U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2023 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Chemical Engineering **Duration: 3 hrs.**
Course Code: 22MA4BSSAP **Max Marks: 100**
Course: Statistics and Probability **Date: 20.09.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.
3. Use of Statistical tables is permitted.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT – I	*CO*	*PO*	Marks
1	a)	The following table gives the results of the measurements of train resistance. V is the velocity in miles per hour, R is the resistance in pounds per tonne. If R is related to V by the relation $R = a + b\,V + cV^2$, find a, b and c for the following table. V: 2, 4, 6, 8, 10 R: 5.5, 9.1, 14.9, 22.8, 33.3	*CO1*	*PO1*	**6**
	b)	The following table represents the magnitude of earthquake (x) and the depth below the surface at the epicentre (y) (in kilometres). Magnitude (x): 7.5, 6.5, 7.0, 7.0, 4.0, 4.0, 7.0 Depth(y): 35, 18, 17, 26, 5, 10, 25 Find the correlation coefficient between the magnitude of the earth quake and the depth. Hence find the regression lines.	*CO1*	*PO1*	**7**
	c)	Given that 2% of the fuses manufactured by a firm are defective, find the probability that a box containing 200 fuses has (i) no defective fuse, (ii) at least one defective fuse, (iii) between 2 and 4 defective fuses.	*CO2*	*PO1*	**7**
		OR			
2	a)	By the method of least squares, fit a curve of the form $y = ab^x$ to the following data: x: 2, 3, 4, 5, 6 y: 144, 172.8, 207.4, 248.8, 298.6	*CO1*	*PO1*	**6**
	b)	The table shows the heights (x in feet) and trunk diameters (y in inches) of eight trees. x: 70, 72, 75, 76, 85, 78, 77 y: 8, 10, 11, 12, 15, 14, 16 Find both the lines of regression and the correlation coefficient.	*CO1*	*PO1*	**7**

		c)	The weekly wages of workers in a company are normally distributed with mean of Rs 700 and standard deviation of Rs 50. Find the probability that the weekly wages of a randomly chosen worker is (i) less than 800, (ii) between Rs 650 and Rs 750, (iii) more than Rs 600.	*CO2*	*PO1*	**7**
			UNIT – II			
	3	a)	A machine is used for a particular job in the forenoon and for a different job in the afternoon. The joint probability distribution of (X, Y), where X and Y represent the number of times the machine breaks down in the forenoon and in the afternoon respectively, is given in the following table. Find $\rho(X,Y)$.	*CO1*	*PO1*	**6**
			X→ / Y↓ | 0 | 1 | 2 0 | 0.1 | 0.04 | 0.06 1 | 0.2 | 0.08 | 0.12 2 | 0.2 | 0.08 | 0.12			
		b)	Assume that a computer system is in one of the three states: busy, idle or undergoing repair denoted by states 0, 1, 2. Observing its state at a certain specified time on each day, it is found that the system approximately behaves like a Markov chain with the transition probability matrix $P = \begin{bmatrix} 0.5 & 0.3 & 0.2 \\ 0.2 & 0.7 & 0.1 \\ 0.4 & 0 & 0.6 \end{bmatrix}$. Prove that the chain is irreducible and determine the steady state probabilities.	*CO2*	*PO1*	**7**
		c)	In a cascade of binary communication channels, the signals 1 and 0 are transmitted in successive stages. In any stage the probability of a transmitted 1 is received as a 1 is 0.75 and the probability of a transmitted 0 is received as a 0 is 0.5. If the probability of transmitting a 1 in the initial stage is 5/8, find the probability of receiving (i) 1 in the fourth stage, (ii) 0 in the fourth stage.	*CO2*	*PO1*	**7**
			UNIT – III			
	4	a)	A new variety of potato grown in 250 plots gave rise to a mean yield of 82.7 quintals per hectare with a standard deviation of 14.6 quintals per hectare. At 1% level of significance, is it reasonable to assert that the new variety is superior in yield to the standard variety with an established mean yield of 80.2 quintals per hectare?	*CO2*	*PO1*	**6**
		b)	The mean yield of two sets of plots and their variability are as given below. Examine whether the difference in the variability in yields is significant. | | Set of 40 plots | Set of 60 plots | Mean yield per plot | 1258 kg | 1243 kg S.D. per plot | 34 | 28	*CO3*	*PO6*	**7**

	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 a random sample of 1600 school boys had the same defect. Is the difference between the proportions significant?	*CO3*	*PO6*	**7**
		UNIT – IV			
5	a)	Measurements on the length of a copper wire were taken in 2 experiments A and B as under: A's (mm): 12.29, 12.25, 11.86, 12.13, 12.44, 12.78, 12.77, 11.9, 12.47 B's (mm): 12.39, 12.46, 12.34, 12.22, 11.98, 12.46, 12.23, 12.06, - Test whether B's measurements are more accurate than A's.	*CO3*	*PO6*	**6**
	b)	A group of 10 rats fed on a diet A and another group of 8 rats fed on a different diet B, recorded the following increase in weights. Diet A: 5, 6, 8, 1, 12, 4, 3, 9, 6, 10 Diet B: 2, 3, 6, 8, 10, 1, 2, 8, -, - Does it show the superiority of diet A over that of B when the analysis is performed by considering their average weights?	*CO3*	*PO1*	**7**
	c)	Given the following contingency table for hair colour and eye colour. Using Chi Square check if there is a good association between the hair and eye color? Hair color: Fair / Brown / Black Blue: 15 / 5 / 20 Grey: 20 / 10 / 20 Brown: 25 / 15 / 20	*CO3*	*PO1*	**7**
		OR			
6	a)	According to a dietary study, a high sodium intake may be related to ulcers, stomach cancer and migraine headaches. The human requirement for salt is only 220 milligrams per day, which is surpassed in most of ready-to-eat foods. If a random of 20 such ready-to-eat foods showed mean sodium content of 244 milligrams with a standard deviation of 24.5 milligrams, does this suggest that the average sodium content in ready-to-eat foods exceed 220 milligrams?	*CO1* *CO2*	*PO1*	**6**
	b)	The number of cars passing a given point was observed as follows: x: 0, 1, 2, 3, 4 f: 419, 352, 154, 56, 19 Fit a Poisson distribution to the data and test the goodness of fit.	*CO1* *CO2*	*PO1*	**7**

	c)	Eleven school boys were given a test in Mathematics carrying a maximum of 25 marks. They were given a month's extra coaching and a second test of equal difficulty was held thereafter. The following table gives the marks in the two tests. Test 1: 23, 20, 19, 21, 18, 20, 18, 17, 23, 16, 19 Test 2: 24, 19, 22, 18, 20, 22, 20, 20, 23, 20, 17 Do the marks give evidence that the students have benefitted by extra coaching? Use 5% level of significance.	*CO3*	*PO6*	**7**
		UNIT – V			
7	a)	An experiment was carried out to determine the effect of claying (four different levels) the ground on the field of barley grains. The yields are given in the below table. 1: D 29.1, B 18.9, C 29.4, A 5.7 2: C 16.4, A 10.2, D 21.2, B 19.1 3: A 5.4, D 38.8, B 24.0, C 37.0 4: B 24.9, C 41.7, A 9.5, D 28.9 Test whether there is any significant difference in the means due to 3 factors i.e., row, column and treatment (different levels of clay).	*CO3*	*PO6*	**10**
	b)	A set of data involving four tropical feed stuffs A, B, C, D tried on 20 chicks is given below. All the twenty chicks are treated alike in all respects except the feeding treatments and each feeding treatment is given to 5 chicks. A: 55, 49, 42, 21, 52 B: 61, 112, 30, 89, 63 C: 42, 97, 81, 95, 92 D: 169, 137, 169, 85, 154 Test whether there is any significant difference in the treatments A, B, C, D.	*CO3*	*PO6*	**10**

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