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

Question Paper Code : 90346

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Fourth Semester

Civil Engineering

MA 8491 : NUMERICAL METHODS

(Common to Aeronautical Engineering/Civil Engineering/Electrical and Electronics Engineering/Electronics and Instrumentation Engineering/ Instrumentation and Control Engineering/Mechanical Engineering (Sandwich) Chemical Engineering/Chemical and Electrochemical Engineering/Plastic Technology/Polymer Technology/Textile Technology)

(Regulations 2017)

Time : Three Hours — Maximum : 100 Marks

Answer ALL questions.

PART – A — **(10×2=20 Marks)**

1. Write the condition for convergence of iteration method.

2. Solve 3x + 2y = 4, 2x – 3y =7 by using Gauss Jordan method.

3. Prove that $E = 1 + \Delta$.

4. Construct the Newton's divided difference table for the following data.

x	0	1	3	4
y	1	4	40	85

5. Write the Newton's backward interpolation formula to find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = x_n$.

6. State Gaussian two point quadrature formula.

7. Using Euler's method, find y(0.1) given that y' = x + y, y(0) =1.

8. Write the Adams-Bashforth predictor -corrector formula.

9. Classify $u_{xx} - 2u_{xy} + u_{yy} = 0$.

10. Write the Bender-Schmidt explicit formula to solve $u_{xx} = au_t$.

PART – B (5×16=80 Marks)

11. a) i) Find the real positive root of $x \log_{10} x = 1.2$ by using Newton-Raphson method correct to four decimal places. (8)

ii) Solve the following system of equations by using Gauss-Seidal method.
$28x + 4y - z = 32$, $x + 3y + 10z = 24$, $2x + 17y + 4z = 35$. (8)

(OR)

b) i) Solve the following system of equations by using Gauss- Elimination method :
$3x - y + 2z = 12$, $x + 2y + 3z = 11$, $2x - 2y - z = 2$. (8)

ii) Find the largest eigenvalue and the corresponding eigenvector of the matrix $\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$ by using Power method. (8)

12. a) i) Using Newton's forward interpolation formula, find the polynomial which takes the following values. (8)

x :	0	1	2	3
f(x) :	1	2	1	10

ii) Using Lagrange's interpolation formula, find y(10) from the following table. (8)

x :	5	6	9	11
y :	12	13	14	16

(OR)

b) Find the cubic spline polynomial to the following data given that $M_0 = M_3 = 0$ and also find y (2.5). (16)

x	:	0	1	2	3
y	:	1	2	33	244

13. a) i) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x = 1.1 given that (8)

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

ii) Evaluate $\int_0^1 \frac{dx}{1+x}$ by using trapezoidal rule with h = 0.125, 0.25, 0.5. Then use Romberg's method to obtain its value. Hence, evaluate $\log_e 2$ correct to 3 decimal places. (8)

(OR)

b) i) Evaluate $\int_{1}^{1.2}\int_{1}^{1.4} \frac{1}{x+y}\,dx\,dy$ by using Simpson's rule taking 2 sub intervals in each direction. (8)

ii) Evaluate $\int_{0}^{1} \frac{dx}{1+x}$ using Gaussian three-point quadrature. (8)

14. a) i) Find the value of y at x = 0.1 and x = 0.2 given that $y' = x^2y - 1$, y (0) =1 using Taylor's series method. (8)

ii) Find y (0.8) given that $y' = y - x^2$, y (0.6) = 1.7379 using fourth order R-K method correct to 4 decimal places. (8)

(OR)

b) i) Compute y at x = 0.1, 0.2 given that $\frac{dy}{dx} = x + y^2$, y (0) = 1 using modified Euler's method. (8)

ii) Find y (0.4) given that $y' = xy + y^2$, y(0) = 1, y(0.1) = 1.1167, y(0.2) = 1.2767, y(0.3) = 1.5023 by using Milne's predictor corrector method. (8)

15. a) i) Solve $y'' - y = x$, $x \in (0, 1)$ given y(0) = y (1) = 0 by dividing the interval into 4 equal parts using finite difference method. (8)

ii) Using Crank-Nicholson's difference scheme, solve $u_{xx} = 16\,u_t$, $0 < x < 1$, $t > 0$ given u (x, 0) = 0, u (0, t) = 0, u (1, t) = 100 t. Compute u for one time step by taking h = 1/4. (8)

(OR)

b) Solve $u_{xx} + u_{yy} = 0$ whose boundary values are as shown in the following figure. (16)