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

R 3421

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2007.

Sixth Semester

Computer Science and Engineering

MA 1011/MA 1251 — NUMERICAL METHODS

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

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. On what type of equations Newton's method can be applicable?

2. By Gauss elimination method solve $x + y = 2$ and $2x + 3y = 5$.

3. What is the nature of n^{th} divided differences of a polynomial of n^{th} degree?

4. Find the second divided differences with arguments a, b, c if $f(x) = \frac{1}{x}$.

5. State Simpson's $\frac{1}{3}^{rd}$ rule formula to evaluate $\int_a^b f(x)\,dx$.

6. Write down the formula to calculate errors in quadrature formulae.

7. Explain the terms initial and boundary value problems.

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

9. Write down the diagonal five point formula in Laplace equation.

10. What is the order of error in solving Laplace and Poisson's equations by using finite difference method?

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Use Newton's method to find the real root of $3x - \cos x - 1 = 0$. (8)

(ii) Apply Gauss Jordan method to solve the equations $x + y + z = 9$, $2x - 3y + 4z = 13$, $3x + 4y + 5z = 40$. (8)

Or

(b) (i) Solve by Jacobi iteration method correct to two decimal places.

$10x + y - z = 11.19$, $x + 10y + z = 28.08$, $-x + y + 10z = 35.61$. (8)

(ii) Obtain by power method the numerically largest eigenvalue of the matrix $\begin{bmatrix} 15 & -4 & -3 \\ -10 & 12 & -6 \\ -20 & 4 & -2 \end{bmatrix}$. (8)

12. (a) (i) Using Newton's divided difference interpolation, find the polynomial of the given data (8)

x :	–1	0	1	3
f :	2	1	0	–1

(ii) Find the cubic spline interpolation. (8)

x :	1	2	3	4	5
f :	1	0	1	0	1

Or

(b) (i) From the given table, the values of y are consecutive terms of a series of which 23.6 is the 6^{th} term. Find the first and tenth terms of the series. (8)

x :	3	4	5	6	7	8	9
y :	4.8	8.4	14.5	23.6	36.2	52.8	73.9

(ii) Given the values (8)

x :	5	7	11	13	17
$f(x)$:	150	392	1452	2366	5202

Evaluate $f(9)$ using Newton's divided difference formula.

13. (a) (i) Using the given data find $f'(5)$ (8)

x :	0	2	3	4	7	9
$f(x)$:	4	26	58	112	466	922

(ii) Evaluate $I = \int_0^1 \frac{dx}{1+x}$ by two and three point Gaussian formulae. (8)

Or

(b) (i) Use Romberg's method to compute $\int_0^1 \frac{1}{1+x^2}\,dx$ correct to 4 decimal places by taking $h = 0.5,\ 0.25$ and 0.125. (8)

(ii) Evaluate $\int_0^1 \int_0^1 \frac{dx\,dy}{1+x+y}$ by using Trapezoidal rule, with step sizes $h = k = 0.5$. (8)

14. (a) Using Runge-Kutta method of fourth order, solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ given that $y(0) = 1$ at $x = 0.2$ and $x = 0.4$. (16)

Or

(b) Given $y' = x(x^2 + y^2)e^{-x}$, $y(0) = 1$ find y at $x = 0.1,\ 0.2$ and 0.3 by Taylor's series method and compute $y(0.4)$ by Milne's method. (16)

15. (a) Solve $\nabla^2 u = -10\left(x^2 + y^2 + 10\right)$ over the square mesh with sides $x = 0$, $y = 0$, $x = 3$, $y = 3$ with $u = 0$ on the boundary and mesh length 1 unit. (16)

Or

(b) Solve by Crank-Nicholson method the equation $u_{xx} = u_t$ subject to $u(x, 0) = 0$, $u(0, t) = 0$ and $u(1, t) = t$ for two time steps. (16)
