Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 80769

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Fourth Semester

Civil Engineering

MA 2264/MA 1251/10177 MA 401/080280026/10144 ECE 15/MA 41/MA 51 – NUMERICAL METHODS

(Regulations 2008/2010)

Time : Three hours — Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What do you mean by the order of convergence of an iterative method for finding the root of the equation $f(x)=0$?

2. Solve the equations $x+2y=1$ and $3x-2y=7$ Gauss-Elimination method.

3. Find the second degree polynomial through the points (0, 2), (2, 1), (1, 0) using Lagrange's formula.

4. State Newton's backward formula for interpolation.

5. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Trapezoidal rule.

6. Write down the three point Gaussian quadrature formula to evaluate $\int_{-1}^{1} f(x)\,dx$.

7. State the advantages and disadvantages of the Taylor's series method.

8. State the Milne's predictor and corrector formulae.

9. Obtain the finite difference scheme for the differential equation $2y''+y=5$.

10. Write Liebmann's iteration process formula.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Find the Newton's iterative formula to calculate the reciprocal of N and hence find the value of $\frac{1}{23}$. (8)

(ii) Using Gauss-Jordan method, find the inverse of the matrix $\begin{bmatrix} 1 & 2 & 6 \\ 2 & 5 & 15 \\ 6 & 15 & 46 \end{bmatrix}$. (8)

Or

(b) (i) Solve the following system of equations using Gauss-Seidal method $10x + 2y + z = 9$, $x + 10y - z = -22$, $-2x + 3y + 10 = 22$. (8)

(ii) Find all the eigen values and eigenvectors of the matrix $\begin{bmatrix} 1 & \sqrt{2} & 2 \\ \sqrt{2} & 3 & \sqrt{2} \\ 2 & \sqrt{2} & 1 \end{bmatrix}$ using Jacobi method. (8)

12. (a) (i) Find $f(3)$ by Newton's divided difference formula for the following data : (8)

x :	–4	–1	0	2	5
y :	1245	33	5	9	1335

(ii) Using Lagrange's interpolation formula, find $y(2)$ from the following data :
$y(0) = 0; y(1) = 1; y(3) = 81; y(4) = 256; y(5) = 625$. (8)

Or

(b) (i) From the following table :

x	1	2	3
y	–8	–1	18

Computer $y(1.5)$ and $y'(1)$ using cubic spline. (8)

(ii) From the following data, find θ at $x = 43$ and $x = 84$. (8)

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

Also express θ interms of x.

13. (a) (i) Apply three point Gaussian quadrature formula to evaluate $\int_0^1 \frac{\sin x}{x} dx$. (8)

(ii) Find the first and second order derivatives of $f(x)$ at $x = 1.5$ for the following data : (8)

x :	1.5	2.0	2.5	3.0	3.5	4.0
$f(x)$:	3.375	7.000	13.625	24.000	38.875	59.000

Or

(b) (i) The velocities of a car running on a straight road at intervals of 2 minutes are given below :

Time (min) :	0	2	4	6	8	10	12
Velocity (km/hr) :	0	22	30	27	18	7	0

Using Simpson's $\frac{1}{3}$-rd rule find the distance covered by the car. (8)

(ii) Evaluate $\int_{2}^{2.4}\int_{4}^{4.4} xy\,dx\,dy$ by Trapezoidal rule taking $h = k = 0.1$. (8)

14. (a) (i) Using Taylor's series method, find y at $x = 0.1$ if $\frac{dy}{dx} = x^2 y - 1$, $y(0) = 1$ with $h = 0.1$ (6)

(ii) Given $5xy' + y^2 = 2$, $y(4) = 1$, $y(4.1) = 1.0049$, $y(4.2) = 1.0097$, $y(4.3) = 1.0143$. Compute $y(4.4)$ using Milne's method. (10)

Or

(b) (i) Apply modified Euler's method to find $y(0.2)$ and $y(0.4)$ given $y' = x^2 + y^2$, $y(0) = 1$ by taking $h = 0.2$. (6)

(ii) Given $y'' + xy' + y = 0$, $y(0) = 1, y'(0) = 0$ find the value of $y(0.1)$ by Runge-Kutta's method of fourth order. (10)

15. (a) Solve $\nabla^2 u = 8x^2 y^2$ over the square $x = -2, x = 2, y = -2, y = 2$ with $u = 0$ on the boundary and mesh length $h = 1$. (16)

Or

(b) (i) Solve $u_{xx} = 32u_t, h = 0.25$ for $t \geq 0$, $0 < x < 1$, $u(0,t) = 0$, $u(x,0) = 0$, $u(1,t) = t$. (8)

(ii) Solve $4u_{tt} = u_{xx}$, $u(0,t) = 0$, $u(4,t) = 0$, $u(x,0) = x(4-x)$, $u_t(x,0) = 0$, $h = 1$ upto $t = 4$. (8)