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

Autonomous Institute Affiliated to VTU

April 2024 Semester End Main 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)	The following table gives the production (in thousand units) of a certain commodity in different years Year (x): 1968, 1978, 1988, 1998, 2008 Production (y): 8, 10, 12, 10, 16 Fit a straight line to the data and estimate the production of the year 2015.	CO1	PO1	**06**
	b)	Find the coefficient of correlation and hence find the lines of regression of the following data: x: 1, 2, 3, 4, 5, 6, 7 y: 9, 8, 10, 12, 11, 13, 14	CO1	PO1	**07**
	c)	If θ is the angle between the lines of regression then show that $\tan\theta = \frac{\sigma_x \sigma_y}{{\sigma_x}^2+{\sigma_y}^2}\left(\frac{1-r^2}{r}\right)$ with usual notations.	CO1	PO1	**07**
		OR			
2	a)	Obtain a curve of best fit of the form $y = a\,x^b$ to the following data: x: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 y: 1.62, 1.00, 0.75, 0.62, 0.52, 0.46	CO1	PO1	**06**
	b)	Given x- series: Mean 18, Standard deviation 14 y-series: Mean 100, Standard deviation 20 and $r = 0.8$ write down the equations of lines of regression and hence find the most probable value of y when $x = 70$.	CO1	PO1	**07**
	c)	Ten students got the following percentage of marks in two subjects x and y . Compute their rank correlation Marks in x: 68, 64, 75, 50, 64, 80, 75, 40, 55, 64 Marks in y: 62, 58, 68, 45, 81, 60, 68, 48, 50, 70	CO1	PO1	**07**

			UNIT - 2			
	3	a)	The number of industrial injuries per working week in a particular factory is known to follow a Poisson distribution with mean 0.5. Find the probability that (a) in a particular week there will be: (i) less than 2 accidents, (ii) more than 2 accidents; (b) in a three-week period there will be no accidents.	*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)	The joint probability function for two discrete random variables x and y is given by the following table y \ x | 1 | 3 | 9 2 | 1/8 | 1/24 | 1/12 4 | 1/4 | 1/4 | 0 6 | 1/8 | 1/24 | 1/12 Find the marginal distribution of x and y and evaluate Cov(x, y) and $\rho(x, y)$.	*CO1*	*PO1*	**07**
			UNIT - 3			
	4	a)	Given that $f(t) = \begin{cases} a & 0 \le t < a \\ -a & a < t \le 2a \end{cases}$ where $f(t + 2a) = f(t)$ show that $L\{f(t)\} = \frac{a}{s}\, tanh\left(\frac{as}{2}\right)$.	*CO1*	*PO1*	**06**
		b)	Find the inverse Laplace transform of $F(s) = \frac{s^2+6s+9}{(s-1)(s-2)(s+4)}$.	*CO1*	*PO1*	**07**
		c)	Solve the initial value problem by using Laplace transform $y'' + 4y' + 4y = e^{-t},\ y(0) = 0, y'(0) = 0.$	*CO1*	*PO1*	**07**
			OR			
	5	a)	Evaluate $L\left[\frac{e^t \sin(3t) \sin(t)}{t}\right]$.	*CO1*	*PO1*	**06**
		b)	Express the given function $f(t) = \begin{cases} \sin t & 0 \le t \le \pi \\ \sin 2t & \pi \le t \le 2\pi \\ \sin 3t & t \ge 2\pi \end{cases}$ in terms of unit step function and hence find its Laplace transform.	*CO1*	*PO1*	**07**
		c)	Solve the initial value problem by using Laplace transform $x'' - 2x' + x = e^t,\ \ x(0) = 2, x'(0) = -1.$	*CO1*	*PO1*	**07**
			UNIT - 4			
	6	a)	Obtain the Fourier series of the function $f(x) = \begin{cases} x & in \quad 0 < x < \pi \\ x - 2\pi & in \quad \pi < x < 2\pi \end{cases}$, given $f(x + 2\pi) = f(x)$.	*CO1*	*PO1*	**06**
		b)	If $f(x) = \begin{cases} 2 - x & in \quad 0 < x < 4 \\ x - 6 & in \quad 4 < x < 8 \end{cases}$ then express $f(x)$ as a Fourier series, given $f(x + 8) = f(x)$.	*CO1*	*PO1*	**07**
		c)	Express y as a Fourier series up to the first harmonic: x | 0 | $\pi/3$ | $2\pi/3$ | π | $4\pi/3$ | $5\pi/3$ | 2π y | 1.98 | 1.30 | 1.05 | 1.30 | -0.88 | -0.25 | 1.98	*CO1*	*PO1*	**07**

			UNIT - 5			
	7	a)	Derive the finite difference formula to solve the one-dimensional wave equation $u_{tt} = c^2 u_{xx}$.	*CO1*	*PO1*	**06**
		b)	Find the numerical solution of the one-dimensional heat equation $u_{xx} = 2u_t$ subject to the conditions $u(0,t) = 0 = u(4,t)$ and $u(x,0) = x(4-x)$ by taking $h = 1, k = 1$. Find the values up to $t = 3$.	*CO1*	*PO1*	**07**
		c)	Solve $25u_{xx} = u_{tt}$ at the pivotal points for $0 \le t \le 0.4$ subject to the conditions $u(0,t) = 0, u(5,t) = 0$ and $u_t(x,0) = 0$ and $u\,(x,0) = \begin{cases} 20x & 0 \le x \le 1 \\ 5(5-x) & 1 \le x \le 5 \end{cases}$ by taking $h = 1, k = 0.2$.	*CO1*	*PO1*	**07**

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