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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
$$-(10 \times 2 = 20 \text{ marks})$$

- 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 nth divided differences of a polynomial of nth degree?
- 4. Find the second divided differences with arguments a, b, c if $f(x) = \frac{1}{x}$.
- 5. State Simpson's $\frac{1}{3}^{\text{rd}}$ 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 $y' = x + y$, $y(0) = 1$.

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

PART B — $(5 \times 16 = 80 \text{ marks})$

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.
$$10x + y - z = 11.19, \ x + 10y + z = 28.08, \ x + y + 10z = 35.61. \tag{8}$$

(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)

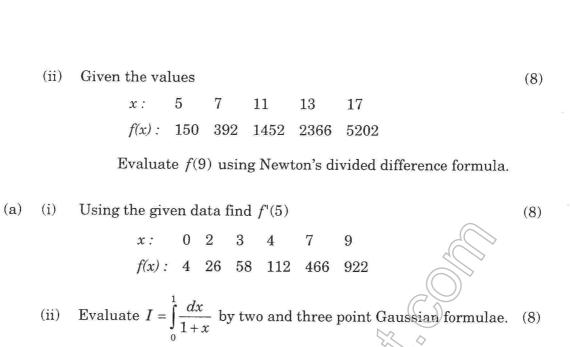
¶2. (a) (i) Using Newton's divided difference interpolation, find the polynomial of the given data (8)

(ii) Find the cubic spline interpolation.

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

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

(8)



13.

- (b) (i) Use Romberg's method to compute $\int_{0.5}^{1} dx$ 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)
 - (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)
 - (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)