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

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

B.Tech. Summer 2018- 19 Examination

Semester: 6 **Date:30/04/2019**
Subject Code: 03101351 **Time:10:30 am to 01:00pm**
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 Objective Type Questions (All Are Compulsory) (Each of one mark) **(15)**

1. CFD is method to calculate heat transfer and fluid flow

A. numerically
B. experimentally
C. instantaneously
D. None of these

2. In steady flow of a fluid, acceleration of any fluid particle is

A. constant
B. zero
C. variable
D. non zero

3. Discretization technique is

A. Finite volume
B. Finite difference
C. Finite element
D. All of these

4. Test used to check accuracy of solution is called

A. grid independence test
B. solution test
C. optimal test
D. aspect test

5. Artificial node is added for

A. Dirichlet boundary condition
B. Neumann boundary condition
C. forced boundary condition
D. discrete boundary condition

6. Forces which act directly on surface of fluid element called……

7. Difference between iterative solution results and exact solution to discretized equations is called……..

8. For partial differential equation, if $b^2 - 4ac = 0$ then equation is called ……..

9. Boundary condition which includes direct boundary value is called …….

10. Numerical method for solving differential equations by approximating them with difference equations is called…….

11. When Truncation error becomes zero?

12. What is the physical meaning of divergence of velocity?

13. What is free sleep boundary condition?

14. Define steady flow.

15. What are the 4 different CFD techniques?

Q.2 **Answer the following questions. (Any Three)** **(15)**

(A) A two-dimensional small-disturbance velocity potential equation for compressible flows is given as $(1- M_\infty^2)\frac{\partial^2 \phi}{\partial^2 x} + \frac{\partial^2 \phi}{\partial^2 y} = 0$, where M is the Mach number of flow.
(i) Examine whether this equation is parabolic, elliptic, or hyperbolic? (ii) Justify your inference from pure physical arguments.

(B) Explain in detail the similarities, differences, advantages and disadvantages between finite difference methods, finite volume methods and finite element methods used for solving fluid flow problems.

(C) Why central difference equation is more accurate than the other two?

(D) What are the different types of boundary conditions encountered in solving fluid flow problems?

Q.3 **(A)** With suitable example explain the significance of Explicit and Implicit approaches. **(07)**

(B) Derive the compressible potential equation from 2D Navier Stokes equations. **(08)**

OR

(B) What are the 3 steps involve in the solution using McCormack Technique? Explain in detail **(08)**

Q.4 **A)** For $\frac{\partial T}{\partial t} = \alpha \frac{\partial^2 T}{\partial x^2}$ Derive the necessary and sufficient condition for stability. **(07)**

OR

(A) What are the significations of grid in CFD? Explain adoptive and structured grid. **(07)**

(B) Apply Jacobian transformation to transform 1st order PDE. **(08)**