Seat No: _____ **Enrollment No: _____**

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

M.Tech. Winter 2017 - 18 Examination

Semester: 1 **Date: 26/12/2017**
Subject Code: 03210101 **Time: 2:00 pm to 4:30 pm**
Subject Name: Computation Method for Thermal Engineering **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Make suitable assumptions wherever necessary.
3. Start new question on new page.

Q.1 **A)** What do you understand by Convergence, Consistency, and Stability of numerical methods, discuss in detail. **(05)**

B) Derive $\left(\frac{d^2u}{dx^2}\right)_{i,j} = \frac{u_{i+1,j}-2u_{i,j}+u_{i-1,j}}{\Delta x^2}$ by using Taylor series. **(05)**

C) Given: $\frac{dy}{dx} = \frac{y-x}{y+x}$ with y=1 for x=0. Find y approximately for x=0.1 by Eulers method. **(05)**

Q.2 **Answer the following questions. (Attempt any three) (Each of five marks)** **(15)**

A) What are the four basic rules the FVM discretisation equation should obey to ensure the physical realism and overall balance.

B) Obtain the equivalent finite difference formulation of given PDE $\frac{\partial u}{\partial t} - \alpha\frac{\partial u}{\partial x} = \frac{\partial^2 y}{\partial x^2}$ write the truncation error also.

C) Write down the MATLAB programme for the following:

II. $y = \cosh^2 x - \sinh^2 x$ **V.** $x = t\sin(t)$

IV. $y = \frac{t-1}{t+1}$ **III.** $z = \frac{\sin(t^2)}{t^2}$

D) Write the steps involved in the mathematical modeling of Thermal System with the help of suitable example.

Q.3 **A)** Find the root of equation $\tan x + \tanh x = 0$ which lies in the interval 1.6, 3.0 correct to four significant digit. Use method of False position. **(07)**

B) Solve the boundary value problem. Use the shooting method. **(08)**

$y"(x) = y(x);\ subject\ to\ boundary\ condition\ y(0) = 0,\ y(1) = 1.1752$

OR

B) Solve the heat conduction equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial t^2}$ $0 \le x \le 1, t \ge 0$ subject to $u = 0$ at $x = 0$ for all t and $\frac{\partial u}{\partial t} = 0$ at $x = 1$ and $u(x,0) = \sin\frac{3\pi x}{2}$ Using the explicit Method, choosing $\Delta x = 0.1$ and $\Delta t = 0.0025$ so that $r = 1/4$, obtain the solution for one time level. **(08)**

Q.4 **A)** Derive the discretisation equation by control volume formulation of one-dimensional heat conduction governed by $\frac{d}{dx}\left(k\frac{dT}{dx}\right) + S = 0$ where k is the thermal conductivity, T is the temperature, S is the rate of heat generation per unit volume. **(07)**

OR

A) Solve the boundary value problem. Use the second order FDM method. **(07)**

$u" = ux \quad subject\ to\ boundary\ condition \quad u(0) + u'(0) = 1,\ u(1) = 1 \quad with \quad h = 1/3.$

B) $A = \begin{bmatrix} 1 & -3 & 3 \\ 3 & -5 & 3 \\ 6 & -6 & 4 \end{bmatrix}$ Find the eigenvalues and corresponding eigenvectors of given matrix. **(08)**