Reg. No. : [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Question Paper Code : 80612

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

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. Derive a formula to find the value of $\sqrt{N}$, where N is a real number, by Newton's method.

2. Which of the iteration method for solving linear system of equation converges faster? Why?

3. Using Lagrange's interpolation formula find y value when $x = 1$ from the following data :

x:	0	–1	2	3
y:	–8	3	1	12

4. State Newton's forward formula and Backward formula.

5. Compare Trapezoidal rule and Simpson's 1/3 rule for evaluating numerical integration.

6. Change the limits of $\int_0^{\pi/2} \sin x \, dx$ into $(-1,1)$.

7. Compare Single-step method and Multi-step method.

8. Write down the Milne's predictor and corrector formulas.

9. Classify the following equation $u_{xx} + 4u_{xy} + 4u_{yy} - u_x + 2u_y = 0$.

10. Write down the standard five point formula.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Find a root of $x \log_{10} x - 1.2 = 0$ using Newton Raphson method correct to three decimal places.

(ii) Solve by Gauss Seidal method, the following system :

$20x + y - 2z = 17$, $3x + 20y - z = -18$, $2x - 3y + 20z = 25$.

Or

(b) (i) Find the dominant Eigen values of $A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$ using power method.

(ii) Apply Gauss Jordan method, find the solution of the following system :

$2x - y + 3z = 8$, $-x + 2y + z = 4$, $3x + y - 4z = 0$.

12. (a) (i) Find an approximate polynomial for $f(x)$ using Lagrange's interpolation for the following data :

x :	0	1	2	5
$y = f(x)$:	2	3	12	147

(ii) Find the value of y at $x = 21$ from the data given below :

x :	20	23	26	29
y :	0.3420	0.3907	0.4384	0.4848

Or

(b) (i) Given the tables :

x :	5	7	11	13	17
$y = f(x)$:	150	392	1452	2366	5202

Evaluate $f(9)$ using Newton's divided difference formula.

(ii) Fit a cubic spline from the given table :

x :	1	2	3
$f(x)$:	–8	–1	18

Compute $y(1.5)$ and $y'(1)$ using cubic spline.

13. (a) (i) The population of a certain town is shown in the following table.

Year :	1931	1941	1951	1961	1971
Population (in thousands) :	40.6	60.8	79.9	103.6	132.7

Find the rate of growth of the population in the year 1945.

(ii) Evaluate $\int_0^1 \frac{1}{1+x} dx$ using Romberg's method and hence find the value of $\log 2$.

Or

(b) (i) The velocity V of a particle at a distance S from a point on its path is given by the table.

S (ft) :	0	10	20	30	40	50	60
V (ft./sec) :	47	58	64	65	61	52	38

Estimate the time taken to travel 60 feet by using Simpson's $\frac{1}{3}$ rule.

(ii) Evaluate $\int_1^{1.4} \int_2^{2.4} \frac{1}{xy} dx\, dy$ using Trapezoidal rule by taking $h = k = 0.1$ and verify with actual integration.

14. (a) (i) Find the value of y at $x = 0.1$ from $\frac{dy}{dx} = x^2 y - 1$, $y(0) = 1$ by Taylor's series method.

(ii) Solve $(1+x)\frac{dy}{dx} = -y^2$, $y(0) = 1$ by Modified Euler's method by choosing $h = 0.1$, find $y(0.1)$ and $y(0.2)$.

Or

(b) (i) Using Runge-Kutta method of fourth order, solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$, $y(0) = 1$ at $x = 0.2$.

(ii) Given $\frac{dy}{dx} = x - y^2$, $y(0) = 0$, $y(0.2) = 0.02$, $y(0.4) = 0.0795$ and $y(0.6) = 0.1762$. Compute $y(0.8)$ using Milne's method.

15. (a) (i) Using Bender Schmidt's method solve $u_t = u_{xx}$ subject to the condition, $u(0,t) = 0$, $u(1,t) = 0$, $u(x,0) = \sin \pi x$, $0 < x < 1$ and $h = 0.2$. Find the value of u up to $t = 0.1$.

(ii) Evaluate the pivotal values of the equation $u_{tt} = 16u_{xx}$ taking $h = 1$ upto $t = 1.25$. The boundary conditions are $u(0,t) = u(5,t) = u_t(x,0) = 0$ and $u(x,0) = x^2(5 - x)$.

Or

(b) By Iteration method solve the elliptic equation $u_{xx} + u_{yy} = 0$ over the square region of side 4, satisfying the boundary conditions $u(0,y) = 0$, $0 \le y \le 4$, $u(4,y) = 12 + y$, $0 \le y \le 4$, $u(x,0) = 3x$, $0 \le x \le 4$, $u(x,4) = x^2$, $0 \le x \le 4$. By dividing the square into 16 square meshes of side 1 and always correcting the computed values to two places to decimals. Obtain the values of u at 9 interior pivotal points.
