E 283

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2003.

Fifth Semester

Computer Science and Engineering

(Common to : Metallurgical Engineering, Polymer Technology)

MA 038 — NUMERICAL METHODS

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What is the condition for the convergence of errors to solve $x - \cos x = 0$ by Iteration method?

2. Are the first iteration values same if the equations $4x + y = 8$ and $2x + 3y = 7$ are solved by Gauss-Seidel and by Jacobi methods?

3. Write down the Bessel's interpolation formula.

4. Using Lagrange's interpolation formula, write down the polynomial for

x :	0	1	3	4
y :	–12	0	0	12

5. Find $y'(4)$ if

x :	1	2	3	4
y :	1	2	5	13

6. Write down the Simpson's three-eighth rule.

7. If $y' = \dfrac{y - x}{y + x}$; $y(0) = 1$, find $y(0.02)$ by Euler's method.

8. Write down Adam-Bashforth predictor and corrector formulae.

9. How many time-steps are required to compute the values of u till $t = 1$ sec for $2u_t = u_{xx}$ to be solved by Bender-Schmidt method given that $h = 1/2$?

10. Write down standard five point and diagonal five point formula to solve $\nabla^2 u = 0$.

PART B — ($5 \times 16 = 80$ marks)

11. (i) Find $f'(1.1)$ and $f''(1.1)$ for (8)

x :	1.0	1.2	1.4	1.6	1.8	2.0
$f(x)$:	0	0.128	0.544	1.296	2.432	4

(ii) Evaluate $\int_1^2\int_1^2 \frac{dx\,dy}{x+y}$ by using Trapezoidal rule with $h = k = 0.25$. (8)

12. (a) (i) Solve
$$\begin{aligned} 27x + 6y - z &= 85 \\ 6x + 15y + 2z &= 72 \\ x + y + 54z &= 110 \end{aligned}$$
by using Gauss-Seidel method. (8)

(ii) Find A^{-1} by Gauss Jordan method if $A = \begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$. (8)

Or

(b) (i) Find an iterative formula to find the reciprocal of a given number N by Newton-Raphson method and hence find the value of $\frac{1}{19}$. (8)

(ii) If $A = \begin{bmatrix} -1 & 1 & 2 \\ 0 & 3 & -1 \\ 0 & 0 & 5 \end{bmatrix}$, find the numerically largest eigen value and the corresponding eigen vector by power method. (8)

13. (a) (i) Find the value of y at $x = 6$ by Newton's divided difference formula for the data : (8)

x :	–1	0	2	3	7	10
y :	–11	1	1	1	141	561

(ii) Find $f(0.47)$ by using Newton's Backward difference formula for (8)

x :	0	0.1	0.2	0.3	0.4	0.5
$f(x)$:	1	1.1103	1.2428	1.3997	1.5836	1.7974

Or

(b) (i) Find $y(0.644)$ by using Stirling's interpolation formula for (8)

x :	0.61	0.62	0.63	0.64	0.65	0.66	0.67
y :	1.840431	1.858928	1.877610	1.896481	1.915541	1.934792	1.954237

(ii) Using Lagrange's formula, find $f(323.5)$ for the data (8)

x :	321.0	322.8	324.2	325.0
$f(x)$:	2.50651	2.50893	2.51081	2.51188

14. (a) (i) Solve $\frac{dy}{dx} = x^2 - y$; $y(0) = 1$ by Taylor's series method to find the values of $y(0.1), y(0.2), y(0.3)$ and $y(0.4)$ assuming $h = 0.1$. (8)

(ii) Solve $y' = x + y$; $y(0) = 0$ by Runge-Kutta method of fourth order to find $y(0.2)$ and $y(0.4)$ given that $h = 0.2$. (8)

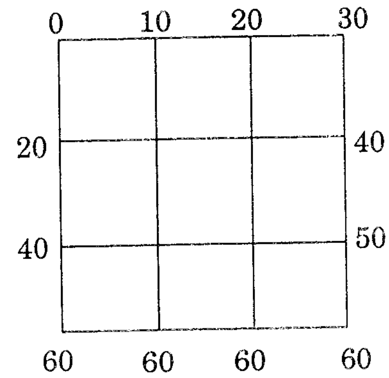
Or

(b) (i) Find the values of y at $x = 0.2, 0.4, 0.6, 0.8$ if $y' = \frac{(1+x)y^2}{2}$; $y(0) = 1$ by Modified Euler's method $[h = 0.2]$. (8)

(ii) Find $y(0.4)$ by Milne's method for $\frac{dy}{dx} = y - \frac{2x}{y}$; $y(0) = 1$; $y(0.1) = 1.0959$; $y(0.2) = 1.1841$; $y(0.3) = 1.2662$. (8)

15. (a) (i) Solve $u_t = u_{xx}$ by Crank-Nicholson method given that $u(0,t) = 0$; $u(1,t) = t$; $u(x,0) = 0$ in $0 < x < 1$. Compute u for 2 time steps $\left[h = \frac{1}{4}\right]$. (8)

(ii) Solve the Laplace equation $\nabla^2 u = 0$ for the region (8)



Or

(b) (i) Solve $4u_{xx} = u_{tt}$ given that $u(0,t) = 0, u(4,t) = 0; u_t(x,0),0$ $u(x,0) = x(4-x)$ in $0 < x < 4$. Assuming $h = 1$ compute u upto $t = 4$ sec. (8)

(ii) Solve the equation $\nabla^2 u = 8x^2y^2$ for the following region $[h = k = 1]$. (8)