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BASE-005

B.Tech. (AEROSPACE)

Term-End Examination

00024

June, 2014

BASE-005 : INTRODUCTION TO COMPUTATIONAL FLUID DYNAMICS

Time : 3 hours *Maximum Marks : 70*

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

1. (a) Write down the significance of Taylor series expansion. **4**

   (b) Considering one dimensional transient conduction, present the algorithm for the explicit method. **6**

2. (a) Define substantial derivative. **4**

   (b) Consider a square control volume of size 'a' and perform mass balance across the control volume. **6**

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

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

4. Derive the continuity equation with integral approach in non-conservative form and from this obtain conservative integral form. **10**

5. Solve the simplified Sturn-Lioville equation with boundary condition $y(0) = 0$; and using Galerkin finite element method. 10

6. (a) What is the necessity for staggered grid in control volume method ? 5

   (b) List out differences between Finite volume and Finite difference method. 5

7. Write short notes on the following : 2x5=10

   (a) Strong formulation

   (b) Weighted residual formulation

   (c) Galerkin formulation

   (d) Weak formulation

   (e) Consistency

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

9. (a) Explain Runge-Kutta and multi-stage time stepping. 5

   (b) Explain cell centered method. 5

10. Explain any numerical method to obtain solution for temperatures. 10