

Reg. No.

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

B.E / B.TECH. DEGREE EXAMINATIONS, MAY 2023

Fourth Semester

MA18451 – COMPUTATIONAL METHODS

(Common to EE, CH, CE, ME & MR)

(Regulation 2018)

TIME: 3 HOURS

MAX. MARKS: 100

- CO 1 Apply numerical technique to solve algebraic and transcendental equations.
- CO 2 Apply the knowledge and skills of numerical methods to do interpolation and approximation.
- CO 3 Develops the skill to evaluate differentiation and integration numerically.
- CO 4 Acquire the skill to solve ordinary differential equation numerically.
- CO 5 Acquire the skill to solve partial differential equation numerically.

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

- | | CO | RBT
LEVEL | | | | | | | | |
|---|----|--------------|----|---|---|---|---|----|--|--|
| 1. Show that the Newton Raphson formula for $\frac{1}{\sqrt{N}}$ is $x_{n+1} = \frac{1}{2}(x_n + \frac{1}{Nx_n})$. | 1 | 3 | | | | | | | | |
| 2. Explain diagonally dominant. | 1 | 2 | | | | | | | | |
| 3. Using Lagrange's formula fit a polynomial to the data. | 2 | 3 | | | | | | | | |
| <table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr><td>x</td><td>-1</td><td>1</td><td>2</td></tr> <tr><td>y</td><td>7</td><td>5</td><td>15</td></tr> </table> | x | -1 | 1 | 2 | y | 7 | 5 | 15 | | |
| x | -1 | 1 | 2 | | | | | | | |
| y | 7 | 5 | 15 | | | | | | | |
| 4. Find the third order divided differences with arguments 2,4,9,10 of the function $f(x) = x(x^2 - 2)$. | 2 | 3 | | | | | | | | |
| 5. Find the value of $\int_1^2 \frac{dx}{x}$ by Simpson's $\frac{1}{3}$ rd rule by taking $h = \frac{1}{4}$. | 3 | 3 | | | | | | | | |
| 6. What is the order of the error in the trapezoidal rule and Simpson's $\frac{1}{3}$ rd rule? | 3 | 1 | | | | | | | | |
| 7. What is the disadvantage in using Taylor's series method? | 4 | 2 | | | | | | | | |
| 8. Find the value of k_1 to solve $y' = x^3 + y$, $y(0) = 2$, $h = 0.2$ by fourth order Runge - Kutta method. | 4 | 3 | | | | | | | | |
| 9. Write the diagonal and standard five point formulae for solving the Laplace equation | 5 | 2 | | | | | | | | |
| 10. State the Bender-Schmidt formula for solving one dimensional heat equation. | 5 | 1 | | | | | | | | |

PART- B (5 x 14 = 70 Marks)

- | | | Marks | CO | RBT
LEVEL |
|---------|---|-------|----|--------------|
| 11. (a) | (i) Solve the following system of equations by Gauss elimination method. | (7) | 1 | 3 |
| | $3x + 4y + 5z = 18, 2x - y + 8z = 13, 5x - 2y + 7z = 20$ | | | |
| | (ii) Solve using Gauss- Jordan method | (7) | 1 | 3 |
| | $x + y + z = 9, 2x - 3y + 4z = 13, 3x + 4y + 5z = 40$ | | | |
| | (OR) | | | |
| (b) | (i) Using Gauss Jordan method find the inverse of the following | (7) | 1 | 3 |
| | $\begin{bmatrix} 2 & 6 & 6 \\ 2 & 8 & 6 \\ 2 & 6 & 8 \end{bmatrix}$ | | | |
| | (ii) Solve using Gauss- Seidel method correct to three places of decimals | (7) | 1 | 3 |
| | $10x - 5y - 2z = 3$
$4x - 10y + 3z = -3$
$x + 6y + 10z = -3$ | | | |

12. (a) Find the values of y at $x = 21$ & $x = 28$ from the following data (14) 2 3

x	20	23	26	29
y	0.3420	0.3907	0.4384	0.4848

(OR)

- (b) Find $f(8)$ and $f(15)$ by Newton's divided difference formula for the data. (14) 2 3

x	4	5	7	10	11	13
f(x)	48	100	294	900	121	202
					0	8

13. (a) The table gives the velocity of a moving particle at time t seconds. Find the distance covered by the particle in 12 seconds and also the acceleration at $t = 2$ seconds. (14) 3 3

t	0	2	4	6	8	10	12
v	4	6	16	34	60	94	136

(OR)

(b) Evaluate $\int_1^{1.4} \int_2^{2.4} \frac{1}{xy} dx dy$ using Trapezoidal rule and Simpson's 1/3rd rule.

(14) 3 3

14. (a) Using the fourth order Runge- kutta method given $\frac{dy}{dx} = x + z$, $\frac{dz}{dx} = x - y^2$, $y(0) = 2, z(0) = 1$, find $y(0.1), z(0.1)$.

(14) 4 3

(OR)

(b) (i) Using Adam's - Bashforth method find $y(1.4)$ given $\frac{dy}{dx} = x^2(1 + y)$ and $y(1) = 1, y(1.1) = 1.233, y(1.2) = 1.548, y(1.3) = 1.979$

(7) 4 3

(ii) Using Taylor series method compute the value of y at $x = 0.1$ and $x = 0.2$ given $\frac{dy}{dx} = 2y + 3e^x, y(0) = 0$

(7) 4 3

15. (a) Solve the Poisson equation $u_{xx} + u_{yy} = -81xy$, $0 < x < 1$, $0 < y < 1$ given that $u(0, y) = 0, u(x, 0) = 0, u(1, y) = 100, u(x, 1) = 100$ and $h = \frac{1}{3}$.

(14) 5 3

(OR)

(b) Solve by Crank-Nicholson implicit finite difference method $u_{xx} = u_t$, $0 < x < 2, t > 0, u(0, t) = u(2, t) = 0$ and given that $u(x, 0) = \sin \frac{\pi x}{2}, 0 \leq x \leq 2$ using $\Delta x = 0.5$ and $\Delta t = 0.25$ for 2 time steps.

(14) 5 3

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

Marks CO RBT LEVEL

16. Find the numerically largest eigenvalue and the corresponding eigenvector of the following matrix using Rayleigh's power method

(10) 1 3

$$\begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$$
