Reg. No. :

Question Paper Code : X 60771

B.E./B.Tech. DEGREE EXAMINATIONS, NOV./DEC. 2020

Fourth/Fifth/Sixth Semester

Civil Engineering

MA 2264/10177 MA 401/080280026/10144 ECE 15/MA 41/MA 51-– NUMERICAL METHODS

(Common to all Branches)

(Regulations 2008/2010)

Time : Three Hours   Maximum : 100 Marks

Answer ALL questions.

PART – A   **(10×2=20 Marks)**

1. Write down the condition for convergence of Newton-Raphson method for f(x) = 0.

2. Find the inverse of $A = \begin{pmatrix} 1 & 3 \\ 2 & 7 \end{pmatrix}$ by Gauss-Jordon method.

3. Find the second divided difference with arguments a, b, c if $f(x) = \frac{1}{x}$

4. Define cubic spline.

5. Evaluate $\int_{-2}^{2} e^{\frac{-x}{2}} dx$ by Gauss two point formula.

6. Evaluate $\int_{0}^{6} \frac{dx}{1+x^2}$ using Trapezoidal rule.

7. Find y(1, 1) if y´ = x + y, y(1) = 0 by Taylor series method.

8. State Euler's formula.

9. State Crank-Nicholson's difference scheme.

10. Write down Bender-Schmidt's difference scheme in general form and using suitable value of λ, write the scheme in simplified form.

PART – B **(5×16=80 Marks)**

11. a) i) Solve the equations by Gauss-Seidel method of iteration.
$10x + 2y + z = 9$, $x + 10y - z = -22$, $-2x + 3y + 10z = 22$. **(8)**

ii) Determine the largest eigen value and the corresponding eigen vector of the matrix $\begin{pmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{pmatrix}$ with $(1\ 0\ 0)^T$ as the initial vector by power method. **(8)**

(OR)

b) i) Find the inverse of the matrix $\begin{pmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{pmatrix}$ using Gauss-Jordon method. **(8)**

ii) Using Newton's method, find the real root of $x \log_{10} x = 1.2$ correct to five decimal places. **(8)**

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

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

ii) Obtain the cubic spline approximation for the function y = f(x) from the following data, given that $y_0'' = y''_3 = 0$. **(8)**

x	–1	0	1	2
y	–1	1	3	35

(OR)

b) i) By using Newton's divided difference formula find f(8), given **(8)**

x	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

ii) Find the polynomial f(x) by using Lagrange's formula and hence find f(3) for the following values of x and y : **(8)**

x	0	1	2	5
y	2	3	12	147

13. a) i) Find $f'(x)$ at x = 1.5 and x = 4.0 from the following data using Newton's formulae for differentiation. **(8)**

x :	1.5	2.0	2.5	3.0	3.5	4.0
y = f(x) :	3.375	7.0	13.625	24.0	38.875	59.0

ii) Compute $\int_0^{\pi/2} \sin x \, dx$ using Simpson's 3/8 rule. **(8)**

(OR)

b) Evaluate $\int_0^2 \int_0^1 4xy \, dx \, dy$ using Simpson's rule by taking $h = \frac{1}{4}$ and $k = \frac{1}{2}$. **(16)**

14. a) i) Using Taylor series method to find y(0.1) if $y' = x^2 + y^2$, y (0) = 1 **(8)**

ii) Using Runge-Kutta method find y(0.2) if $y'' = xy'^2 - y^2$, y(0) = 1, $y'(0) = 0$, h = 0.2. **(8)**

(OR)

b) i) Solve $y' = \frac{y - x}{y + x}$, y(0) = 1 at x = 0.1 by taking h = 0.02 by using Euler's method. **(8)**

ii) Using Adam's method to find y(2) if $y' = (x + y)/2$ y(0) = 2, y(0.5) = 2.636, y(1) = 3.595, y(1.5) = 4.968. **(8)**

15. a) i) Using Bender-Schmidt's method solve $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$ given u(0, t) = 0, u(1, t) = 0 u(x, 0) = sin πx, 0 < x < 1 and h = 0.2. Find the value of u upto t = 0.1. **(8)**

ii) Solve $y'' - y = x$, x by $x \in (0, 1)$ given y(0) = y(1) = 0 using finite differences by dividing the interval into four equal parts. **(8)**

(OR)

b) i) Solve the Poisson equation $\nabla^2 u = -10(x^2 + y^2 + 10)$, $0 \le x \le 3$, $0 \le y \le 3$, u = 0 on the boundary. **(8)**

ii) Solve the wave equation $\frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial t^2}, 0 < x < 1, t > 0$, u(0, t) = u(1, t) = 0, t > 0,

$u(x,0) - \begin{cases} 1, 0 \le x \le 0.5 \\ -1, 0.5 \le x \le 1 \end{cases}$ and $\frac{\partial u}{\partial t}(x,0) = 0$, using h = k = 0.1, find u for three time steps. **(8)**
