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

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?

   (a) Taylor series formula.

   (b) Euler's modified formula.

   (c) 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 :

$s(ft)$:	0	10	20	30	40	50	60
$v(ft/s)$:	47	58	64	65	61	52	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

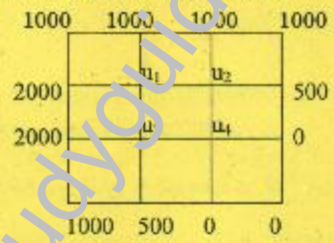
(b) Evaluate $\int_0^1 \frac{1}{1+x}dx$ correct to three decimal places using Romberg's method. Hence find the value of $\log_e 2$.

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 $x = i$, $i = 0, 1, 2, 3, ...7$ and $t = \frac{1}{8}j$; $j = 0, 1, 2, 3, ...5$.
