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BASE-005

B.Tech. AEROSPACE ENGINEERING (BTAE)

00396

Term-End Examination

June, 2015

BASE-005 : INTRODUCTION TO COMPUTATIONAL FLUID DYNAMICS

Time : 3 hours *Maximum Marks : 70*

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

1. (a) List the different methods used to solve the algebraic simultaneous equations. Explain any one method with suitable example. *5*

(b) Solve the following algebraic equations using Gauss-Seidel iterative method : *5*

$$7x_1 + x_2 + 2x_3 = 17$$

$$3x_1 + 8x_2 + 2x_3 = 14$$

$$4x_1 + 2x_2 + 9x_3 = 20$$

2. (a) What are the different types of panels used in the analysis of flow using panel method ? *4*

(b) Explain in detail about the source panel method. *6*

3. The first order partial differential equation is given $\mu_0 \mu_x + \mu_y - \mu = 0$ with the initial condition, $\mu(x, 0) = x + 10$. Determine : *10*

(a) Characteristic equation

(b) Compatibility equation

4. Define isentropic flow. What do you mean by quasi-one dimensional flow ? Derive the expression for governing equations of quasi-one dimensional steady, isentropic flow by considering equation of state. *10*

5. (a) What are the theoretical aspects of transonic flows ? *3*

(b) Using Taylor's series, derive the backward difference expression for $\frac{\partial \mu}{\partial y}$. *7*

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

7. Briefly write about shock fitting and shock capturing techniques using neat and appropriate sketches. Explain how shock capturing technique is used for conserved form of equations. *10*

8. Using Vortex panel method, obtain the lift generated by a flat plate considering N Vortex panels. Make necessary assumptions. *10*

9. Write short notes on the following :

   (a) Stability *2*

   (b) Consistency *2*

   (c) Lax-equivalence theorem *3*

   (d) Round-off and discrimination errors *3*