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

A 1423

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

Fifth Semester

Computer Science and Engineering

MA 038 — NUMERICAL METHODS

(Common to Polymer Technology and Metallurgical Engineering)

(Common to Fourth Semester Aeronautical Engineering, Automobile Engineering, Civil Engineering, Instrumentation Engineering, Instrumentation and Control Engineering, Mechanical Engineering, Mechatronics Engineering and Production Engineering)

(Common to Sixth Semester Electronics and Instrumentation Engg., Chemical Engg., Leather Technology, Textile Technology)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Find a real root of the equation $f(x) = x^3 + x^2 - 1 = 0$ using iteration method.

2. Use the Newton-Raphson Method to find the root of the equation $4x - e^x = 0$.

3. Write down the Newton forward and backward difference interpolation formula.

4. Using the Lagrange's interpolation formula, find the value of $y(10)$ from the data below :

x :	5	6	9	11
y	12	13	14	16

5. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Trapezoidal rule with h = 0.2. Hence obtain an approximate value of π.

6. Write down the three point Gaussian quadrature formula.

7. Find $y(0.1)$ given $y' = \frac{1}{2}(x+y), y(0) = 1$ by Euler Method.

8. Write down the Milne's predictor and corrector algorithms.

9. Write down the Crank-Nicholson difference scheme for one dimensional heat equation.

10. Write down the standard and diagonal five-point formula for solving Laplace's equation.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Find a real root of the equation $f(x) = x^3 - 4x + 1 = 0$ using regula falsi method. (correct to four decimal places). (8)

(ii) Find the largest eigen value of $A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$ and the corresponding eigen vector. (8)

Or

(b) (i) Determine the roots of equations

$x^2 + xy = 6$ and $x^2 - y^2 = 3$

using the Newton-Raphson method, starting with initial approximation (1, 1). (Calculate the result up to second iteration).(8)

(ii) Using Gauss-Elimination method find the inverse of

$$A = \begin{pmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{pmatrix}$$ (8)

12. (a) (i) Using Newton's divided difference formula, find the value of $f(2)$, $f(8)$ and $f(15)$ from the data below : (8)

X	4	5	7	10	11	13
F (x)	48	100	294	900	1210	2028

(ii) Estimate the population increase during the period 1946 to 1976 from the data given below (The population of a town is follows) (8)

Year x :	1941	1951	1961	1971	1981	1991
Population in lakhs y :	20	24	29	36	46	51

Or

(b) (i) Find $y(35)$ using Stirling and Bessel's formula from the data below : (8)

x :	20	30	40	50
y :	512	439	346	243

(ii) Fit a polynomial to the data given below and hence find $y(1)$. (using Lagrange's method). (8)

x :	–1	0	2	3
y :	–8	3	1	12

13. (a) (i) Find y' and y'' for the data below at $x = 0.6$ (8)

x :	0.4	0.5	0.6	0.7	0.8
y :	1.58	1.79	2.04	2.32	2.65

(ii) Evaluate $\int_{-3}^{3} x^4 dx$ by Trapezoidal rule and Simpson rule. Also check up the results by actual integration. (8)

Or

(b) (i) Find the first two derivatives at x = 50 and x = 56 from the data below using Newton's formula. (8)

X :	50	51	52	53	54	55	56
Y :	3.684	3.708	3.733	3.756	3.780	3.803	3.826

(ii) Evaluate $\int_{0}^{6} \frac{dx}{1+x^2}$ by Simpson 1/3 and 3/8 rule. (8)

14. (a) (i) Compute $y(0.1), y(0.2)$ and $y(0.3)$ if $y'' = y + xy'$ given $y(0) = 1$, $y'(0) = 0$ by Taylor's series method. (8)

(ii) Find y (0.4) and y (0.6) using Adam's Predictor-Corrector Method, given that

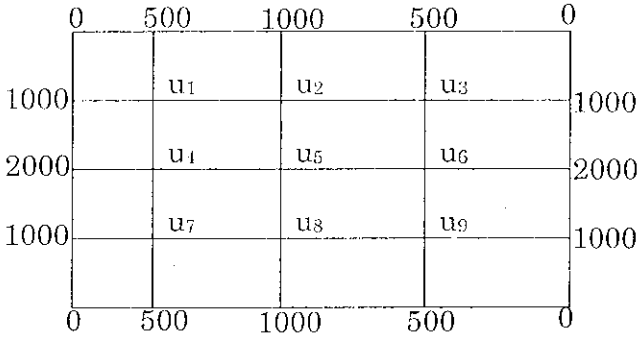
$y' = xy/2,\ y(0) = 1, y(0.1) = 1.01, y(0.2) = 1.022, y(0.3) = 1.023$. (8)

Or

(b) (i) Using modified Euler method find y (0.1) and y (0.2) given $y' = x^2 + y^2, y(0) = 1$. (8)

(ii) Using RK method of fourth order find y (0.2) and y (0.4). Given $y' = (y^2 - x^2)/(y^2 + x^2), y(0) = 1$. (8)

15. (a) Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown below. (16)



Or

(b) Using Crank Nicholson method solve $u_{xx} = u_t$. Subject to $u(x, 0) = 0, u(0, t) = 0$ and $u(1, t) = t$ by taking (i) $h = 0.5$ and $k = 1/8$ and (ii) h = 0.25 and k = 1/8. (16)
