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THAKUR COLLEGE OF ENGINEERING & TECHNOLOGY
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END SEMESTER EXAMINATION, MAY 2023
S.T. SEMESTER IV (CBCGS-HME 2020)

Branch:	**AI&DS**	**Q.P. Code:**	**T2415001-3**
Subject:	**Mathematics IV**	**Duration:**	**2 hours**
Subject Code:	**BSC- AIDS401**	**Max. Marks:**	**60**

Instructions: **1. All sections are compulsory**
2. Figures to the right indicate full marks.
3. Assume suitable data if necessary and state the assumptions clearly.

Section-I	**Short Answer Questions (Answer any 05 questions out of 06) (Fundamental, Core Types)**	**Marks**	**CO**	**RBT Level**	**PI**
1	A die is thrown twice and the sum of the numbers appearing is observed to be 6. What is the probability that the number 4 has appeared at least once?	2	CO1	A	3.2.2
2	X is normally distributed, and the mean of X is 12 and the standard deviation is 4. Find out the probability of the following: $P(X \geq 20), P(0 \leq X \leq 12)$. (Area from $z = 0$ to $z = 2$ is 0.4772 and area from $z = 0$ to $z = 3$ is 0.4987)	2	CO2	A	3.2.2
3	From the following data, find the value of n. $\sum x = 4,\ \sum y = 4,\ \sum x^2 = 44,\ \sum y^2 = 44, \sum xy = -40,\ r = -1.$	2	CO3	U	1.1.1
4	Define Level of significance in Testing of Hypothesis.	2	CO4	R	1.2.1
5	If $n_1 = 121, n_2 = 81,\ \overline{X_1} = 84, \overline{X_2} = 81, s_1 = 10, s_2 = 12$, calculate the value of Z statistic.	2	CO5	A	3.2.2
6	Write the formula for SSC with degree of freedom.	2	CO6	R	1.2.1
Section-II	**Descriptive Answer Questions (Answer any 04 out of 06) (Descriptive, Comprehension Types)**				**(20 Marks)**
1	i. A businessman goes to hotels X, Y, Z for 20%, 50%, 30% of the time respectively. It is known that 5%, 4%, 8% of the rooms in X, Y, Z hotels have faulty plumbing. What is the probability that the businessman's room having faulty plumbing is assigned to hotel Z?	5	CO1	U,A	2.2.2
	ii. Verify whether the following functions can be regarded				

	as the probability mass function for the given values of X: (a) $P(X=x)=\begin{cases}\frac{1}{5}, x=0,1,2,3,4\\ 0, \text{ otherwise}\end{cases}$ (b) $P(X=x)=\begin{cases}\frac{x-2}{5}, x=1,2,3,4,5\\ 0, \text{ otherwise}\end{cases}$				
2	It has been claimed that in 60% of all solar heat installations the utility bill is reduced by at least one-third. Accordingly, what are the probabilities that the utility bill will be reduced by at least one third in (a) four of five installations? (b) at least four of five installations?	5	CO2	U,A	3.3.1
3	For a bivariate data, the mean value of x is 25 and the mean value of y is 40. The regression coefficient of y on x is $\frac{1}{9}$ and that of x on y is 4. Find (i) Coefficient of correlation and, (ii) σ_x when $\sigma_y = 12$. (iii) Also write down the equations of line of regression. (iv) And estimate the value of x when $y = 5$.	5	CO3	U,A	2.1.1
4	Explain the procedure of Testing of Hypothesis.	5	CO4	R	1.2.1
5	A sample of 8 students of 16 years each showed up a mean blood pressure of 118.4 mm of Hg with standard deviation of 12.17 mm of Hg. While a sample of 10 students of 17 years each showed the mean blood pressure of 121 mm of Hg with standard deviation of 12.88 mm of Hg during an investigation. The investigator feels that blood pressure is related to age. Do you think that the data provides enough reasons to support investigators feeling at 5% level of significance? ($t_\alpha = 2.12$)	5	CO5	U,A	3.2.1
6	A certain drug is claimed to be effective in curing fever in an experiment on 164 persons with fever. Half of them were given the drug and half were given sugar pills. The results obtained are shown in the following table. Test the hypothesis that the drug is effective in curing fever.	5	CO6	A,U	2.3.1

	Helped	Harmed	No effect	Total
Drug	52	10	20	82
Sugar pills	44	12	26	82
Total	96	22	46	164

Use 5% Level of significance. ($\chi^2_\alpha = 5.99$)

Section-III **Long Answer Question (Answer any 03 out of 05)** **(30 Marks)**
(Application, Analytical, Evaluation, Design Type)

1	i. A player tosses two fair coins. He wins rupees100 if a head appears and rupees 200 if two heads appear. On the other hand, he loses rupees 500 if no head appears. Determine the expected value of the game. Find the expected value of the game.	10	CO1	U,A	3.2.1

	ii. A continuous random variable X is distributed over the interval $[0, 1]$ with pdf $f(x) = ax^2 + bx$, where a, b are constants. If the mean of X is 0.5, find the values of a and b.				
2	In a certain factory turning out blades there is a small chance $\frac{1}{250}$ for a blade to be defective. The blades are supplied in packets of 10. Calculate the approximate number of packets containing. i. No defective ii. Two defectives in a consignment of 10,000 packets using. (a) Binomial distribution (b) Poisson distribution.	10	CO2	A	2.2.1
3	i. Ten competitors in a musical test were ranked by the three judges A, B, and C in the following order.	10	CO3	A	2.3.2

Rank by A	1	6	5	10	3	2	4	9	7	8
Rank by B	3	5	8	4	7	10	2	1	6	9
Rank by C	6	4	9	8	1	2	3	10	5	7

Using the rank correlation method, find which pair of judges has the nearest approach to common liking in music.

ii. Fit a straight line to the following data. Also, estimate the value of y at $x = 1.3$.

x	0	1	2	3	4
y	12	15	16	27	33

4	The height of 7 randomly chosen sailors are in inches. 63, 65, 65, 68, 69, 72,73, The height of 10 randomly chosen soldiers are: 59, 58, 64, 66, 69, 69, 70, 71, 72, 73. In the light of these data can we conclude that soldiers on average are taller than sailors? Use 5% level of significance. $(t_\alpha = 2.145)$	10	CO5	A	2.3.1
5	A farmer applied three types of seeds on 4 separate plots. The observation on per acre is given by the following table.	10	CO6	A	2.3.1

Seeds	A	B	C	D	Total
P	6	4	8	6	24
Q	7	6	6	9	28
R	8	5	10	9	32
Total	21	15	24	24	84

Test whether the plots are equally effective, and if the seeds have the same effect at 5% level of significance.
$(F(3,8) = 8.84)$