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BASE-005

B.Tech. AEROSPACE ENGINEERING (BTAE)

Term-End Examination

December, 2015

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 ? List out the important applications of CFD. 5

(b) Derive the continuity equation for an inviscid flow in partial differential non-conservation form. 5

2. (a) What is the source of errors in CFD Analysis ? How can it be minimized ? 5

(b) Obtain the CFL condition for Lax Method of discretization of first order wave equation. 5

3. (a) List out the advantages and limitations of Panel method. 5

(a) Explain the various computer graphic techniques used in CFD. 5

4. (a) Discuss in detail about shock capturing and shock fitting methods. *5*

(b) List out the differences between Finite volume and Finite difference methods. *5*

5. Derive the Navier-Stokes equation in conservation form. *10*

6. How do you determine the accuracy of discretization process ? What are the uses and difficulties of approximating the derivatives with higher order finite difference schemes ? How do you overcome these difficulties ? *10*

7. (a) What are the different categories of boundary conditions ? Give examples of each category. *5*

(b) What is the importance of CFL condition ? Explain. *5*

8. Explain the need for turbulence modeling in dealing with CFD problems. What are the various turbulence models used in CFD problems ? *10*

9. What is the Finite Element Method (FEM) ? Explain why should one use it. *10*

10. Write short notes on the following : *5×2=10*

(a) Galerkin Formulation

(b) Weighted Residual Formulation

(c) Consistency

(d) Convergence

(e) Degree of Freedom