U.S.N.										

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

Autonomous Institute Affiliated to VTU

October 2024 Supplementary Examinations

Programme: B.E. **Semester: IV**
Branch: Medical Electronics **Duration: 3 hrs.**
Course Code: 23MA4BSMMD **Max Marks: 100**
Course: Mathematical Methods for Medical Electronics

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 are 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 - 1	CO	PO	Marks
1	a)		If $f(z)$ is an analytic function of z, then prove that $\left[\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}\right]\lvert f(z)\rvert^2 = 4\lvert f'(z)\rvert^2$.	1	1	6
	b)		Find the analytic function $f(z)=u(r,\theta)+iv(r,\theta)$, such that $v(r,\theta)=\left(r-\frac{1}{r}\right)\sin\theta$, $r\neq 0$.	1	1	7
	c)		Evaluate $\int_C \frac{\sin\pi z^2+\cos\pi z^2}{(z-1)^2(z-2)}dz$ over the circle $C:\lvert z\rvert=3$.	1	1	7
			OR			
2	a)		Show that the function $u=e^x(x\sin y+y\cos y)$ is harmonic and hence find its harmonic conjugate by constructing the analytic function $f(z)$ using Milne-Thomson method.	1	1	6
	b)		Discuss the transformation $w=z+\frac{a^2}{z}$, $z\neq 0$.	1	1	7
	c)		State and prove Cauchy's theorem.	1	1	7
			UNIT – 2			
3	a)		Fit a power function $y=ax^b$ to the following data pertaining to demand for a product and its price charged at five different cities. Predict the demand when price of the product is Rs. 12.	1	1	6

Price (Rs.) (x)	20	16	10	11	14
Demand (y)	22	41	120	89	56

	b)		Ten students get the following percentage of marks in two subjects A and B.	1	1	7

Marks in A	78	36	98	25	75	82	90	62	65	39
Marks in B	84	51	91	60	68	62	86	58	53	47

Find the rank correlation coefficient between two subjects.

		c)	If the coefficient of correlation between two variables x and y is 0.5 and the acute angle between their lines of regression is $\tan^{-1}\left(\frac{3}{5}\right)$, show that $\sigma_x = \frac{1}{2}\sigma_y$.	*1*	*1*	**7**
			OR			
	4	a)	Fit a second-degree parabola of the form $y = a + bx + cx^2$ to the following data: x: 1.0, 1.5, 2.0, 2.5, 3.0 y: 1.1, 1.3, 1.6, 2.0, 2.7	*1*	*1*	**6**
		b)	Data on inflorescence length (cm) and the number of branches per plant are recorded on ten randomly selected plants. Obtain the regression line of number of secondary branches on the length of inflorescence and hence estimate the approximate number of secondary branches when the length of inflorescence is 6 cm. Length of inflorescence (cm): 1, 2, 3, 4, 5 No. of secondary branches: 2, 5, 3, 8, 7	*1*	*1*	**7**
		c)	In a partially destroyed laboratory record, only the lines of regression of y on x and x on y are available as $4x - 5y + 33 = 0$ and $20x - 9y = 107$ respectively. Calculate $\bar{x}$, $\bar{y}$ and the coefficient of correlation between x and y.	*1*	*1*	**7**
			UNIT – 3			
	5	a)	Derive an expression for mean and variance of Poisson distribution.	*1*	*1*	**6**
		b)	In an examination taken by 500 candidates, the average and standard deviation of marks obtained (normally distributed) are 40% and 10%. Find approximately: (i) how many will pass, if 50% is fixed as a minimum? (ii) how many have scored marks above 60%?	*1*	*1*	**7**
		c)	If X and Y are independent random variables, X takes the values 2, 5, 7 with probability 1/2, 1/4, 1/4 respectively and Y takes the values 3, 4, 5 with probability 1/3, 1/3, 1/3 respectively. (i) Find the joint probability distribution of X and Y. (ii) Show that the covariance of X and Y is equal to zero.	*1*	*1*	**7**
			UNIT – 4			
	6	a)	A machine runs on an average of 125 hours/year. A random sample of 49 machines has an annual average use of 126.9 hours with standard deviation 8.4 hours. Does this suggest to believe that machines are used on the average more than 125 hours annually at 0.05 level of significance?	*1*	*1*	**6**
		b)	Test the N.H.: $\mu_A - \mu_B = 0$ against the A.H.: $\mu_A - \mu_B \neq 0$ at 0.01 level of significance for the following data: Type *A*: Sample Size 40, Mean (kgs) 247.3, S.D. (kgs) 15.2 Type *B*: Sample Size 30, Mean (kgs) 254.1, S.D. (kgs) 18.7	*1*	*1*	**7**

		c)	The blood pressure (B.P.) of 5 women before and after intake of a certain drug are given below: Before: 110, 120, 125, 132, 125 After: 120, 118, 125, 136, 121 Test at 1% level of significance whether there is a significant change in B.P.	*1*	*1*	**7**
			UNIT - 5			
	7	a)	In an ontological examination of school children, out of 146 children examined 21 were found to have some type of ontological abnormalities. Does it confirm with statement that 20% of the school children have ontological abnormalities? Use 5% level of significance.	*1*	*1*	**6**
		b)	An instructor has two classes, A and B, in a particular subject. Class A has 16 students while class B has 25 students. On the same examination, class A had a standard deviation of 9 while class B had a standard deviation of 12. Can we conclude at 0.01 level of significance that the variability of grades is same for both the classes?	*1*	*1*	**7**
		c)	Fit a Poisson distribution for the following data and test the goodness of fit at $\alpha = 5\%$. x: 0, 1, 2, 3, 4, 5 f: 77, 87, 55, 30, 5, 6	*1*	*1*	**7**

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