Register Number:……..

KUMARAGURU
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M.E / M.TECH DEGREE EXAMINATIONS: NOV/ DEC 2024

(Regulation 2024)

First Semester

STRUCTURAL ENGINEERING

24MAI502: Applied Numerical Methods and Statistics for Structural Engineering

COURSE OUTCOMES

CO1: Apply techniques for solving both single and multi-dimensional nonlinear equations to real-world numerical analysis and computational problems, developing practical problem-solving skills.

CO2: Apply least squares fitting techniques to different types of data and models, demonstrating a broad understanding of how to use these methods effectively.

CO3: Apply spline curves and their techniques to model and interpolate data, demonstrating an understanding of their practical applications.

CO4: Apply the finite difference method for solving shooting methods, and in solving boundary value problems for parabolic and hyperbolic equations.

CO5: Apply multiple and partial correlation, regression analysis, and residual diagnostics to perform and interpret complex statistical analyses, demonstrating a deep understanding of these methods

CO6: Apply theoretical and practical knowledge of ANOVA and experimental design techniques to analyze and interpret data effectively.

Time: Three Hours **Maximum Marks: 100**

PART A (4*20= 80 Marks)

1.	a)	What is the rate of convergent and convergent condition in Newton Raphson method?	2	CO1	[K_1]
	b)	Find a positive root for the equation 3x – cosx = 1 by Newton Raphson method.	8	CO1	[K_3]
	c)	Write the algorithm for Muller's iteration process.	2	CO1	[K_2]
	d)	Find a root of an equation $x^3 - x - 1 = 0$ using Muller method	8	CO1	[K_3]
2.	a)	Convert the following non-linear curves into linear form $y = ab^x, y = ax^b$	2	CO2	[K_2]

b)	From the table given below, find the best values of a and b in the law $y = ae^{bx}$ by the method of least squares:	8	CO2	[K_3]
c)	Write the normal equations to fit the second degree parabola of the form	2	CO2	[K_1]
d)	Using cubic spline interpolation find y(1.5) given that $y_0''=y_2''=0$	8	CO3	[K_3]

x	0	5	8	12	20
y	3.0	1.5	1.0	0.55	0.18

x:	1	2	3
y:	-6	-1	16

3.	a)	Solve the differential equations $\frac{d^2y}{dx^2} - y = x \text{ with } y(0) = 0, y(1) = 0 \text{ with } h = \frac{1}{4}$	8	CO4	[K_3]
	b)	Define Bezier curves and Bernstein Polynomial.	2	CO4	[K_1]
	c)	Use the shooting method to solve $\frac{d^2T}{dx^2} + h'(T_\infty - T) = 0$ for a 10-m rod with h' = 0.01 m^{-2} , T_∞ = 20, and the boundary conditions T (0) = 40 and T (10) = 200	8	CO4	[K_3]
	d)	What is the difference between implicit and explicit methods?	2	CO4	[K_2]
4.	a)	From the data relating to the yield of dry bark(x1) height (x2) and girth(x3) for 18 cinchona plants, the following correlation coefficients are got. $r_{12} = 0.77, r_{13} = 0.72, r_{23} = 0.52$ Find the correlation coefficient $r_{12.3}$ and multiple correlation coefficient $R_{1.23}$	6	CO5	[K_1]
	b)	In a trivariate distribution, it is given that $\sigma_1 = 3, \sigma_2 = 4, \sigma_3 = 5, r_{23} = 0.4, r_{31} = 0.6, r_{12} = 0.7$ Find the linear regression equations.	10	CO5	[K_3]
	c)	From the heights (X_1), weights (X_2) and ages(X_3) of a group of students, the following SD'S and correlation coefficient were obtained. $r_{12} = 0.75, r_{23} = 0.54, r_{31} = 0.43$ calculate ω	4	CO5	[K_3]

Answer any ONE Question

PART B (1*20 = 20 Marks)

5. a) The following data represents the number of units of productions per day turned out by different workers using four different types of machines. 16 CO6 [K_3]

		Machine Type		
		A	B	C
	1	44	38	47
Workers	2	46	40	52
	3	34	36	44
	4	43	38	46
	5	38	42	49

Use a two-way ANOVA test and analysis whether the 5 men differ with respect to mean productivity and test whether the mean productivity is the same for the four different machine types.

b) State the uses of Analysis of variance 4 CO6 [K_2]

OR

6. a) Analyse the following by Latin square design. 16 CO6 [K_3]

Column\ ROW	1	2	3	4
1	A(12)	D(20)	C(16)	B(10)
2	D(18)	A(14)	B(11)	C(14)
3	B(12)	C(15)	D(19)	A(13)
4	C(16)	B(11)	A(15)	D(20)

b) State the advantages of Latin square design over other designs 4 CO6 [K_2]

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