Reg. No. :

Question Paper Code : 50785

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017

Fourth Semester

Electrical and Electronics Engineering

MA 6459 : NUMERICAL METHODS

(Common to Aeronautical Engineering/Agriculture Engineering/Civil Engineering/ Electrical and Electronics Engineering/Electronics and Instrumentation Engineering/Geoinformatics Engineering/Instrumentation and Control Engineering/Manufacturing Engineering/Mechanical and Automation Engineering/ Petrochemical Engineering/Production Engineering/Chemical Engineering/ Chemical and Electrochemical Engineering/Handloom and Textile Technology/ Petrochemical Technology/Plastic Technology/Polymer Technology/Textile Chemistry/Textile Technology)

(Regulations 2013)

Time : Three Hours   Maximum : 100 Marks

Answer ALL questions.

PART – A   (10×2=20 Marks)

1. Write down the order of convergence of Newton-Raphson method.

2. State the rate convergence of Gauss Jacobi method and Gauss Seidel method.

3. What is the nature of nth divided differences of a polynomial of nth degree ?

4. Distinguish between interpolation and extrapolation.

5. Write the formula for the derivative to compute at $\frac{dy}{dx}$ at the point $x = x_0$ by using Newton's forward difference formula.

6. What is two-point Gaussian quadrature formula ? For what class of functions f (x) does it given exact answers.

7. State the modified Euler formula to find $y(x_1)$ for solving $\frac{dy}{dx} = f(x, y)$, $Y(x_0) = y_0$.

8. How many prior values are required in predictor-corrector formulae?

9. Write down the diagonal five point formula to solve the Laplace's Equation $\nabla^2 u(x, y) = 0$.

10. Write down the explicit formula to solve the hyperbolic equation $u_{tt} = 9u_{xx}$ when $\Delta x = 0.25$ and $\Delta t = 1/16$.

PART – B   (5×16=80 Marks)

11. a) i) Find the smallest positive root of $x^3 - 2x - 5 = 0$ by the fixed point iteration method, correct to three decimal places.   (8)

   ii) Find the inverse of the matrix $A = \begin{pmatrix} 4 & 1 & 2 \\ 2 & 3 & -1 \\ 1 & -2 & 2 \end{pmatrix}$ by Gauss-Jordan method.   (8)

(OR)

   b) i) Solve the following system of equations by Gauss-Seidel method, correct to three decimal places :
       $28x + 4y - z = 32$; $x + 3y + 10z = 24$ and $2x + 17y + 4z = 35$.   (8)

   ii) Find, by power method, the largest eigenvalue and the corresponding eigenvector of a matrix $A = \begin{pmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$ starting with initial vector $X^{(0)} = (1\ 0\ 0)^T$.   (8)

12. a) i) Find the interpolation polynomial $f(x)$ by Lagrange's formula and hence find $f(3)$ for $(0, 2)$, $(1, 3)$ $(2, 12)$ and $(5, 147)$.   (8)

   ii) Find the interpolation polynomial $f(x)$ by using Newton's forward difference interpolation formula and hence find the value of $f(5)$ for

x :	4	6	8	10
f(x):	1	3	8	16

(8)

(OR)

   b) Find the cubic spline approximation for the function given below.

x :	0	1	2	3
f(x):	1	2	33	244

Assume that $M(0) = 0 = M(3)$. Hence find the value of $f(2.5)$.   (16)

13. a) i) Find the first and second derivatives of y with respect to x at x = 10 from the following data :

x :   3   5   7   9   11

y :   31   43   57   41   27   (8)

   ii) Evaluate $\int_0^2\int_0^2 f(x,y)\,dx\,dy$ by Trapezoidal rule for the following data, correct to three decimal places :

x \ y	0	0.5	1	1.5	2
0	2	3	4	5	5
1	3	4	6	9	11
2	4	6	8	11	14

(8)

(OR)

b) i) The following data give the corresponding values for pressure (p) and specific volume (v) of a superheated steam. Find the rate of change of pressure with respect to volume when v = 2.

v :   2   4   6   8   10

p :   105   42.7   25.3   16.7   13.0   (8)

   ii) Using Simpson's one-third rule, evaluate $\int_0^{0.6} e^{-x^2}\,dx$ correct to three decimal places by step-size = 0.1.   (8)

14. a) Given dy/dx = xy + y², y(0) = 1, y (0.1) = 1.1169 and y (0.2) = 1.2773, find

   i) y (0.3) by R-K method of fourth order and

   ii) y (0.4) by Milne's method.   (16)

(OR)

b) i) Use Taylor series method to find y at x = 0.1, given dy/dx = x² − y, y(0) =1, correct to 4 decimal places.   (8)

   ii) Using Adam's method, find y(0.4), given dy/dx = (xy)/2, y (0) = 1, y (0.1) = 1.01, y (0.2) = 1.002 and y (0.3) = 1.023.   (8)

50785 -4-

15. a) Solve $\nabla^2 u = -10(x^2 + y^2 + 10)$ in the square region $0 \le x, y \le 3$ with $u = 0$ on the boundary and mesh length 1 unit. (16)

(OR)

b) i) Solve the boundary value problem $x\,y'' + y = 0$ with the boundary conditions $y(1) = 1$ and $y(2) = 2$, taking $h = 1/4$ by finite difference method. (8)

ii) Solve $u_t = u_{xx}$ in $0 < x < 4, t > 0$, given that $u(0, t) = 0$, $u(4, t) = 0$, $u(x, 0) = x(4 - x)$. Compute u up to t = 4 with $\Delta x = \Delta t = 1$. (8)