

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

Term-End Examination

December, 2013

BAS-012 : AERODYNAMICS - I

Time : 3 hours

Maximum Marks : 70

Note : *Question No. 1 is compulsory. Attempt any six questions from the remaining eight questions. All questions carry equal marks. Use of scientific calculator is permitted.*

1. Define the following terms : 5x2=10
 - (a) Centre of Pressure
 - (b) Aerodynamic Centre
 - (c) Vorticity
 - (d) Buoyancy
 - (e) Circulation

2. Derive Euler's equation for a fluid element. What is its significance ? 10

3. Explain Stream Function and Velocity Potential. Derive the expression that establishes the relationship between the stream function and velocity potential. 10

4. (a) Explain source flow and doublet flow. 5
(b) Consider an airfoil in a flow at standard sea-level conditions with a free stream velocity of 100 m/s. At a given point on the airfoil, the pressure is $0.8 \times 10^5 \text{ N/M}^2$. Calculate the velocity at this point. 5
5. (a) Explain the Magnus effect over a spinning cylinder. 5
(b) Distinguish between symmetric and cambered airfoil. 5
6. What are the sources of aerodynamic forces and moments on a body in air? Derive the lift and drag expressions on an airfoil in terms of angle of attack, normal and axial forces with neat sketches. 10
7. Derive the fundamental equation of thin airfoil theory. List the assumptions made. 10
8. What is a boundary layer? Show boundary layer development on a flat plate with the help of a neat diagram. Also explain displacement and momentum thickness. 10
9. List down the parts of a supersonic wind tunnel and explain its working with the help of a neat diagram. 10
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