

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

M.Tech Degree S2 (R, S) / S2 (WP) (R) Examination May 2024 (2022 Scheme)

**Discipline: Civil Engineering****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 Differentiate between Direct and Iterative methods for solving system of equations. (5)
- 2 Using Euler's Method solve $\frac{dy}{dx} = x + y$, $y(0) = 1$ for $y(0.2)$ & $y(0.4)$. (5)
- 3 What is the classification of the equations (5)
 - (i) $u_{xx} + 2u_{xy} + u_{yy} = 0$
 - (ii) $(1 + x^2)u_{xx} + (5 + 2x^2)u_{xt} + (4 + x^2)u_{tt} = 0$
- 4 What are the basic concepts of Finite Element Method. (5)
- 5 Define shape functions and write its properties. (5)

PART B*Answer any 5 questions. Each question carries 7 marks*

- 6 Use Gauss-Seidel Method to approximate the solution of the following system of linear equations (7)

$$8x_1 + x_2 + x_3 = 8; \quad 2x_1 + 4x_2 + x_3 = 4; \quad x_1 + 3x_2 + 5x_3 = 5.$$
- 7 Find the value of $y(0.2)$ and $y(0.4)$ using Runge Kutta Fourth Order Method (7)

given $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$.
- 8 Solve using Crank-Nicholson method $u_{xx} = 16u_t$ with boundary condition (7)
 $u(0, t) = 0, u(1, t) = 100t$ and $u(x, 0) = 0$. Compute u for one step in t direction taking $h = 1/4$.
- 9 Solve $u_{xx} + u_{yy} = -10(x^2 + y^2 + 10)$ over the square mesh with sides $x =$ (7)
 $y = 0$ and $x = y = 3$ with $u = 0$ on the boundary and mesh length 1 unit.
- 10 What are the advantages of Mathematical Modelling. (7)
- 11 Explain the procedure of Finite Element Analysis in detail. (7)
- 12 Derive the element stiffness matrix for a 2-noded bar element. (7)
