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**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. (8)

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

(OR)

- b) i) Solve the following system of equations by using Gauss- Elimination method : (8)

$$3x - y + 2z = 12, x + 2y + 3z = 11, 2x - 2y - z = 2.$$

- 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)

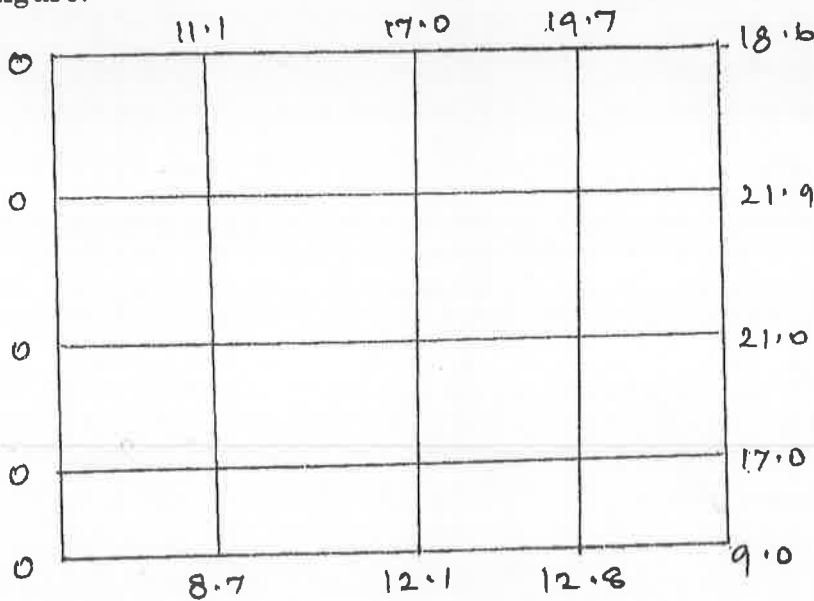
ii) Find y (0.4) given that  $y' = xy + y^2$ ,  $y(0) = 1$ ,  $y(0.1) = 1.1167$ ,  $y(0.2) = 1.2767$ ,  $y(0.3) = 1.5023$  by using Milne's predictor corrector method. (8)

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)



175)  $\frac{1}{2} \ln \left| \frac{x+1}{x-1} \right| + \frac{1}{2} \ln \left| \frac{x+2}{x-2} \right| + \frac{1}{2} \ln \left| \frac{x+3}{x-3} \right| + \dots$   
 in each direction.

176)  $\frac{1}{2} \ln \left| \frac{x+1}{x-1} \right| + \frac{1}{2} \ln \left| \frac{x+2}{x-2} \right| + \frac{1}{2} \ln \left| \frac{x+3}{x-3} \right| + \dots$

177)  $\frac{1}{2} \ln \left| \frac{x+1}{x-1} \right| + \frac{1}{2} \ln \left| \frac{x+2}{x-2} \right| + \frac{1}{2} \ln \left| \frac{x+3}{x-3} \right| + \dots$   
 in each direction.

178)  $\frac{1}{2} \ln \left| \frac{x+1}{x-1} \right| + \frac{1}{2} \ln \left| \frac{x+2}{x-2} \right| + \frac{1}{2} \ln \left| \frac{x+3}{x-3} \right| + \dots$   
 in each direction.

179)  $\frac{1}{2} \ln \left| \frac{x+1}{x-1} \right| + \frac{1}{2} \ln \left| \frac{x+2}{x-2} \right| + \frac{1}{2} \ln \left| \frac{x+3}{x-3} \right| + \dots$   
 in each direction.

180)  $\frac{1}{2} \ln \left| \frac{x+1}{x-1} \right| + \frac{1}{2} \ln \left| \frac{x+2}{x-2} \right| + \frac{1}{2} \ln \left| \frac{x+3}{x-3} \right| + \dots$   
 in each direction.

181)  $\frac{1}{2} \ln \left| \frac{x+1}{x-1} \right| + \frac{1}{2} \ln \left| \frac{x+2}{x-2} \right| + \frac{1}{2} \ln \left| \frac{x+3}{x-3} \right| + \dots$   
 in each direction.

182)  $\frac{1}{2} \ln \left| \frac{x+1}{x-1} \right| + \frac{1}{2} \ln \left| \frac{x+2}{x-2} \right| + \frac{1}{2} \ln \left| \frac{x+3}{x-3} \right| + \dots$   
 in each direction.

183)  $\frac{1}{2} \ln \left| \frac{x+1}{x-1} \right| + \frac{1}{2} \ln \left| \frac{x+2}{x-2} \right| + \frac{1}{2} \ln \left| \frac{x+3}{x-3} \right| + \dots$   
 in each direction.

