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BASE-005

00510

B.Tech. (AEROSPACE)

Term-End Examination

June, 2013

BASE-005 : INTRODUCTION TO COMPUTATIONAL FLUID DYNAMICS

Time : 3 hours *Maximum Marks : 70*

*Note : Answer **any seven** questions. Use of calculator is **permitted**.*

1. Solve the following equations by Gauss - Elimination method : 10

$2x + 2y + 4z = 18$

$x + 3y + 2z = 13$

$3x + y + 3z = 14$

2. (a) What is the source of error in the CFD Analysis ? How it can be removed or minimized ? 6

   (b) Discuss the Application of CFD in Aero Space Engineering. 4

3. Derive the Navier-Stokes equations in conservation form. 10

4. Explain the method of solving an incompressible flow problem using stream function - vorticity formulation. **10**

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

6. Derive the first order accurate forward difference and backward finite difference approximation for the second derivative of 'f' with respect to 'x' using Taylor Series expansion. **10**

7. (a) Compare the generation of grids in physical and computational planes. **6**

   (b) Is it necessary to have the computational plane grid to be of rectangular element's ? If yes why ? **4**

8. (a) Show that Laplace's equation given below is elliptical in nature. **6**

$$\frac{\partial^2 \phi}{\partial x^2} + C^2 \frac{\partial^2 \phi}{\partial y^2} = 0$$

   (b) Draw a neat sketch and show vortex lattice along a wing. **4**

9. Consider the 2D TSP equation 10

$$[(1-M_\alpha^2)-(\gamma+1)\ M_\alpha^2\ \psi_x]\ \psi_{xx}+\psi_{yy}=0.$$

Develop the boundary conditions satisfying the condition of No Normal flow on the surface of the thin airfoil like object along with the expression for CP.