U.S.N.										

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

Autonomous Institute Affiliated to VTU

December 2023 Supplementary Examinations

Programme: B.E. **Semester: IV**
Branch: Biotechnology **Duration: 3 hrs.**
Course Code: 22MA4BSBDE **Max Marks: 100**
Course: Biostatistics and Design of Experiments

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)	Predict the mean radiation dose at an altitude of 4500 feet by fitting an exponential curve of the form $y = ae^{bx}$ to the given data: Altitude (x): 50, 450, 780, 1200, 4400, 4800, 5300 Dose of radition (y): 28, 30, 32, 36, 51, 58, 69	CO1	PO1	**6**
	b)	Psychological tests of intelligence and of engineering ability were applied to 7 students. Here is a record of ungrouped data showing intelligence ratio and engineering ratio. Calculate the co-efficient of correlation between the intelligence and of engineering ability ratio. *Student*: *A*, *B*, *C*, *D*, *E*, *F*, *G* *I.R*: 105, 104, 102, 101, 100, 99, 98 *E.R*: 101, 103, 100, 98, 95, 104, 92	CO1	PO1	**7**
	c)	Suppose a continuous random variable x has the probability density function $f(x) = \begin{cases} k(1-x^2) & 0 < x < 1 \\ 0 & \text{elsewhere} \end{cases}$. Find (i) Constant k, (ii) $P(0.1 < x < 0.2)$, (iii) $P(x > 0.5)$ and (iv) Cumulative distribution function $F(x)$.	CO1	PO1	**7**
		OR			
2	a)	The following table gives the results of the measurements of train resistances, V is the velocity in miles per hour, R is the resistance in pounds per ton. V: 20, 40, 60, 80, 100, 120 R: 5.5, 9.1, 14.9, 22.8, 33.3, 46.0 If R is related to V by the relation $R = a + bV + cV^2$. Find a, b and c.	CO1	PO1	**6**

	b)	Data on inflorescence length (cm) and the number of cluster per plant are recorded on ten randomly selected plants of Cymposistetragonaloba. Calculate the regression coefficients and obtain the lines of regression: Length of infloresecence(cm): 1 2 3 4 5 No. of secondary branches: 2 5 3 8 7	CO1	PO1	**7**
	c)	If X is Poisson variate with probability mass function $p(x)$ then prove that the mean and variance of a Poisson distribution are same.			**7**
		UNIT – II			
3	a)	According to a recent survey of 1,200 people, 61% feel that the president is doing an acceptable job. We are interested in the population proportion of people who feel the president is doing an acceptable job. Construct a 90% confidence interval for the population proportion of people who feel the president is doing an acceptable job.	CO1	PO1	**6**
	b)	Random samples of 400 men and 600 women were asked whether they would like to have a flyover near their residence. 200 men and 325 women were in favour of the proposal. Do the data indicate that the men and women are significantly different in favour of the proposal are same at 5% level.	CO1	PO1	**7**
	c)	In 1000 extensive sets of trials for an event of small probability, the frequency f of the number x of seeds proved to be x: 0 1 2 3 4 5 6 7 f: 304 366 210 80 28 9 2 1 Fit a Poisson distribution and test for its goodness of fit at $\alpha = 5\%$.	CO1	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?	CO1	PO1	**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 diet B when the analysis is performed by considering their average weights?	CO1	PO1	**7**
	c)	Cardiac output(L/min) was measured by thermodilution in a sample random of 15 post cardiac surgical patients in the left lateral position. The results were as shown. 4.91, 4.10, 6.74, 7.27, 7.24, 5.98, 3.14, 3.23, 5.80, 0.17, 7.5, 6.56, 4.64, 5.39, 5.77 Using Wilcoxon signed rank test can we conclude on the basis of this data that the population median is different than 5.05 at 5% level of significance?	CO1	PO1	**7**

			OR			
	5	a)	In a random sample of 100 tube lights produced by company A, the mean lifetime of tube light is 1190hrs with standard deviation of 90hrs. Also, in a random sample of 75 tube lights from company B the mean lifetime is 1230hrs with standard deviation of 120hrs. is there a difference between the mean lifetimes of the two brands of tube lights at significant level of 1%?	CO1	PO1	**6**
		b)	The following data gives the amount of androgen present in blood of 10 deers before and 30 minutes after a certain drug is injected to them. *Before* 2.76 5.18 2.68 3.05 4.10 7.05 6.6 4.79 7.39 7.3 *After* 7.02 3.1 5.44 3.99 5.21 10.26 13.91 18.53 7.91 4.85 Test at 0.01 level of significance, whether there is significant change in the concentration levels of androgen in blood.	CO1	PO1	**7**
		c)	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? Use Kruskal- Wallis One way Analysis of Variance. *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**
			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**

<table>
<tr><td></td><td></td><td></td><td>UNIT - V</td><td></td><td></td><td></td></tr>
<tr><td></td><td>7</td><td>a)</td><td>Explain the basic principles of design of experiment.</td><td>CO1</td><td>PO1</td><td>4</td></tr>
<tr><td></td><td></td><td>b)</td><td>An oil company tested 4 different blends - A, B, C and D of gasoline for fuel efficiency according to a Latin Square Design in order to control for the variability of 4 different drivers and 4 different models of cars. Fuel efficiency was measured in miles per gallon after driving the cars over a standard course. The data are presented below. Analyse the data.
<table>
<tr><td rowspan="2">Driver</td><td colspan="4">Car Model</td></tr>
<tr><td>I</td><td>II</td><td>III</td><td>IV</td></tr>
<tr><td>1</td><td>D-15.5</td><td>B-33.9</td><td>C-13.2</td><td>A-29.1</td></tr>
<tr><td>2</td><td>B-16.3</td><td>C-26.6</td><td>A-19.4</td><td>D-22.8</td></tr>
<tr><td>3</td><td>C-10.8</td><td>A-31.8</td><td>D-17.1</td><td>B-30.3</td></tr>
<tr><td>4</td><td>A-14.7</td><td>D-34</td><td>B-19.7</td><td>C-21.6</td></tr>
</table></td><td>CO1</td><td>PO1</td><td>8</td></tr>
<tr><td></td><td></td><td>c)</td><td>An experiment was conducted on the yield of potatoes in a randomized block design with four replications. Analyse the following 2^2 factorial design.
<table>
<tr><td>Block</td><td colspan="4">Treatment Combinations</td></tr>
<tr><td>(1)</td><td>(1) - 23</td><td>K - 25</td><td>P - 22</td><td>KP - 38</td></tr>
<tr><td>(2)</td><td>P - 40</td><td>(1) - 26</td><td>K - 36</td><td>KP - 38</td></tr>
<tr><td>(3)</td><td>(1) - 29</td><td>K - 20</td><td>KP - 30</td><td>P - 20</td></tr>
<tr><td>(4)</td><td>KP - 34</td><td>K - 31</td><td>P - 24</td><td>(1) - 28</td></tr>
</table></td><td>CO1</td><td>PO1</td><td>8</td></tr>
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