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

C 3346

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2008.

Sixth Semester

(Regulation 2004)

Computer Science and Engineering

MA 1011/MA 1251 — NUMERICAL METHODS

(Common to Chemical Engineering, Information Technology, Electronics and Communication Engineering, Mechanical Engineering and Automobile Engineering)

Time : Three hours — Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Find the approximate real root of $xe^x - 3 = 0$ in $1 < x < 1.1$ by method of false position.

2. State the condition and order for convergence of $f(x) = 0$ using Newton–Raphson method.

3. Find the third order difference using Newton's divided differences for the data

x :	2	5	7	8
y :	1	2	3	4

4. State the Newton's forward interpolation formula upto third order finite differences.

5. State the formula for trapezoidal rule of integration.

6. State the formula for 2-point Gaussian quadrature.

7. Using Euler's method, find $y(1.25)$ if $\frac{dy}{dx} = x^2 + y^2, y(1) = 1$ taking $h = 0.25$.

8. State Adam's predictor and corrector formula.

9. Express $\frac{\partial u}{\partial t} = \alpha^2 \frac{\partial^2 u}{\partial x^2}$ interms of difference quotients.

10. Write down the explicit scheme to solve one-dimensional wave equation.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Find the positive real root of $x^3 - 2x + 0.5 = 0$ using Newton-Raphson method correct to 3 decimal places. (8)

(ii) Solve by Gauss-Jordan method, the following systems of equations :

$x + 5y + z = 14$; $2x + y + 3z = 13$; $3x + y + 4z = 17$. (8)

Or

(b) (i) Find the inverse of the matrix $\begin{bmatrix} 3 & 1 & 2 \\ 2 & -3 & -1 \\ 1 & 2 & 1 \end{bmatrix}$ using Gauss-Jordan method. (8)

(ii) Find the numerically largest eigen value of $A = \begin{bmatrix} 1 & -3 & 2 \\ 4 & 4 & -1 \\ 6 & 3 & 5 \end{bmatrix}$ by Power method with the initial eigen vector $X_0 = \begin{Bmatrix} 1 \\ 1 \\ 1 \end{Bmatrix}$. (8)

12. (a) (i) Find x when $y = 20$ using Lagrange's interpolation formula for the data : (8)

x :	1	2	3	4
y :	1	8	27	64

(ii) Using cubic spline approximation, find $y(0.5)$ and $y'(1)$ given $M_0 = M_2 = 0$ and (8)

x :	0	1	2
y :	–5	–4	3

Or

(b) (i) Find the equation $y = f(x)$ of the least degree and passing through the points $(-1, -21)(1, 15)(2, 12)(3, 3)$. Also find at $x = 0$ using Newtons divided differences. (8)

(ii) The following data are taken from the steam table

Temp °C	140	150	160	170	180
Pressure kg f/cm^2	3.685	4.854	6.302	8.076	10.225

Find the pressure at temperature $t = 175^\circ C$, using Newton's backward difference formula. (8)

13. (a) (i) Obtain the first and second derivatives of y at $x = 0.96$ from the data : (8)

x :	0.96	0.98	1.00	1.02	1.04
y :	0.7825	0.7739	0.7651	0.7563	0.7473

(ii) Evaluate $\int_1^{1.4}\int_2^{2.4} \frac{1}{xy}dxdy$ using trapezoidal rule. (8)

Or

(b) (i) By dividing the range into 10 equal parts, evaluate $\int_0^{\pi} \sin x \, dx$ using Simpon's one-third rule. (8)

(ii) Apply Gaussian three point formula to find $\int_{0.2}^{1.5} e^{-r^2} dr$. (8)

14. (a) (i) Using Runge-Kutta method of fourth order, find $y(0.8)$ correct to 4 decimal places if $y' = y - x^2, y(0.6) = 1.7379$ with $h = 0.1$. (8)

(ii) Given $\frac{dy}{dx} = \frac{1}{2}(1 + x^2)y^2$ and $y(0)=1, y(0.1)=1.06, y(0.2)=1.12$, $y(0.3) = 1.21$, evaluate $y(0.4)$ by Milne's predictor-corrector method. (8)

Or

(b) (i) Using modified Euler method, find $y(0.1)$ and $y(0.2)$ given $\frac{dy}{dx} = x^2 + y^2$, $y(0)=1$ with $h = 0.1$ (8)

(ii) Obtain $y(0.6)$ given $\frac{dy}{dx} = x + y, y(0) = 1$ using $h = 0.2$ by Adam's method if $y(-0.2) = 0.8373$ $y(0.2) = 1.2427$ and $y(0.4) = 1.5834$. (8)

15. (a) (i) Solve the equation $u_t = u_{xx},\ 0 \le x \le 4,\ t > 0$ using the conditions, $u(0,t) = 0$, $u(4,t) = 0$ and $u(x,0) = \frac{x}{3}(16 - x^2)$, by Crank-Nicolson's method with $h = 1$ and $k = 1$. (8)

(ii) Solve $u_{tt} = 4u_{xx}$, $0 < x < 10$, $t > 0$ satisfying the boundary conditions $u(10, t) = 0$, $\frac{\partial u}{\partial t}(x, 0) = 0$ and $u(x, 0) = \frac{1}{100}x(10 - x)$, $0 \le x \le 10$. Compute u for three timesteps. (8)

Or

(b) Solve the Laplace equation $u_{xx} + u_{yy} = 0$ for the squremesh with the boundary values, using Leibmann's method correct to integers. (16)

0	100	200	100	0
200				200
400				400
200				200
0	100	200	100	0