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

Question Paper Code : 10399

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2012.

Fourth Semester

Civil Engineering

MA 2264/MA 41/MA 1251/10177 MA 401/080280026 — NUMERICAL METHODS

(Common to Fourth Semester Aeronautical Engineering and Electrical and Electronics Engineering)

(Also Common to Fifth Semester Chemical Engineering and Plastic Technology)

(Also Common to Sixth Semester Computer Science and Engineering, Electronics and Communication Engineering and Information Technology)

(Regulation 2008)

Time : Three hours — Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. State the order of convergence and the criterion for the convergence in Newton's method.

2. Give two direct methods to solve a system of linear equations.

3. For cubic splines, what are the 4n conditions required to evaluate the unknowns.

4. Construct the divided difference table for the following data :

x : 0 1 2 5

$f(x)$: 2 3 12 147

5. Apply two point Gaussian quadrature formula to evaluate $\int_{-1}^{1} \frac{1}{1+x^2}\, dx$.

6. Under what condition, Simpson's 3/8 rule can be applied and state the formula.

7. What is the major drawback of Taylor series method?

8. Using Euler's method, find the solution of the initial value problem $\frac{dy}{dx} = \log(x+y)$, $y(0)=2$ at $x=0.2$ by assuming $h=0.2$.

9. What is the central difference approximation for y''?

10. Write the difference scheme for solving the Poisson equation $\nabla^2 u = f(x,y)$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Using Gauss, Jordan method, find the inverse of the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$. (8)

(ii) Solve $e^x - 3x = 0$ by the method of fixed point iteration. (8)

Or

(b) (i) Apply Gauss-Seidal method to solve the equations $20x + y - 2z = 17$; $3x + 20y - z = -18$; $2x - 3y + 20z = 25$. (8)

(ii) Determine the largest eigen value and the corresponding eigen vector of the matrix $\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$. (8)

12. (a) (i) Find the cubic polynomial which takes the following values : (8)

x : 0 1 2 3

$f(x)$: 1 2 1 10

(ii) Derive Newton's backward difference formula by using operator method. (8)

Or

(b) (i) The following values of x and y are given :

x :	1	2	3	4
y :	1	2	5	11

Find the cubic splines and evaluate $y(1.5)$ and $y'(3)$. (10)

(ii) Using Lagrange's interpolation, calculate the profit in the year 2000 from the following data : (6)

Year :	1997	1999	2001	2002
Profit in Lakhs of Rs. :	43	65	159	248

13. (a) (i) Using Trapezoidal rule, evaluate $\int_1^2\int_1^2 \frac{dx\,dy}{x^2+y^2}$ numerically with $h=0.2$ along x-direction and k = 0.25 along y-direction. (8)

(ii) A slider in a machine moves along a fixed straight rod. Its distance x cm along the rod is given below for various values of the time 't' seconds. Find the velocity of the slider when t = 1.1 second. (8)

t :	1.0	1.1	1.2	1.3	1.4	1.5	1.6
x :	7.989	8.403	8.781	9.129	9.451	9.750	10.031

Or

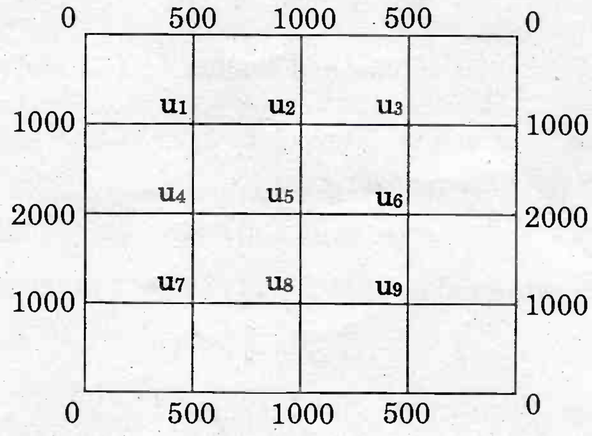
(b) Use Romberg's method to compute $\int_0^1 \frac{dx}{1+x^2}$ correct to 4 decimal places. Also evaluate the same integral using three-point Gaussian quadrature formula. Comment on the obtained values by comparing with the exact value of the integral which is equal to $\pi/4$. (16)

14. (a) Given that $y''+xy'+y=0$, $y(0)=1$, $y'(0)=0$ obtain y for $x=0.1, 0.2$ and 0.3 by Taylor's series method and find the solution for $y(0.4)$ by Milne's method. (16)

Or

(b) Consider the second order initial value problem $y''-2y'+2y=e^{2t}\sin t$ with $y(0)=-0.4$ and $y'(0)=-0.6$ using Fourth order Runge Kutta algorithm, find $y(0.2)$. (16)

15. (a) Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown : (16)



Or

(b) (i) Solve the equation $y'' = x + y$ with the boundary conditions $y(0) = y(1) = 0$. (6)

(ii) Solve $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$, subject to $u(0,t) = u(1,t) = 0$ and $u(x, 0) = \sin \pi x$, $0 < x < 1$ using Bender-Schmidt method. (10)