Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

M.Tech Degree S2 (R,S) (FT/WP) / PhD Examination May 2025 (2022 scheme)

Course Code & Name: 222TCE100 ADVANCED NUMERICAL METHODS

Max. Marks: 60 Duration: 2.5 Hours

PART A

Answer all questions. Each question carries 5 marks Marks

1 What is numerical analysis and its importance? Explain the concept of the factorization method for solving a system of linear equations. (5)

2 Solve the following by Euler's method $\frac{dy}{dx} = x + y^2$, y(0)=1,compute y(0.3) with h=0.1 (5)

3 How the second-order partial differential equations are classified? Write one example for each type of partial differential equation. (5)

4 What is FEM? Write any three practical applications of FEM (5)

5 Explain with sketches any ten elements used in FEM (5)

PART B

Answer any 5 questions. Each question carries 7 marks

6 Solve the following equations by the Gauss-Seidel iteration method. (7)

$18x_1+2x_2+x_3+x_4=19$

$x_1+18x_2+2x_3+4x_4= -7$

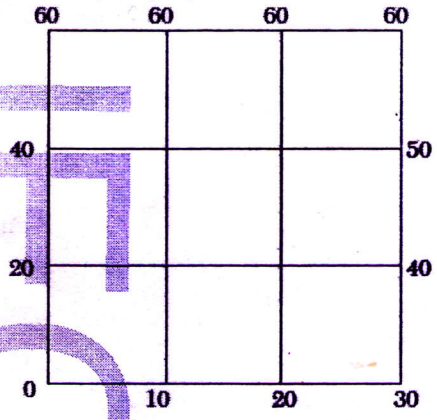
$2x_1+x_2+18x_3+x_4=21$

$x_1+x_2+2x_3+18x_4=38$

7 Using the Runge-Kutta method of order 4, find y (0.2) given that $\frac{dy}{dx} = 3x + y$, $y(0) = 1$ taking $h = 0.1$. (7)

8 Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the square mesh with boundary (7)

values as shown in Figure. Iterate until the maximum difference between successive values at any point is less than 0.005



9 What is the finite element method? Explain with examples of modeling field problems in engineering.? (7)

10 Describe any two methods to solve a one-dimensional heat equation. (7)

11 Describe the requirements of a displacement function in FEM (7)

12 Formulate the stiffness matrix for a two-noded bar element . (7)

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