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

Question Paper Code : 86623

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

Fourth/Fifth/Sixth Semester

Civil Engineering

MA 1251 — NUMERICAL METHODS

(Common to Aeronautical Engineering, Computer Science and Engineering, Electrical and Electronics Engineering, Electronics and Communication Engineering, Chemical Engineering, Information Technology and Petrochemical Technology)

(Regulations 2008)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Derive Newton's algorithm for finding the p^{th} root of a number N, where $N > 0$.

2. Explain the procedure involved in the Gauss Jordan elimination method.

3. State Newton's forward interpolation formula.

4. Using Lagrange's formula, find the polynomial to the given data :

X :	0	1	3
Y :	5	6	50

5. What are the errors in Trapezoidal and Simpson's rules of numerical integration?

6. State three point Gaussian quadrature formula

7. By Taylor series with first two non-zero terms find $y(1.1)$ given that $y' = x + y, y(1) = 0$.

8. Using Euler's method find $y(0.2)$ given that $y' = x + y, y(0) = 1$.

9. Write the diagonal five point formula for solving the two dimensional Laplace equation $\nabla^2 u = 0$.

10. Using finite difference solve $y'' - y = 0$ given $y(0) = 0$, $y(1) = 1$, $n = 2$.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Solve $e^x - 3x = 0$ by the method of fixed point iteration. (8)

(ii) Solve the following system by Gauss-Seidal iterative procedure : $10x - 5y - 2z = 3, 4x - 10y + 3z = -3, x + 6y + 10z = -3$. (8)

Or

(b) (i) Using Gauss-Jordan method, find the inverse of $\begin{bmatrix} 2 & 2 & 6 \\ 2 & 6 & -6 \\ 4 & -8 & -8 \end{bmatrix}$. (8)

(ii) Using power method, find all the eigenvalues of $A = \begin{pmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{pmatrix}$. (8)

12. (a) (i) Apply Lagrange's formula, to find $y(27)$ to the data given below : (8)

x :	14	17	31	35
y :	68.8	64	44	39.1

(ii) Fit a polynomial, by using Newton's forward interpolation formula, to the data given below : (8)

x :	0	1	2	3
y :	1	2	1	10

Or

(b) (i) Use Newton's divided difference formula to find $f(x)$ from the following data : (8)

x :	1	2	7	8
y :	1	5	5	4

(ii) Using cubic spline, compute $y(1.5)$ from the given data : (8)

x :	1	2	3
y :	–8	–1	18

13. (a) (i) Using Romberg's method, evaluate $I=\int_0^1 \frac{dx}{1+x}$, correct to 3 decimal places. Evaluate $\log_e 2$. (8)

(ii) Evaluate $\int_0^{\pi/2}\int_0^{\pi/2} \sqrt{\sin(x+y)}\, dx\, dy$ by using Trapezoidal rule. (8)

Or

(b) (i) From the following table, obtain the value of $\frac{d^2y}{dx^2}$ at $x=0.96$. (8)

x :	0.96	0.98	1.00	1.02	1.04
f(x) :	0.7825	0.7739	0.7651	0.7563	0.7473

(ii) Evaluate $\int_0^1 \frac{1}{1+x^2}dx$ using Gauss three point formula. (8)

14. (a) (i) Solve $y' = x + y;\ y(0) = 1$ by Taylore series method, find the values of y at $x = 0.1$ and $x = 0.2$. (8)

(ii) Given $\frac{dy}{dx} = x^2(1 + y),\ y(1) = 1,\ y(1.1) = 1.233,\ y(1.2) = 1.548,$ $y(1.3) = 1.979$ evaluate $y(1.4)$ by Adam's-Bashforth method. (8)

Or

(b) (i) 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 $x = 0.2$. (8)

(ii) Using Milne's method find $y(4.4)$ given $5xy^1 + y^2 - 2 = 0$, $y(4) = 1,\ y(4.1) = 1.0049,\ y(4.2) = 1.0097$, $y(4.3) = 1.0143$. (8)

15. (a) By iteration method solve the elliptic equation $u_{xx} + u_{yy} = 0$ over the square region of side 4, satisfying the boundary conditions.

(i) $u(0, y) = 0, 0 \le y \le 4$

(ii) $u(4, y) = 8 + 2y,\ 0 \le y \le 4$

(iii) $u(x, 0) = \frac{x^2}{2},\ 0 \le x \le 4$

(iv) $u(x, 4) = x^2,\ 0 \le x \le 4$

Compute the values at the interior points correct to one decimal with $h = k = 1$. (16)

Or

(b) (i) Using Crank-Nicolson's scheme, solve $16\frac{\partial u}{\partial t}=\frac{\partial^2 u}{\partial x^2}$, $0<x<1$, $t>0$ subject to $u(x, 0)=0$, $u(0,t)=0$, $u(1, t)=100t$. Compute u for one step in t direction taking $h=\frac{1}{4}$. (8)

(ii) Solve $u_{tt}=u_{xx}$, $0<x<2$, $t>0$ subject to $u(x, 0)=0$, $u_t(x,0)=100(2x-x^2)$, $u(0, t)=0$, $u(2, t)=0$, choosing $h=\frac{1}{2}$ compute u for four time steps. (8)
