U.S.N.										

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

Autonomous Institute Affiliated to VTU

October 2024 Supplementary Examinations

Programme: B.E. **Semester: III**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 23MA3BSMCV **Max Marks: 100**
Course: Mathematics for Civil Engineering- 3

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)	With usual notations, derive $r = \frac{\sigma_x^2+\sigma_y^2-\sigma_{x-y}^2}{2\sigma_x\sigma_y}$.	CO1	PO1	**06**
	b)	The results of measurement of electric resistance R of a copper bar at various temperatures $t^\circ C$ are listed below: t: 19, 25, 30, 36, 40, 45, 50 R: 76, 77, 79, 80, 82, 83, 85 Find a relation $R = a + bt$ where a & b are constants.	CO1	PO1	**07**
	c)	While calculating correlation co-efficient between two variables x and y from 25 pairs of observations, the following results were obtained: $n = 25, \sum x = 125, \sum x^2 = 650, \sum y = 100,$ $\sum y^2 = 460, \sum xy = 508$. Later it was discovered at the time of checking that the pairs of values (8,12) and (6,8) were copied down as (6,12) and (8,6) respectively. Obtain the correct value of correlation co-efficient.	CO1	PO1	**07**
		OR			
2	a)	Ten students get the following percentage of marks in two subjects A and B. Find the rank correlation coefficient. 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	CO1	PO1	**06**
	b)	Apply least squares method to fit a second-degree polynomial of the form $y = a + bx + cx^2$ for the following data: x: 0, 1, 2, 3, 4, 5, 6, 7, 8 y: 12.0, 10.5, 10.0, 8.0, 7.0, 8.0, 7.5, 8.5, 9.0	CO1	PO1	**07**
	c)	Find the coefficient of correlation and the equation of lines of regression for the data: x: 1, 2, 3, 4, 5, 6, 7 y: 9, 8, 10, 12, 11, 13, 14	CO1	PO1	**07**

			UNIT - 2			
	3	a)	In a certain factory turning out razor blades, there is a small chance of 0.002 for any blade to be defective. The blades are supplied in packets of 10. Use Poisson distribution to calculate the approximate number of packets containing (i) no defective (ii) Exactly one defective (iii) At most one defective and (iv) At least one defective blades respectively in a consignment of 10,000 packets.	*CO1*	*PO1*	**06**
		b)	In a normal distribution, 31% of the items are under 45 and 8% are over 64. Find the mean and standard deviation of the distribution.	*CO1*	*PO1*	**07**
		c)	Find i) marginal distributions of X and Y ii) $E(X)$ and $E(Y)$ iii) $\rho(X,Y)$ for the following distribution. Are X and Y independent random variables? Y \ X | -4 | 2 | 7 1 | $\frac{1}{8}$ | $\frac{1}{4}$ | $\frac{1}{8}$ 5 | $\frac{1}{4}$ | $\frac{1}{8}$ | $\frac{1}{8}$	*CO1*	*PO1*	**07**
			UNIT - 3			
	4	a)	Find the Laplace transform of $f(t) = \sin 3t \cos 2t + e^{4t} \cos t$.	*CO1*	*PO1*	**06**
		b)	Find the Laplace transform of the square wave function of period $T = a$ defined as $f(t) = \begin{cases} 1 & 0 < t < a/2 \\ -1 & a/2 < t < a \end{cases}$.	*CO1*	*PO1*	**07**
		c)	Find the inverse Laplace transform of $F(s) = \frac{s^2+6s+9}{(s-1)(s-2)(s+4)}$.	*CO1*	*PO1*	**07**
			OR			
	5	a)	Obtain the Laplace transform of $f(t) = t \sin^2 t + \frac{\sin^2 t}{t}$.	*CO1*	*PO1*	**06**
		b)	Express the function $f(t) = \begin{cases} \sin t & 0 < t < \pi \\ \sin 2t & \pi < t < 2\pi \\ \sin 3t & t > 2\pi \end{cases}$ in terms of unit step function and hence find its Laplace transform.	*CO1*	*PO1*	**07**
		c)	Solve the differential equation $\frac{d^2x}{dt^2} + 9x = \cos(2t)$ using Laplace transform if $x(0) = 1$ and $x'(0) = 0$.	*CO1*	*PO1*	**07**
			UNIT - 4			
	6	a)	Find the Fourier series expansion of $f(x) = \|x\|$ in $(-\pi, \pi)$ given $f(x) = f(x + 2\pi)$.	*CO1*	*PO1*	**06**
		b)	Find the Fourier series expansion of the function $f(x) = \begin{cases} 1 + \frac{4x}{3} & \frac{-3}{2} < x < 0 \\ 1 - \frac{4x}{3} & 0 < x < \frac{3}{2} \end{cases}$ given $f(x) = f(x + 3)$.	*CO1*	*PO1*	**07**

	c)	Obtain the constant term and the first harmonic term of the Fourier series expansion of y using the following data: x: 0, 1, 2, 3, 4, 5 y: 9, 18, 24, 28, 26, 20	*CO1*	*PO1*	**07**
		UNIT - 5			
7	a)	Derive Bendre-Schmidt formula for the one-dimensional heat equation $u_t = c^2 u_{xx}$.	*CO1*	*PO1*	**06**
	b)	Solve numerically the equation $u_t = u_{xx}$ subject to the conditions $u(0,t) = 0 = u(1,t); t > 0$ and $u(x,0) = \sin \pi x, 0 \le x \le 1$. Carryout computations for three-time levels taking $h = \frac{1}{3}, k = \frac{1}{36}$.	*CO1*	*PO1*	**07**
	c)	Evaluate the pivotal values of the equation $u_{tt} = 16u_{xx}$ taking $h = 1, k = \frac{1}{4}$ upto $t = 0.5$ subject to the boundary conditions $u(0,t) = u(5,t) = 0$; $u_t(x,0) = 0$ and $u(x,0) = x^2(5-x)$.	*CO1*	*PO1*	**07**

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