Seat No: _____ Enrollment No: _____

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

M.Tech. Winter 2017 - 18 Examination

Semester: 2 **Date: 08/01/2018**
Subject Code: 03210151 **Time: 02:00 pm to 4:30 pm**
Subject Name: Computational Fluid Dynamics **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 A) Explain Finite volume method with mathematical formulation **(05)**
B) Differentiate between FVM & FDM **(05)**
C) State Four basic golden rule of FVM **(05)**

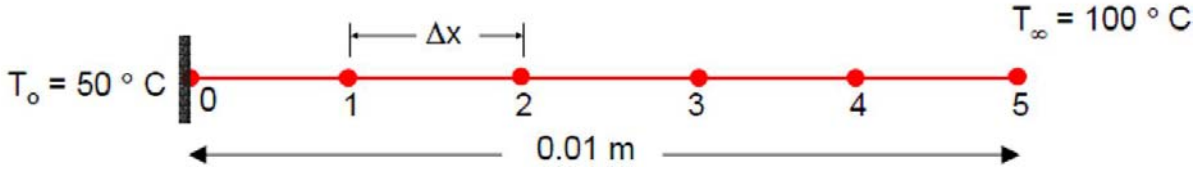
Q.2 **Answer the following questions. (Attempt any three) (Each five mark)** **(15)**
A) Explain the importance of Upwind scheme.
B) Write a note on structured and unstructured grid in finite volume method for complex geometry.
C) Define Neumann, Dirichlet's Boundary Conditions.
D) Write down the steps involved in solving a problem using FVM.

Q.3 A) Classify Partial differential equation with example. **(07)**
B) Consider the solution of the following template 1 –D wave equation: $\frac{\partial u}{\partial t} + c\frac{\partial u}{\partial x} = 0$ **(08)**
Using a modified FTCS scheme, in which the term u_i^n for time discretization is expressed as $u_i^n = \frac{1}{2}(u_{i+1}^n + u_{i-1}^n)$
where the index 'i' represents spatial discretization where as the superscript 'n' represents temporal discretization. Examine the numerical stability of this scheme using von- Neumann stability analysis.

OR

B) Consider the steady state heat conduction in a slab of thickness L, in which energy is generated at a constant rate of S (W/m^3) as shown in Figure. The boundary surface at x = 0 is maintained at a constant temperature To, while the boundary surface at x = L dissipates heat by convection with a heat transfer coefficient h into an ambient at temperature T∞. Compute the temperature inside the slab for h = 200 W/ (m^2/°C), k = 18 W/(m/°C), L = 0.01 m, T∞ = 100°C, To = 50°C, and S = 7.2 x 10^7. The governing equation is: **(08)**

$$k\frac{d^2T}{dx^2} + S = 0$$



Q.4 A) Explain the need of turbulence model in dealing with CFD problem. Briefly explain the difference between Laminar and Turbulent flow. **(07)**

OR

A) Explain four basic rules for formulation of SIMPLE algorithm based on finite volume discretization. **(07)**
B) Derive General form of conservation equation. Define advection and diffusion term. **(08)**