Register Number:……..

KUMARAGURU
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B.E/B.TECH DEGREE EXAMINATIONS: APRIL /MAY 2024

(Regulation 2018)

Fourth Semester

(COMMON TO FT/BT/TXT)

U18MAT4102 : Numerical Methods

COURSE OUTCOMES

CO1: Solve a set of algebraic equations representing steady state models formed in engineering problems.
CO2: Fit smooth curves for the discrete data connected to each other or to use interpolation methods over these data tables.
CO3: Find the trend information from discrete data set through numerical differentiation.
CO4: Estimate integrals from discrete data through numerical methods.
CO5: Predict the system dynamic behaviour through solution of ODEs modeling the system.

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

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

1.	State the order of convergence and convergence condition for Newton-Raphson method.	CO1	[K1]
2.	Solve the following system of equations by Gauss-Jordan method, 5x + 4y = 15,3x + 7y = 12.	CO1	[K2]
3.	Give the inverse of Lagrange's interpolation formula.	CO2	[K1]
4.	Find the divided difference of $f(x)=x^3+x+2$ for the arguments 1, 3, 6, 11.	CO2	[K2]
5.	Using Newton's backward difference formula, write the formulae for the first and second order derivatives at the end values $x=x_n$ up to the fourth order difference term.	CO3	[K1]
6.	State Trapezoidal rule to evaluate $\int_{x_0}^{x_n} f(x)dx$.	CO3	[K1]
7.	Find y(0.1) if $\frac{dy}{dx}=1+y,\ y(0)=1,$ using Taylor's series method.	CO4	[K2]
8.	Find y(0.3) if $\frac{dy}{dx}=\frac{1}{2}(x^2+1)y^2,\ y(0.2)=1.1114,$ using Euler's method.	CO4	[K2]
9.	Write the diagonal five-point formula to solve the Laplace's equation $u_{xx}+u_{yy}=0.$	CO5	[K1]
10.	State Schmidt's explicit formula for solving heat flow equation.	CO5	[K1]

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11. a) Find the real positive root of $3x - \cos x - 1 = 0$ by Newton's method correct to 6 decimal places. (8) CO1 [K2]

b) Solve the following system of equations by Gauss-Seidel method, (8) CO1 [K3]

$$27x + 6y - z = 85,\ x + y + 54z = 110,\ 6x + 15y + 2z = 72.$$

12. a) Find f(8) by Newton's divided difference formula for the data: (8) CO2 [K2]

x:	4	5	7	10	11	13
f(x):	48	100	294	900	1210	2028

b) Using Lagrange interpolation, find y(2) from the following data. (8) CO2 [K2]

x:	0	1	3	4	5
y:	0	1	81	256	625

13. a) From the following data, find θ at x = 43, and x = 84 (8) CO3 [K2]

x:	40	50	60	70	80	90
θ :	184	204	226	250	276	304

b) By dividing the range into ten equal parts, evaluate $\int_0^{\pi} \sin x \, dx$ by Trapezoidal and Simpson's rule. Verify your answer with integration. (8) CO3 [K3]

14. a) Using Taylor's series expansion, find y at x = 0.1, 0.2 correct to three significant digits given $\frac{dy}{dx} - 2y = 3e^x$, $y(0) = 0$. (8) CO4 [K2]

b) Using R-K method of fourth order, solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ *with* $y(0) = 1$ at x = 0.2, h=0.2. (8) CO4 [K3]

15. Solve, the Poisson's equation $\nabla^2 u = -10\left(x^2 + y^2 + 10\right)$ over the square with sides x = 0, y = 0, x = 3, y = 3 with u = 0 on the boundary, taking h=1. (16) CO5 [K3]

16. Using Runge-Kutta method of fourth order, find y for x = 0.1, 0.2, 0.3 given that $\frac{dy}{dx} = xy + y^2$ *with* $y(0) = 1$ and find the solution at x = 0.4 using Milne's method. (16) CO4 [K_2]

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