T 3321

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2008.

Sixth Semester

(Regulation 2004)

Computer Science and Engineering

MA 1011/MA 1251 — NUMERICAL METHODS

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

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART **A** — (10 x 2 = 20 marks)

1. By Newton's method, find an iterative formula to find $\sqrt{N}$ (where N is a positive number).

2. Why Gauss Seidel iteration is a method of successive corrections?

3. Define forward, backward, central differences and divided difference.

4. Evaluate $\Delta^{10}(1-x)(1-2x)(1-3x)\ldots(1-10x)$, by taking h = 1

5. Show that the divided difference operator Δ is linear.

6. In numerical integration, what should be the number of intervals to apply Simpson's one-third rule and Simpson's three-eighths rule.

7. Explain one-step methods and multistep methods.

8. State the Adams-Bashforth predictor-corrector formula.

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9. For what points of x and y, the equation $x.f_{xx} + y \cdot f_{yy} = 0$, $x > 0$, $y > 0$ is elliptic.

10. Define difference quotient of a function $y(x)$.

PART B — (5 x 16 = 80 marks)

11. (a) (i) Solve $u_{xx} + u_{yy} = 0$ over the square mesh of side 4 units; satisfying the following conditions.

$u(x, 0) = 3x$ for $0 \le x \le 4$

$u(x, 4) = x^2$ for $0 \le x \le 4$

$u(0, y) = 0$ for $0 \le y \le 4$; $u(4, y) = 12 + y$ for $0 \le y \le 4$. (10)

(ii) Solve $\frac{\partial^2 u}{\partial x^2} - 2 \cdot \frac{\partial u}{at} = 0$ given $u(0,t) = 0$, $u(4,t) = 0$, $u(x,0) = x(4-x)$. Assume h = 1. Find the values of u upto $t = 5$. (6)

Or

(b) Solve $y_{tt} = 4y_{xx}$ subject to the conditions $y(0,t) = 0$, $y(2,t) = 0$, $y(x,0) = x(2-x)$, $\frac{\partial y}{\partial t}(x,0) = 0$. Do 4 steps. Find values upto 2 decimal accuracy

12. (a) (i) Apply Guass-Jordan method to find the solution of the following system.

$10x + y + z = 12$; $2x + 10y + z = 13$; $x + y + 5z = 7$. (10)

(ii) Solve for a positive root of $x - \cos x = 0$ by Regula Falsi method. (6)

Or

(b) (i) Find the numerically largest eigen value of $\mathbf{A} = \begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{bmatrix}$ and the corresponding eigen vector by power method. (10)

(ii) Find the root between 1 and 2 of $2x^3 - 3x - 6 = 0$ by Newton-Raphson method correct to five decimal places. (6)

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13. (a) (i) Using Lagrange's interpolation formula, find $y(10)$ from the following table : (10)

x :	5	6	9	11
y :	12	13	14	16

(ii) Find the sixth term of the sequence 8, 12, 19, 29, 42. (6)

Or

(b) (i) From the following table of half-yearly premium for policies maturing at different ages, estimate the premium for policies maturing at age 46. (10)

Age x :	45	50	55	60	65
Premiumy :	114.84	96.16	83.32	74.48	68.48

(ii) Form the divided difference table for the following data : (6)

x :	–	2	0	3	5	7	8
$y = f(x)$:	–792	108	–72	48	–144	–252	

14. (a) (i) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Romberg's method. Hence obtain an approximate value of π. (10)

(ii) A river is 80 meters wide. The depth 'd ' in meters at a distance x meters from one bank is given by the following table. Calculate the area of cross-section of the river using Simpson's $\frac{1}{3}$ rule. (6)

x :	0	10	20	30	40	50	60	70	80
d :	0	4	7	9	12	15	14	8	3

Or

(b) (i) The table given below reveals the velocity v of a body during the time 't' specified. Find its acceleration at $t = 1.1$. (10)

t :	1.0	1.1	1.2	1.3	1.4
v :	43.1	47.7	52.1	56.4	60.8

(ii) Evaluate the integral of

$f(x) = 0.2 + 25x - 200x^2 + 675x^3 - 900x^4 + 400x^5$ between the limits $x = 0$ to 0.8 using two point Gaussian quadrature formula. (6)

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15. (a) (i) Given $y' + xy^2 + y = 0$, $y(0) = 1$, find the value of $y(0.2)$ by using Runge-Kutta method of fourth order. (10)

(ii) Using Taylor series method, find correct to four decimal places, the value of $y(0.1)$, given $\frac{dy}{dx} = x^2 + y^2$ and $y(0) = 1$. (6)

Or

(b) (i) 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 $y(4.3) = 1.0143$. (10)

(ii) Using Euler's method, solve numerically the equation $y' = x + y$, $y(0) = 1$, for $x = 0.0$ (0. 2) (1.0). Check your answer with the exact solution. (6)

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