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

R 3420

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

Fourth Semester

(Regulation 2004)

Civil Engineering

MA 1251 — NUMERICAL METHODS

(Common to Aeronautical Engineering, Electrical and Electronic Engineering, Mechatronics Engineering/Metallurgical Engineering and Petroleum Engineering)

(Common to B.E. (Part-Time) Third Semester, Regulation 2005)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Compare Gaussian elimination and Gauss-Jordan methods in solving the linear system $[A]\{X\} = \{B\}$.

2. Define Eigen value and Eigen vector.

3. What do you understand by inverse interpolation?

4. Write down Newton's forward and backward difference formulae.

5. State two point Gaussian quadrature formula to evaluate $\int_{-1}^{1} f(x)\, d(x)$.

6. Compare Trapezoidal rule and Simpson's 1/3 rule for evaluating numerical integration.

7. What is a Predictor-Corrector method?

8. Mention the multistep methods available for solving ordinary differential equation.

9. Write down the finite difference scheme for solving the Poisson's equation.

10. Obtain the finite difference scheme for the differential equation $2\frac{d^2y}{dx^2} + y = 5$.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Find the real root of the equation $X \log_{10} X - 1.2 = 0$ correct to four places of decimal using false position method. (8)

(ii) Using Gauss-Jordan method, solve the following system of equations

$$2x - y + 3z = 8$$
$$-x + 2y + z = 4$$
$$3x + y - 4z = 0.$$
(8)

Or

(b) (i) Solve by Gauss-Jacobi method, the following equations

$$4x_1 + x_2 + x_3 = 6$$
$$x_1 + 4x_2 + x_3 = 6$$
$$x_1 + x_2 + 4x_3 = 6.$$
(8)

(ii) Find the largest eigen values and eigen vector of the matrix by power method $\begin{bmatrix} 1 & 2 & 3 \\ 0 & -4 & 2 \\ 0 & 0 & 7 \end{bmatrix}$. (8)

12. (a) Use Lagrange formula to calculate $f(3)$ from the following table.

x:	0	1	2	4	5	6
$f(x)$:	1	14	15	5	6	19

(16)

Or

(b) (i) Using Newton's divided difference formula, find the value of $f(8)$ and from the following table : (8)

x :	4	5	7	10	11	13
$f(x)$:	48	100	294	900	1210	2028

(ii) Given

x	1	2	3	4	5	6	7	8
$f(x)$	1	8	27	64	125	216	343	512

Estimate $f(7.5)$. Use Newton's formula. (8)

13. (a) (i) Find the value of $f'(8)$ from the table given below : (8)

x	6	7	9	12
$f(x)$	1.556	1.690	1.908	2.158

(ii) Use Simpson's 1/3 rule to estimate the value of $\int_1^5 f(x)\,dx$ given (8)

x	1	2	3	4	5
$f(x)$	13	50	70	80	100

Or

(b) (i) Find the first and second derivatives of the function $f(x) = x^3 - 9x - 14$ at $x = 3.0$ using the values given below : (8)

x	3.0	3.2	3.4	3.6	3.8	4.0
$f(x)$	−14	−10.03	−5.296	−0.256	−6.672	14

(ii) Find the value of the following integral using Gaussian quadrature technique $\int_3^5 \frac{4}{(2x^2)}\,dx$. (8)

14. (a) (i) Solve numerically $\frac{dy}{dx} = x + y$ when $y(1) = 0$ using Taylor's series upto $x = 1.2$ with $h = 0.1$. (8)

(ii) Using fourth order Runge-Kutta method, solve the following equation taking each step of $h = 0.1$. Given $y(0) = 3$, $\frac{dy}{dt} = \left[\frac{4t}{y} - t \cdot y\right]$. Calculate y for $x = 0.1$ and 0.2 (8)

Or

(b) (i) Apply the modified Euler's method to find $y(0.2)$ and $y(0.4)$, given that $y' = x^2 + y^2$, $y(0) = 1$. Take $h = 0.2$. (8)

(ii) Using Milne's method, find $y(4.4)$ given $5xy' + y^2 - 2 = 0$. Given $y(4) = 1$, $y(4.1) = 1.0049$, $y(4.2) = 1.0097$ and $y(4.3) = 1.0143$. (8)

15. (a) Find the solution of the initial boundary value problem

$$\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2} \quad 0 \le x \le 1$$

Subject to the initial conditions

$$u(x,0) = \sin \pi x, \quad 0 \le x \le 1$$

$$(\partial u / \partial t)\,(x,0) = 0, \quad 0 \le x \le 1$$

and the boundary conditions

$$u(0,t) = 0,\ u(1,t) = 0, \quad t > 0$$

by using (i) the explicit scheme (ii) the implicit scheme. (16)

Or

(b) Solve

$$\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$$

given $u(0,t) = 0$, $u(4,t) = 0$, $u(x,0) = x(4-x)$ assuming $h = k = 1$.

Find the values of u upto $t = 1.5$. (16)

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