B 2318

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2007.

Fifth Semester

Computer Science and Engineering

MA 038 — NUMERICAL METHODS

(Common to Metallurgical Engineering / Polymer Technology)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Solve the linear system $x_1 - 4x_2 = -2,\ 3x_1 + x_2 = 7$ by Gauss Jordan method.

2. What is the condition for the convergence while an iterative method is used for solving an equation of the form $x = \phi(x)$.

3. State Stirling's formula for interpolation.

4. Form the divided difference table for

x :	0	1	2	15
$f(x)$:	2	3	12	3587

5. State Simpson's $\frac{3}{8}$ th rule.

6. Explain the concept used in Gaussian quadrature.

7. Find $y(0.1)$ by Eulers method satisfying $\frac{dy}{dx} = x^2 + y^2 + 1$ given that $y(0) = 1$.

8. How many previous values are required to predict the next value by Milne's method?

9. Formulate the explicit finite difference formula for $\frac{\partial u}{\partial t} = \alpha^2 \frac{\partial^2 u}{\partial x^2}$.

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

PART B — (5 × 16 = 80 marks)

11. (a) (i) Solve the system of non-linear equations $x^2 + y = 11$, $y^2 + x = 7$ by Newton-Raphson method, starting with the approximation $(3.5, -1.8)$. (8)

(ii) Solve the following system of equations by Gauss-Jacobi method (8)

$$10x + 2y + z = 9$$
$$x + 10y - z = -22$$
$$-2x + 3y + 10z = 22$$

Or

(b) (i) Using Gauss Elimination method, solve the system (8)

$$3.15x - 1.96y + 3.85z = 12.95$$
$$2.13x + 5.12y - 2.89z = -8.61$$
$$5.92x + 3.05y + 2.15z = 6.88$$

(ii) Find by power method, the largest eigen value of the matrix (8)

$$A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}.$$

12. (a) Construct an approximate polynomial for the following data : (16)

k	x_k	$f(x_k)$	$f'(x_k)$
0	1.3	0.6200860	– 0.5220232
1	1.6	0.4554022	– 0.5698959
2	1.9	0.2818186	– 0.5811571

Using Hermite interpolation.

Or

(b) (i) The following table gives corresponding values of x and y. Construct the difference table and then express y as a function of x using Netwon's forward difference interpolation formula. (8)

x :	0	1	2	3	4
y :	3	6	11	18	27

(ii) Given the values, (8)

x	:	0	2	3	6
$f(x)$	:	-4	2	14	158

Use Lagranges formula for interpolation and find the value of $f(4)$.

13. (a) (i) Find the numerical value of the first derivative at $x = 0.4$ of the function $f(x)$ defined as under (8)

x	:	0.1	0.2	0.3	0.4
$f(x)$	:	1.10517	1.22140	1.34986	1.49182

(ii) Evaluate $\int_0^{\pi/2}\int_0^{\pi/2} \sin(x+y)\,dx\,dy$ by using Trapezoidal rule, using $\Delta x = \Delta y = \pi/4$. (8)

Or

(b) (i) Given that

x :	1.0	1.1	1.2	1.3	1.4	1.5	1.6
y :	7.989	8.403	8.781	9.129	9.451	9.750	10.031

Find $\frac{dy}{dx}$ at $x = 1.1$. (8)

(ii) A solid of revolution is formed by rotating about the x axis the area between the x axis, the lines $x = 0$ and $x = 1$ and a curve through the points with the following coordinates :

x :	0.00	0.25	0.50	0.75	1.00
y :	1.0000	0.9896	0.9589	0.9089	0.8415

Estimate the volume of the solid formed, using Simpson's 1/3 rule. (8)

14. (a) (i) Solve $\frac{dy}{dx} = y + x^3$ for $x = 1.1,\ 1.2$ given $y(1) = 1$ correct to 4 decimal places by Taylors series method. (8)

(ii) Given $\frac{dy}{dx} + \frac{y}{x} = \frac{1}{x^2}$, $y(1) = 1$. Evaluate $y(1.1)$ by modified Euler's method. (8)

Or

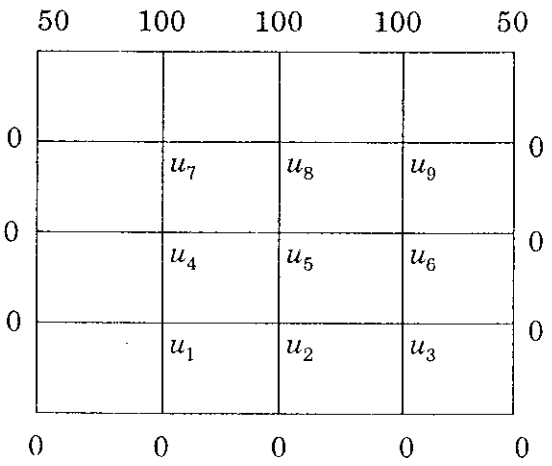
(b) Given $\frac{dy}{dx} = 1 + y^2$, where $y = 0$ when $x = 0$, find $y(0.2)$, $y(0.4)$ and $y(0.6)$ by Runge-Kutta method and then find $y(0.8)$ by Adam-Bashforth method. (16)

15. (a) (i) Using finite difference method solve the equation $y'' - y - x = 0$ with the boundary conditions $y(0) = y(1) = 0$ and find y at $x = 0.25$, 0.5 and 0.75. (8)

(ii) Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to $u(0, t) = 0$ $u(1, t) = 0$ and $u(x, 0) = \sin \pi x$, $0 < x < 1$ taking $h = 0.2$, $k = 0.02$. Find values of u upto 5 time steps. (8)

Or

(b) Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ for the following square mesh with given boundary conditions. (16)



Time :

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