

Reg. No. :

Question Paper Code : Q 2294

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Sixth Semester

(Regulation 2004)

Computer Science and Engineering

MA 1011/MA 1251 — NUMERICAL METHODS

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

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Show that Newton-Raphson formula to find \sqrt{a} can be expressed in the form

$$x_{n+1} = \frac{1}{2} \left(x_n + \frac{a}{x_n} \right), \quad n = 0, 1, 2, \dots$$

2. State the condition for convergence of Jacobi's iteration method, for solving a system of simultaneous algebraic equation.

3. Obtain the function whose first difference is $2x^3 + 3x^2 - 5x + 4$.

4. Form the divided difference table from the following data

x : 0 1 2 4 5 6

$f(x)$: 1 14 15 5 6 9

5. Find $y'(0)$ from the following table :

x : 0 1 2 3 4 5

y : 4 8 15 7 6 2

6. State Trapezoidal rule of numerical integration.

7. Which of the following formula is a particular case of Runge-Kutta formula of the second order?
- Taylor series formula.
 - Euler's modified formula.
 - Milne's predictor corrector formula.
8. State the Adam's predictor corrector formula.
9. Write down the standard five point formula to solve the laplace equation $\nabla^2 u = 0$.
10. Give the Crank-Nicolson difference scheme to solve a parabolic equation.

PART B — (5 × 16 = 80 marks)

11. (a) Using Gauss-Seidel iteration method, solve the system of equations upto four decimals.

$$\begin{aligned} 10x - 2y - z - w &= 3 \\ -2x + 10y - z - w &= 15 \\ -x - y + 10z - 2w &= 27 \\ -x - y - 2z + 10w &= -9. \end{aligned}$$

Or

- (b) Determine, by power method, the largest eigenvalue of the matrix

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

12. (a) Use Lagrange's formula to find the form of $f(x)$, given

$x:$	0	2	3	6
$f(x):$	648	704	729	792

hence find $f(5)$.

Or

- (b) In the following table, the values of y are consecutive terms of a series of which 12.5 is the 5th term. Find the first and tenth terms of the series.

$x:$	3	4	5	6	7	8	9
$y:$	2.7	6.4	12.5	21.6	34.3	51.2	72.9

13. (a) The velocity v of a particle at a distance s from a point on its path is given by the following table :

$$s(\text{ft}) : \quad 0 \quad 10 \quad 20 \quad 30 \quad 40 \quad 50 \quad 60$$

$$v(\text{ft/s}) : \quad 47 \quad 58 \quad 64 \quad 65 \quad 61 \quad 52 \quad 38$$

Estimate the time taken to travel 60 ft using Simpson's 1/3 rule. Compare the result with Simpson's 3/8 rule.

Or

- (b) Evaluate $\int_0^1 \frac{1}{1+x} dx$ correct to three decimal places using Romberg's method. Hence find the value of $\log_e 2$.

14. (a) Apply fourth order Runge-Kutta method to find an approximate value of y when $x = 0.2$, given that $\frac{dy}{dx} = x + y^2$ and $y = 1$ when $x = 0$.

Or

- (b) Given $\frac{dy}{dx} = x^2(1+y)$ and $y(1) = 1$, $y(1.1) = 1.233$, $y(1.2) = 1.548$, $y(1.3) = 1.979$, evaluate $y(1.4)$ by Milne's predictor corrector method.

15. (a) Given the values of $u(x, y)$ on the boundary of the square given in the figure. Evaluate the function $u(x, y)$ satisfying the Laplace's equation $\nabla^2 u = 0$ at the pivotal points of this figure.



Or

- (b) Find the values of $u(x, t)$ satisfying the parabolic equation $\frac{\partial u}{\partial t} = 4 \frac{\partial^2 u}{\partial x^2}$ with boundary conditions $u(0, t) = 0$, $u(8, t) = 0$ and $u(x, 0) = 4x - \frac{1}{2}x^2$ at the points $x = i$, $i = 0, 1, 2, 3, \dots, 7$ and $t = \frac{1}{8}j$; $j = 0, 1, 2, 3, \dots, 5$.