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: Biotechnology **Duration: 3 hrs.**
Course Code: 22MA4BSBDE **Max Marks: 100**
Course: Biostatistics and Design of Experiments **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.

		UNIT - I	CO	PO	Marks
1	a)	The following table gives the results of the measurements of train resistances; V is the velocity in mile per hour and R is the resistance in pound per ton. If R is related to V by the relation $R = a + bV + cV^2$ obtain the best values of a, b and c using the least square method. V: 0, 1, 2, 3, 4 R: -4, 1, 4, 11, 20	CO1	PO1	**6**
	b)	The wind speed x in miles per hour and wave height y in feet were measured under various conditions on an enclosed deep-water sea, with the results shown in the table x: 2, 7, 9, 13, 17, 20, 23, 29, 31, 34 y: 0.3, 0.7, 3.3, 4.9, 3.0, 6.9, 5.9, 7.2, 6.3, 6.1 Compute the correlation coefficient for the data and interpret the result.	CO1	PO1	**7**
	c)	A survey was conducted to measure the number of hours spent per day by children aged 10-15 years on their mobile in a city. It is observed that, the numbers of hours were normally distributed, having a mean of 8 hours and a standard deviation of 1.5 hours. A participant is randomly selected from the survey. Find the probability that the number of hours spent on the mobile by the participant is between 6.5 and 8.5 hours per day.	CO1	PO1	**7**
		OR			
2	a	The table shows the acres x of wheat planted and acres y of wheat harvested, in millions of acres, in a particular country in ten successive years. x: 75.7, 78.9, 78.6, 80.9, 81.8, 78.3, 93.5, 85.9, 86.4, 88.2 y: 68.8, 69.3, 70.9, 73.6, 75.1, 70.6, 86.5, 78.6, 79.5, 81.4 Find the regression lines of y on x and x on y.	CO1	PO1	**6**
	b	A retail shop has 3 diesel generator sets which it hires every day. The demand for a generator set on an average is Poisson's variate with value 1.5. Obtain the probability that on particular day (i) there was no demand (ii) a demand for more than 3 generators.	CO1	PO1	**7**

	c)	The growth of bacteria y in a community after x hours is given by the following table: x: 1, 2, 3, 4, 5 y: 0.5, 2, 4.5, 8, 12.5 Apply the method of least squares to fit a curve of the form $y = ab^x$.	*CO1*	*PO1*	**7**
		UNIT - II			
3	a)	The manufacturer of a certain medicine claimed that it was 90% effective in relieving an allergy for a period of 8 hours. In a sample of 200 persons who had the allergy, the medicine provided relief for 160 persons. Determine whether the manufacturer's claim is legitimate at 0.01 level of significance.	*CO1*	*PO1*	**6**
	b)	Suppose the Cartoon Network conducts a nation-wide survey to assess viewer attitudes toward Superman. Using a simple random sample, they select 400 boys and 300 girls to participate in the study. Forty percent of the boys say that Superman is their favorite character, compared to thirty percent of the girls. What is the 90% confidence interval for the true difference in attitudes toward Superman?	*CO1*	*PO1*	**7**
	c)	Two varieties of tomato were grown in field plots. Yield (kgs) data are as follows: Variety 1: 1.4, 1.1, 1.4, 1.8, 1.8, 1.2, 0.8, 1.0, 1.2, 1.6 Variety 2: 1.0, 1.2, 1.0, 1.6, 1.7, 0.7, 0.8, 1.3, -, - Test whether there is a variation in the varieties of tomato yield.	*CO1*	*PO1*	**7**
		UNIT - III			
4	a)	The mean life-time of a sample of 100 fluorescent tube lights manufactured by a company is found to be 1570 hours. Test the hypothesis that the mean life-time of the lights produced by the company is 1600 hours and standard deviation of 120 hours.	*CO1*	*PO1*	**6**
	b)	In a study of cerebrovascular disease, patients from 3 socio-economic backgrounds were thoroughly investigated. One characteristic measured was the diastolic blood pressure (mm/Hg). Is there any reason to believe that the 3 groups differ with respect to this characteristic by applying Kruskal-Wallis Test. Group A: 100, 103, 89, 78, 105 Group B: 92, 97, 88, 84, 90, 95 Group C: 81, 102, 86, 83, 99	*CO1*	*PO1*	**7**
	c)	A group of 5 patients treated with medicine "A" weigh 42, 39, 48, 60, and 41 kgs. A second group of 7 patients from the same hospital treated with medicine "B" weigh 38, 42, 56, 64, 68, 69, and 62 kgs. Do you agree with the claim that the medicine "B" increases the weight significantly when the analysis is performed by considering their average weights?	*CO1*	*PO1*	**7**
		OR			

	5	a)	In a study of usefulness of yoga in weight reduction, a random sample of 8 persons undergoing yoga were examined of their weight before and after yoga with the following results: Weight before: 209, 178, 169, 212, 180, 192, 158, 180 Weight after: 196, 171, 170, 207, 177, 190, 159, 180 Test whether yoga is useful in weight reduction at $\alpha = 1\%$	*CO1*	*PO1*	**6**
		b)	The duration of endurance of pain by eleven mice before and after administration of a drug (adrenaline 0.04 mg/20 gm body-weight) is shown in table below. By applying Wilcoxon's Signed-rank Test, is there sufficient evidence in the data to say that the drug increases the duration of endurance of pain? Before: 15.5, 12.7, 14.8, 16.7, 20.1, 22, 20.2, 18.1, 17.6, 17.4, 19.1 After: 21.2, 20.1, 17.2, 22.7, 20, 19.8, 19.8, 18.8, 17.9, 24.3, 18.6	*CO1*	*PO1*	**7**
		c)	Consider a Phase II clinical trial designed to investigate the effectiveness of a new drug to reduce symptoms of asthma in children. A total of n=10 participants are randomized to receive either the new drug or a placebo. Participants are asked to record the number of episodes of shortness of breath over a 1-week period following receipt of the assigned treatment. The data are shown below. Placebo: 7, 5, 6, 4, 12 New Drug: 3, 6, 4, 2, 1 Apply Mann-Whitney test, to check if there is a difference in the number of episodes of shortness of breath over a 1-week period in participants receiving the new drug as compared to those receiving the placebo?	*CO1*	*PO1*	**7**
			UNIT - IV			
	6	a)	Explain the following types of variables with an example. (i) Intervening variable (ii) Extraneous variable (iii) Composite variable	*CO1*	*PO1*	**6**
		b)	Seventeen patients admitted to the hospital were diagnosed as having liver problem. The following are the ages of the subjects in the study: 63 72 62 69 71 84 81 78 61 76 84 67 86 69 64 87 76 Calculate (i) five number summary (ii) interquartile range (iii) standard deviation.	*CO1*	*PO1*	**7**
		c)	Researchers are conducting a prospective cohort study of the association between being an office worker who uses a computer daily and carpal tunnel syndrome. A total of 300 exposed and 300 unexposed participants are enrolled and followed for 10 years. A total of 25 exposed and 17 unexposed had the outcome of interest over the follow-up period. (i) What is the *relative risk* for developing carpal tunnel syndrome? (ii) What is the incidence attributable to daily computer use? (iii) If 60% of the population uses a computer daily at work, how much carpal tunnel could we prevent if we implemented a national work-place ergonomics program (and thus eliminated the exposure of daily computer use)?	*CO1*	*PO1*	**7**

			UNIT - V			
	7	a)	Explain the basic principles of design of experiments.	*CO1*	*PO1*	**4**
		b)	Three varieties of a crop are tested in a RBD with 4 replications, the layout being given in the table. The plot yields are also given. Analyze the experimental yield and state your conclusions. A 6 C 5 A 8 B 9 B 8 A 4 B 6 C 9 C 7 B 6 C 10 A 6	*CO1*	*PO1*	**8**
		c)	A farmer wishes to test the effect of four different fertilizers A, B, C, D on the yield of wheat. In order to eliminate sources of error due to variability in soil fertility, he uses the fertilizers in a Latin square arrangement as indicated with following table, where the numbers indicate yields in bushels per unit area. Perform an analysis of variance to determine if there is a significant difference between the fertilizers at $\alpha = 0.05$ levels of significance. A 18 C 21 D 25 B 11 D 22 B 12 A 15 C 19 B 15 A 20 C 23 D 24 C 22 D 21 B 10 A 17	*CO1*	*PO1*	**8**

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