

00202

**B.Tech. AEROSPACE ENGINEERING
(BTAE)**

Term-End Examination

December, 2017

**BASE-005 : INTRODUCTION TO
COMPUTATIONAL FLUID DYNAMICS**

Time : 3 hours

Maximum Marks : 70

Note : Answer any seven questions. All questions carry equal marks. Use of scientific calculator is permitted.

1. (a) What is CFD ? Explain the reasons for the present growth of CFD in aerospace application. 5
- (b) Justify CFD as a Research Tool. Write and explain the steps involved in CFD process. 5
2. (a) How the boundary conditions and initial conditions are applied to the nozzle flow ? 5
- (b) Discuss the application of CFD in Aerospace Engineering. 5

3. (a) Obtain the CFL condition for Lax Method of discretization of first order wave equation. 5
- (b) Classify the following system of equations : 5
- (i) $\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0$
- (ii) $\frac{\partial v}{\partial x} - \frac{\partial u}{\partial y} = 0$
4. Explain the need of turbulence modeling in dealing with CFD problems. What are the various turbulence models used in CFD problems? 10
5. (a) What are the different categories of boundary conditions. Give example of each category. 5
- (b) Differentiate between structured and unstructured grids. 5
6. State and Explain the difference between explicit and implicit methods and suitable example. Also specify the which condition need to apply these methods. 10
7. Derive the continuity equation in differential form for incompressible flow. 10

8. (a) Compare the generation of grids in physical and computational planes. 5
(b) Discuss the need of upwind type discretization. Explain. 5
9. What is Finite Element (FEM) ? How it can be applied in CFD problems ? Explain with suitable examples. 10
10. Write short notes on any two of the following : 2x5=10
(a) Degree of Freedom
(b) Galarkin Formulation
(c) Finite Difference Method
(d) Panel Method
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