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)**

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 n^{th} divided differences of a polynomial of n^{th} 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 :

y \ x	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 $dy/dx = xy + y^2$, 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 $dy/dx = x^2 - y$, 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)**