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**B.Tech. (AEROSPACE ENGINEERING)
(BTAE)**

Term-End Examination

June, 2014

BAS-012 : AERODYNAMICS - I

Time : 3 hours

Maximum Marks : 70

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

1. Derive the general continuity equation in Cartesian co - ordinate system. What is the physical principle used for deriving it ? 10

2. Consider the velocity field given by 5+5

$$u = \frac{y}{(x^2 + y^2)} \text{ and } v = \frac{-x}{(x^2 + y^2)}$$
 - (a) Calculate the equation of the streamline passing through the point (0 , 6).
 - (b) Calculate the vorticity.

3. Derive the equation for angular velocity of a fluid element in 3 - D space. Explain Vorticity using this equation. Also give the value of vorticity for an irrotational flow. 10

4. Describe the construction of a pitot tube with the help of a neat diagram. Which physical quantity can be measured by a pitot tube and how it can be measured ? 10
 5. Derive the general Navier Stokes equation for an unsteady, incompressible and viscous flow. 10
 6. What are wind tunnels ? Explain the difference between subsonic and supersonic wind tunnels, using neat sketches. 10
 7. Derive the governing equation (Laplace equation) for irrotational, incompressible flow in Cartesian co - ordinate system. Also prove that the stream function satisfies the Laplace equation. 10
 8. Explain subsonic, transonic, supersonic and hypersonic flows in terms of Mach no. Also give neat sketches with Mach no. regimes for each of them. 10
 9. What is boundary layer separation ? Explain with the help of neat sketches. Discuss different methods used to avoid boundary layer separation. 10
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