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

Question Paper Code : 27335

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Fourth Semester

Civil Engineering

MA 6459 — NUMERICAL METHODS

(Common to Aeronautical Engineering, Electrical and Electronics Engineering, Instrumentation and Control Engineering, Electronics and Instrumentation Engineering, Instrumentation and Control Engineering, Geoinformatics Engineering, Petrochemical Engineering, Production Engineering, Chemical and Electrochemical Engineering, Textile Chemistry and Textile Technology)

(Regulations 2013)

Time : Three hours — Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What is the criterion for the convergence of Newton-Raphson 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 data $(0, 1)$, $(1, 4)$, $(3, 40)$ and $(4, 85)$.

5. Apply two point Gaussian quadrature formula to evaluate $\int_0^2 e^{-x^2} dx$.

6. Under what condition Simpson's $\frac{3}{8}$ rule can be applied and state the formula.

7. Using Euler's method, find $y(0.1)$ given that $\frac{dy}{dx} = x + y$, $y(0) = 1$.

8. State Adam's Predictor–Corrector formulae.

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

10. Write down the difference scheme for solving the equation $y_{tt} = \alpha^2 y_{xx}$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Find the largest eigenvalue and the corresponding eigenvector of a matrix $\begin{pmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$. (8)

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

Or

(b) (i) Apply Gauss-Seidal method to solve the equations (8)

$$28x + 4y - z = 32$$
$$x + 3y + 10z = 24$$
$$2x + 17y + 4z = 35.$$

(ii) Find the root of $4x - e^x = 0$ that lies between 2 and 3 by Newton-Raphson method. (8)

12. (a) (i) Using Lagrange's interpolation formula calculate the profit in the year 2000 from the following data : (8)

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

(ii) Using Newton's forward interpolation formula, find the cubic polynomial which takes the following values : (8)

x :	0	1	2	3
y :	1	2	1	10

Or

(b) The following values of x and y are given: (16)

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

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

13\. (a) (i) Using Trapezoidal rule evaluate $\int_0^1\int_0^1 \frac{dxdy}{x+y+1}$ with $h=0.5$ along x - direction and $k=0.25$ along y - direction. (8)

(ii) Find $f'(10)$ from the following data : (8)

x :	3	5	11	27	34
y :	–13	23	899	17315	35606

Or

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

14\. (a) Determine the value of $y(0.4)$ using Milne's method given $y'=xy+y^2$, $y(0)=1$. Use Taylor's series method to get the values of $y(0.1)$, $y(0.2)$ and $y(0.3)$. (16)

Or

(b) Find $y(0.1)$, $y(0.2)$ and $y(0.3)$ from $y'=x+y^2$, $y(0)=1$ by using Runge-Kutta method of Fourth order and then find $y(0.4)$ by Adam's method. (16)

15\. (a) (i) Solve $y''=x+y$ with the boundary conditions $y(0)=y(1)=0$. (6)

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

Or

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