BAS-012

B.Tech. AEROSPACE ENGINEERING (BTAE)

Term-End Examination

December, 2015

BAS-012 : AERODYNAMICS – I

Time : 3 hours   *Maximum Marks : 70*

Note : *Attempt any **seven** questions. All questions carry equal marks.*

1. (a) How are the boundary conditions and initial conditions applied to nozzle flow ?   *6*

   (b) Explain the steady boundary layer flows over a body.   *4*

2. (a) Differentiate between compressible and incompressible flows.   *4*

   (b) Derive the momentum equation for 2-D subsonic and supersonic flow through a C-D nozzle.   *6*

3. (a) Draw the propagation of disturbance waves for subsonic and supersonic conditions.   *4*

   (b) Draw the pitching moment curve for supersonic profiles. How do pitching moment and centre of pressure vary with angle of attack for a supersonic profile ?   *6*

4. Answer any *five* of the following questions in brief : *5×2=10*

   (a) Distinguish between Real and Ideal fluid.

   (b) What is conformal transformation ?

   (c) State the condition for irrotationality of flow.

   (d) Enumerate the application of thin airfoil theory.

   (e) State Kutta-Joukowski theorem.

   (f) Define doublet. Draw its streamline.

   (g) What is meant by Washin and Washout for wings ?

   (h) Explain starting vortex.

5. (a) Derive the fundamental equation for thin airfoil theory and give the assumptions that are made in the airfoil theory. *6*

   (b) Define angular velocity, strain rate and vorticity of a fluid element. *4*

6. (a) Explain the types of drag produced due to the effects of viscosity. Derive Navier-Stokes equations for an unsteady, compressible three-dimensional viscous flow. *6*

   (b) How are streamlines and equipotential lines related to each other ? *4*

7. (a) Derive continuity equation in 3D Cartesian coordinates. *4*

   (b) Draw a neat sketch of a hypersonic wind tunnel circuit and explain the function of each component. *6*

8. (a) Derive the expressions for stream function and velocity potential function. Explain source, sink, free and forced vortex with neat sketches. *6*

   (b) What is the principle of operation of a typical shock tunnel ? *4*

9. Write short notes on any *two* of the following : *2×5=10*

   (a) Wake

   (b) Centre of Pressure

   (c) Stall Condition

   (d) Velocity Potential