U.S.N.										

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

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main 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. Each unit has an internal choice; answer one complete 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.

				CO	PO	Marks
			UNIT - 1			
1	a)		Derive Cauchy-Riemann equations of an analytic function $f(z)=u+iv$ in Cartesian form.	*1*	*1*	**6**
	b)		Construct an analytic function $f(z)=u+iv$, if it is given that $u-v=e^x(cosy-siny)$.	*1*	*1*	**7**
	c)		Verify the Cauchy's theorem for the integral of $1/z$ taken over the boundary of the triangle having vertices $(1,2),(1,4)$ and $(3,2)$.	*1*	*1*	**7**
			OR			
2	a)		If $f(z)$ is an analytic function then show that $\left\{\frac{\partial}{\partial x}\lvert f(z)\rvert\right\}^2+\left\{\frac{\partial}{\partial y}\lvert f(z)\rvert\right\}^2=\lvert f'(z)\rvert^2$.	*1*	*1*	**6**
	b)		Discuss the conformal transformation $w=z+\frac{1}{z}, z\neq 0$.	*1*	*1*	**7**
	c)		Evaluate $\int_C \frac{sin\pi z^2+cos\pi z^2}{(z-1)^2(z-2)}dz$ where C is the circle $\lvert z\rvert=3$ using Cauchy's integral formula.	*1*	*1*	**7**
			UNIT - 2			
3	a)		If θ is the angle between the lines of regressions, then show that $\tan\theta=\frac{\sigma_x\sigma_y}{\sigma_x^2+\sigma_y^2}\left(\frac{1-r^2}{r}\right)$.	*1*	*1*	**6**
	b)		Obtain the lines of regression and correlation coefficient for the data x: 1 2 3 4 5 6 7 y: 9 8 10 12 11 13 14	*1*	*1*	**7**
	c)		Find the best parabolic curve $y=a+bx+cx^2$ in the least square sense for the data x: 1 2 3 4 5 6 7 8 9 y: 2 6 7 8 10 11 11 10 9 and hence approximate $y(6.5)$.	*1*	*1*	**7**
			OR			

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	4	a)	Obtain the lines of regression from the following data given $r = 0.8$ and hence find y at $x = 70$. x-series: Mean 18, Standard Deviation 14; y-series: Mean 100, Standard Deviation 20	*1*	*1*	**6**
		b)	Fit a least square geometric curve $y = a\,x^b$ from the data x: 1, 2, 3, 4, 5 y: 0.5, 2, 4.5, 8, 12.5	*1*	*1*	**7**
		c)	Two judges gave the following ranks to 11 girls in a beauty contest. Find the rank correlation for the following data Judge A: 3, 4, 1, 2, 5, 10, 11, 7, 9, 8, 6 Judge B: 2, 4, 3, 1, 7, 9, 6, 11, 10, 5, 8	*1*	*1*	**7**
			UNIT - 3			
	5	a)	The number of accidents in a year to taxi drivers in a city follows a Poisson distribution with mean 3. Out of 1000 taxi drivers find approximately the number of the drivers with i) no accident in a year, ii) at most 2 accidents in a year and iii) more than 3 accidents in a year.	*1*	*1*	**6**
		b)	In a normal distribution 31% of the items are under 45 and 8% of the items are over 64. Find the mean and standard deviation of the distribution.	*1*	*1*	**7**
		c)	Determine $\mathrm{Cov}(X, Y)$, if the joint probability distribution for two random variables X and Y is as given below. $X=1$: 0.1, 0.2, 0, 0.3 $X=2$: 0.2, 0.1, 0.1, 0	*1*	*1*	**7**
			OR			
	6	a)	Derive an expression for mean and variance of Poisson distribution.	*1*	*1*	**6**
		b)	A manufacturer of air-mail envelopes knows from experience that weight of the envelopes is normally distributed with mean 1.95 gm and S.D. 0.05 gm. About how many envelopes weighting i) 2 gm or more ii) 2.05 gm or more can be expected in a given packet of 100 envelopes.	*1*	*1*	**7**
		c)	Two fruits are selected at random from a bag containing 3 apples, 2 oranges and 4 mangoes. If X and Y are respectively, the number of Apples and the number of Oranges included among the two fruits drawn from the bag, find the probability associated with all possible pair of values (x, y). Also, find the covariance of variables X and Y.	*1*	*1*	**7**

B.M.S.C.E. EVEN SEM 2024-25

			UNIT - 4			
	7	a)	Mice with an average lifespan of 32 months will live up to 40 months when fed by a certain nutritious food. If 64 mice fed on this diet have an average lifespan of 38 months and standard deviation of 5.8 months, is there any reason to believe that average lifespan is less than 40 months. Use 5% level of significance.	*1*	*1*	**6**
		b)	A random sample for 1000 workers in company has mean wage of $Rs.50$/- per day and standard deviation of $Rs.15$/- Another sample of 1500 workers from another company have mean wage of $Rs.45$/- per day and standard deviation of $Rs.20$/-. Does the mean rate of wages vary between the two companies? Use 1% level of significance.	*1*	*1*	**7**
		c)	Random samples of specimens of coal from two mines A and B are drawn and their heat producing capacity (in millions of calories/tons) were measured yielding the following results: Mine A: 8350, 8070, 8340, 8130, 8260, - Mine B: 7900, 8140, 7920, 7840, 7890, 7950 Is there significant difference between the means of these two samples at 1% level of significance.?	*1*	*1*	**7**
			OR			
	8	a)	The Pulsality Index (P.I.) of 6 patients before and after contracting a disease are given below. Test at 0.05 level of significance whether there is a significant increase of the mean of P.I. values. Before: 0.4, 0.45, 0.44, 0.54, 0.48, 0.62 After: 0.5, 0.60, 0.57, 0.65, 0.63, 0.78	*1*	*1*	**6**
		b)	A sample of 100 bulbs produced by a company A showed a mean life of 1190 hrs and a standard deviation of 90 hrs. Another sample of 75 bulbs produced by a company B showed a mean life of 1230 hrs and a standard deviation of 120 hrs. Is there a difference between the mean life time of the bulbs produced by the two companies at 5% level of significance?	*1*	*1*	**7**
		c)	A group of 10 boys fed on a diet A and another group of 8 boys fed on a different diet B for a period of 6 months recorded the following increase in weights (lbs.) Diet A: 5, 6, 8, 1, 12, 4, 3, 9, 6, 10 Diet B: 2, 3, 6, 8, 10, 1, 2, 8, -, - Test whether diets A and B differ significantly regarding their effect on increase in weight. Use 1% level of significance.	*1*	*1*	**7**
			UNIT - 5			
	9	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 1% level of significance.	*1*	*1*	**6**

B.M.S.C.E. - EVEN SEM 2024-25

		b)	Can we conclude that the two population variances are equal for the following data of post graduates passed out from a state and private university. Use 5% level of significance. State: 8350 8260 8130 8340 8070 - Private: 7890 8140 7900 7950 7840 7920	*1*	*1*	**7**
		c)	A sample analysis of examination results of 500 students was made. It was found that 22 students had failed, 170 had secured third class 90 had secured second class and 20 ha secured first class. Do these figures support the general examination result which is in t ratio 4: 3: 2: 1 for the respective categories? Use 5% level of significance.	*1*	*1*	**7**
			OR			
	10	a)	A coin is tossed 1000 times and head turns up 540 times. Decide on the hypothesis that the coin is unbiased. Use 5% level of significance.	*1*	*1*	**6**
		b)	Five dice were thrown 96 times and the numbers 1, 2 or 3 appearing on the face of the dice follows the frequency distribution as below. No. of dice showing 1,2 or 3: 5 4 3 2 1 0 Frequency: 7 19 35 24 8 3 Test the hypothesis that the data follows a Poisson distribution. Use 5% level of significance.	*1*	*1*	**7**
		c)	A farmer applied 3 types of fertilizers on 4 separate plots. The figure of yield per acre is tabulated below: A B C D Nitrogen 6 4 8 6 Potash 7 6 6 9 Phosphate 8 5 10 9 Find out if the plots are materially different in fertility, as also, if the three fertilizers make any significant difference in the yield. Use 1% level of significance.	*1*	*1*	**7**

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