></tr>
<tr><td>2</td><td>0.2</td><td>0.1</td><td>0.1</td><td>0</td></tr>
</table>
Determine the marginal probability distributions of X & Y. Also compute i) Expectations of X, Y & XY, ii) Covariance of X & Y, iii) Correlation of X & Y.</td><td>L2</td><td>6</td></tr>
<tr><td></td><td>b</td><td>The joint probability distribution of random variables X & Y are 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>¼</td><td>1/8</td></tr>
<tr><td>5</td><td>¼</td><td>1/8</td><td>1/8</td></tr>
</table>
then determine i) marginal distribution of X & Y, ii) E(X), E(Y) & E(XY), iii) COV(X,Y), iv) $\rho(X, Y)$.</td><td>L2</td><td>7</td></tr>
<tr><td></td><td>c</td><td>The students study habits are as follows; If he studies on one night, he is 60% sure not to study on next night. On the other hand, if he does not study on to night, he is 80% sure to study next night. Write the transition probability matrix for his chain of study. In the long run how often does he study? Suppose he studies on Monday night, what is the probability that he does not study on Friday night?</td><td>L3</td><td>7</td></tr>
<tr><td colspan="3">Module-3</td><td></td><td></td></tr>
<tr><td>Q.05</td><td>a</td><td>A die was thrown 9000 times and throw of 5 or 6 was obtained 3240 times on the assumption of random throwing do the data indicate an unbiased die?</td><td>L3</td><td>6</td></tr>
<tr><td></td><td>b</td><td>Before an increase in excise duty on tea 400 people out of a sample 500 persons were found to be tea drinkers. After an increase in duty 400 people were tea drinkers in a sample of 600 people. Using standard error of proportion, state whether there is a significant decrease in the consumption of tea for 95% and 99% level of significance?</td><td>L3</td><td>7</td></tr>
<tr><td></td><td>c</td><td>A survey was conducted in a slum locality of 2000 families by selecting a sample of size 800 families. It was revealed that 180 families were illiterate. Find the probable limits of the illiterate families in the population of 2000.</td><td>L3</td><td>7</td></tr>
<tr><td colspan="3">OR</td><td></td><td></td></tr>
<tr><td>Q.06</td><td>a</td><td>In 324 throws a die an odd number turned up 181 times. Is it reasonable to think that the die is an unbiased one?</td><td>L3</td><td>6</td></tr>
<tr><td></td><td>b</td><td>The mean weight obtained from a random sample of size 100 is 64gms. The standard deviation of the weight distribution of the population is 3gms. Test the statement that the mean weight of the population is 67gms at 5% level of significance. Also set up 99% confidence limits of the mean weight of the population.</td><td>L3</td><td>7</td></tr>
<tr><td></td><td>c</td><td>In a sample of 100 people in this city, the average income was Rs. 210, with a standard deviation of Rs. 10. For another sample of 150 persons, the average income was Rs. 220, with a standard deviation of Rs. 12. The standard deviation of the incomes of the people of the city was Rs. 11. Test whether there is any significant difference between the average incomes of the localities.</td><td>L3</td><td>7</td></tr>
</table>

OR

Q.8 **a.** Two random samples gave the following data: — 06 | L2 | CO4

	Size	Mean	Variance
Sample 1	8	9.6	1.2
Sample 2	11	16.5	2.5

Can we conclude that the two samples have been drawn from the same normal population? $F_{5\%}(10, 7) = 3.64$.

b. The following data relate to the marks obtained by 11 students in two tests. Second test is after intense coaching. Do the data indicate that the students have benefited by coaching? — 07 | L3 | CO4

Test 1	19	23	16	24	17	18	20	18	21	19	20
Test 2	17	24	20	24	20	22	20	20	18	22	19

($t_{5\%}(\gamma = 10)$ is 1.81)

c. The mean value of a random sample of 60 items was found to be 145 and standard deviation is 40. Find the 95% confidence limits for the population mean. — 07 | L2 | CO5

Module – 5

Q.9 **a.** The following figures relate to production in kgs of three variables A, B, C of wheat sown on 12 plots. — 10 | L3 | CO6

A	14	16	18		
B	14	13	15	22	
C	18	16	19	19	22

Apply one-way Annova using a 0.05 significance level in the production of the varieties. F_c at 5% (2, 9) d.f is 4.26.

b. Analyze and interpret the following statistics concerning output of wheat per field obtained as a result of experiment conducted to test four varieties of wheat viz., A, B, C and D under a Latin – Square design. — 10 | L3 | CO6

C 25	B 23	A 20	D 20
A 19	D 19	C 21	B 18
B 19	A 14	D 17	C 20
D 17	C 20	B 21	A 15

OR

Q.10 **a.** Four doctors each test four treatments for a certain disease and observe the number of days each patient takes to recover. The results are as follows: — 10 | L3 | CO6

Doctor/Treatment	T_1	T_2	T_3	T_4
D_1	10	14	19	20
D_2	11	15	17	21
D_3	9	12	16	19
D_4	8	13	17	20

Discuss the difference between doctors and treatments F_{at} 5% level (3, 9) is 3.86.

CBCS SCHEME

BCS301

USN ☐☐☐☐☐☐☐☐☐☐

Third Semester B.E./B.Tech. Degree Examination, June/July 2024

Mathematics for Computer Science

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.

<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>Obtain the mean and variance of Poisson distribution.</td><td>06</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>b.</td><td>Out of 800 families with 4 children each, how many families would be expected to have (i) 2 boys and 2 girls (ii) atleast one boy (iii) at most 2 girls. Assume equal probabilities for boys and girls.</td><td>07</td><td>L3</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>The length of telephone conversation in a booth has been an exponential distribution and found on an average to be 5 minutes. Find the probability distribution and found on an average to be 5 minutes. Find the probability that a random call made from this booth (i) ends less than 5 minutes (ii) between 5 and 10 minutes.</td><td>07</td><td>L2</td><td>CO2</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.2</td><td>a.</td><td>The probability distribution of a finite random variable X is given by
<table>
<tr><td>X</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>P(X)</td><td>0.1</td><td>k</td><td>0.2</td><td>2k</td><td>0.3</td><td>k</td></tr>
</table>
(i) Find the value of k (ii) Variance (iii) $P(x \leq 2)$</td><td>06</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>The number of accidents in a year to taxi drivers in a city follows a Poisson distribution with mean 3. Out of 1000 taxi drivers find approximately number of drivers with (i) more than 3 accidents in a year (ii) at most 2 accidents in a year.</td><td>07</td><td>L3</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>The marks of 1000 students in an exam follows normal distribution with mean 70 and standard deviation 5. Find the students whose marks will be (i) less than 65 (ii) between 65 and 75. A(1) = 0.3413.</td><td>07</td><td>L3</td><td>CO2</td></tr>
<tr><td colspan="6">Module – 2</td></tr>
<tr><td>Q.3</td><td>a.</td><td>Given the following joint distribution of the random variables X and Y. Find the corresponding marginal distribution. Also compute the covariance.
<table>
<tr><td>X \ Y</td><td>1</td><td>3</td><td>9</td></tr>
<tr><td>2</td><td>1/8</td><td>1/24</td><td>1/12</td></tr>
<tr><td>4</td><td>1/4</td><td>1/4</td><td>0</td></tr>
<tr><td>6</td><td>1/8</td><td>1/24</td><td>1/12</td></tr>
</table></td><td>06</td><td>L3</td><td>CO2</td></tr>
<tr><td></td><td>b.</td><td>A salesmen's territory consists of 3 cities A, B and C. He never sells in the same city for 2 consecutive days. If he sells in city A, then the next day he sells in city B. However if he sells in either B or C then the next day he is twice as likely to sell in city A as in the other city. In the long run how often does he sell in each of the cities.</td><td>07</td><td>L3</td><td>CO3</td></tr>
<tr><td></td><td>c.</td><td>Show that $P = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1/2 & 1/2 & 0 \end{bmatrix}$ is a regular stochastic matrix. Also find the associated unique fixed probability vector.</td><td>07</td><td>L2</td><td>CO2</td></tr>
</table>

Module – 5

Q.9 **a.** Three different kinds of food are tested on three groups of rats for 5 weeks. The objective is to check the difference in mean weight (in grams) of the rats per week. Apply one-way ANOVA using a 0.05 significance level to the following data: **10** **L3** **CO6**

Food 1	8	12	19	8	6	11
Food 2	4	5	4	6	9	7
Food 3	11	8	7	13	7	9

b. Analyze and interpret the following statistics concerning output of wheat per field obtained as a result of experiment conducted to test four varieties of wheat viz. A, B, C, D under a Latin-square design. **10** **L4** **CO6**

C 25	B 23	A 20	D 20
A 19	D 19	C 21	B 18
B 19	A 14	D 17	C 20
D 17	C 20	B 21	A 15

OR

Q.10 **a.** Set up an analysis of variance table for the following per acre production data for three varieties of wheat, each grown on four plots and state it the variety differences are significant at 5% significant level (Two way ANOVA). **10** **L3** **CO6**

Plot of land	Per acre production data		
	Variety of wheat		
	A	B	C
1	6	5	5
2	7	5	4
3	3	3	3
4	8	7	4

b. Set up ANOVA table for the following information relating to three drugs testing to judge the effectiveness in reducing blood pressure for three different groups of people. **10** **L4** **CO6**

Group of people	Drug		
	X	Y	Z
A	14 15	10 9	11 11
B	12 11	7 8	10 11
C	10 11	11 11	8 7

Do the drugs act differently?
Are the different groups of people affected differently?
Is the interaction term significant?
Answer the above questions taking a significant level of 5%?

*****

Module-4

Q.07 a An experiment on Pea breading the following frequency of seeds were obtained

Round & Yellow	Wrinkled & Yellow	Round & Green	Wrinkled & Green	Total
315	101	108	32	556

Theory predicts that the frequences should be in the proportions 9:3:3:1. Examine the correspondence between theory and experiment ($\chi^2_{0.05}$= 7.815).

L3 **6**

b Use the Central Limit 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 $\sigma^2 = 400$ (Given, A(1.5) = 0.4332).

L2 **7**

c Ten individuals are chosen at random from a population and their heights in inches found to be 63, 63, 66, 67, 68, 69, 70, 70, 71 and 71. Test the hypothesis that the mean height of the universe is 66 inches. ($t_{0.05}$ = 2.262 for 9 d.f.).

L3 **7**

OR

Q.08 a The following table shows the runs scored by two batsmen can it be said that the performance of batsman A is more consistent than the performance of batsman B? Use 1% level of significance ($F_{0.01}$,4,7 = 7.85).

Batsman-A	40	50	35	25	60	70	65	55
Batsman-B	60	70	40	30	50			

L3 **6**

b The following table gives the number of aircraft accidents that occurred during the various days of the week. Find whether the accidents are uniformly distributed over the week?

Days	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Total
Accidents	14	16	8	12	11	9	14	84

Given that $\chi^2_{0.05}$= 12.59.

L3 **7**

c Consider the sample consisting of nine numbers 45, 47, 50, 52, 48, 47, 49, 53, 51. The sample is drawn from a population whose mean is 47.5. Find whether the sample mean differs significantly from the population mean at 5% level of significance ($t_{0.05}$ for 8 d.f. = 2.31).

L2 **7**

Module-5

Q.09 a A manufacturing company has purchase three new machines of different brands and wishes to determine whether one of them is faster than the others in producing a certain output, 5 hourly production figures are obtained at random from each other machine and the results are given below;

Observation	A	B	C
1	25	31	24
2	30	39	30
3	36	38	28
4	38	42	25
5	31	35	28

Use ANOVA and determine whether the machines are significantly

L3 **1**

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 fertility

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

10 **L3** **CO**

OR

Q. 10 a A trial was run to check the effects of different diets. Positive numbers indicate weight loss and negative numbers indicate weight gain. Check if there is an average difference in the weight of people following different diets using an ANOVA Table.

Low Fat	Low Calorie	Low protein	Low carbohydrate
8	2	3	2
9	4	5	2
6	3	4	-1
7	5	2	0
3	1	3	3

10 **L3** **CO**

b The following data show the number of worms quarantined from the GI areas of four groups of muskrats in a carbon tetrachloride anthelmintic study. Conduct a two-way ANOVA test.

I	II	III	IV
33	41	12	38
32	38	35	43
26	40	46	25
14	23	22	13
30	21	11	26

10 **L3** **CO**

<table>
<tr><td></td><td>b.</td><td>In 324 throws of a six faced die an odd number turned up 181 times. Is it reasonable to think that the die is an unbiased one at 5% level of significance?</td><td>7</td><td>L3</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>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 200 flights. Is there a significant difference in the two types of aircrafts so far as engine defects are concerned? Test at 5% significance level.</td><td>7</td><td>L3</td><td>CO4</td></tr>
<tr><td colspan="6" align="center">OR</td></tr>
<tr><td>Q.6</td><td>a.</td><td>Define :
(i) Null Hypothesis.
(ii) Significance level.
(iii) Type I and II error.</td><td>6</td><td>L1</td><td>CO5</td></tr>
<tr><td></td><td>b.</td><td>A coin was tossed 1000 times and head turns up 540 times. Test the hypothesis that the coin is unbiased at 1% level of significance.</td><td>7</td><td>L3</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>In an exit poll enquiry it was revealed that 600 voters in one locality and 400 voters from an other locality favoured 55% and 48% respectively a particular party to come to power. Test the hypothesis that there is a difference in the locality in respect of the opinion at 1% level of significance.</td><td>7</td><td>L3</td><td>CO4</td></tr>
<tr><td colspan="6" align="center">Module – 4</td></tr>
<tr><td>Q.7</td><td>a.</td><td>A random sample of size 64 is taken from an infinite population having mean 112 and variance 144. Using central limit theorem, find the probability of getting the sample mean $\bar{X}$ greater than 114.5</td><td>6</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>b.</td><td>The following data shows the runs scored by two batsman: Can it be said that the performance of batsman A is more consistent than the performance of batsman B? Use 1% level of significance $(F_{0.01,4,7} = 7.85)$
<table>
<tr><td>Batsman A</td><td>40</td><td>50</td><td>35</td><td>25</td><td>60</td><td>70</td><td>65</td><td>55</td></tr>
<tr><td>Batsman B</td><td>60</td><td>70</td><td>40</td><td>30</td><td>50</td><td>-</td><td>-</td><td>-</td></tr>
</table></td><td>7</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>A coins are tossed 100 times and the following results were obtained. Fit a binomial distribution for the data and calculate the theoretical frequencies.
<table>
<tr><td>Number of heads</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>Frequency</td><td>5</td><td>29</td><td>36</td><td>25</td><td>5</td></tr>
</table>
(Given $\chi^2_{0.05} = 9.49$ for 4 degree of freedom)</td><td>7</td><td>L3</td><td>CO4</td></tr>
<tr><td colspan="6" align="center">OR</td></tr>
<tr><td>Q.8</td><td>a.</td><td>Suppose that 10, 12, 16, 19 is a sample taken from a normal population with variance 6.25. Find at 95% confidence interval for the population mean.</td><td>6</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>The individuals are choosen at random from a population and their heights in inches are found to be 63, 63, 66, 67, 68, 69, 70, 70, 71,71. Test the hypothesis that the mean height of the universe is 66 inches. (Given $t_{0.05} = 2.262$ for 9 degree of freedom).</td><td>7</td><td>L3</td><td>CO5</td></tr>
<tr><td></td><td>c.</td><td>A sample analysis of examination results of 500 students war made. It was found that 220 students had failed, 170 had secured third class, 90 had secured second class and 20 had secured first class. Do these figures support the general examination result which is in the ratio 4 : 3 : 2 : 1 for the respective categories
(Given $\chi^2_{0.05} = 7.81$ for 3 degree of freedom).</td><td>7</td><td>L3</td><td>CO4</td></tr>
</table>

OR

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

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

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	-13
II	5	8	13	6	-8
III	18	19	11	13	21

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.

* * * * *

ech. 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>.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 $P(x < 6)$, $P(3 < x \leq 6)$ and $(x \geq 6)$.</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><td colspan="6">OR</td></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) $P(1 \leq x \leq 2)$</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 70 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="3">Module – 2</th><td></td><td></td><td></td></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) $P(x \leq 2,\ y = 1)$ (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
$$P = \begin{bmatrix} 0 & 1 & 0 \\ 1/6 & 1/2 & 1/3 \\ 0 & 2/3 & 1/3 \end{bmatrix}$$</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>

Module – 2

Q.3 a. The joint probability distribution table for two random variable x and y is as follows

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

Determine the marginal probability distribution of x and y. Obtain the correlation coefficient between x and y.

6 | L2 | CO2

b. Find the unique fixed probability vector for the regular stochastic matrix

$$A = \begin{bmatrix} 0 & 1 & 0 \\ \frac{1}{6} & \frac{1}{2} & \frac{1}{3} \\ 0 & \frac{2}{3} & \frac{1}{3} \end{bmatrix}$$

7 | L2 | CO3

c. Three boys A, B, C are throwing ball to each other. A always throws the ball to B and B always throws the ball to C. 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 after three throws :

(i) A has the ball.
(ii) B has the ball
(iii) C has the ball.

7 | L3 | CO3

OR

Q.4 a. The joint probability distribution of two discrete random variables x and y is given by f(x, y) = k(2x+y) where x and y are integers. Such that $0 \le x \le 2,\ 0 \le y \le 3$.

(i) Find the value of the constant K.
(ii) Find the marginal probability distribution of X and Y.
(iii) Show that the random variables X and Y are dependent.

6 | L2 | CO2

b. Find the unique fixed probability vector for the matrix, $P = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ \frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$.

7 | L2 | CO3

c. Each year a man trades his car for a new car in 3 brands of the popular company. If he has a 'swift' he trades it for 'Dzire'. If he has a 'Dzire' he trades it for a 'Wagnor'. If he has a 'Wagnor' he is just as likely to trade it for a new 'Wagnor' or for a 'Dzire' or a 'Swift' one. In 2020 he bought his first car which was 'Wagnor'. Find the probability that he has

(i) 2022 Wagnor.
(ii) 2022 Swift.
(iii) 2023 Dzire.
(iv) 2023 Wagnor.

7 | L3 | CO3

Module – 3

Q.5 a. Explain the following terms:

(i) Statistical Hypothesis.
(ii) Critical region of statistical test.
(iii) Test for significance.

6 | L1 | CO5