

**B.E. DEGREE EXAMINATIONS: NOV/DEC 2010**

Fourth Semester

**ARONAUTICAL ENGINEERING**

U07AR401: Aerodynamics - I

**Time: Three Hours**

**Maximum Marks: 100**

**Answer ALL Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. The similarity parameters are  
a) M, Re                      b) Re, T                      c) M, T                      d) M, P
2. A hydrostatic equation is  
a)  $dv = dTh$                       b)  $dp = (-) gdh$                       c)  $dT = gdh$                       d)  $dp = (-)gdh$
3. The line joining various potential functions is called  
a) Equipotential line                      b) Stream Line                      c) Uniform Flow                      d) Rotational Flow
4. The flow in which the layers of flow don't cross each other is known as  
a) Equipotential line                      b) Stream Line                      c) Uniform Flow                      d) Irrotational Flow
5. The Drawback of Joukowski transformation is  
a) Trailing Edge becomes cusped  
b) Trailing Edge becomes thick  
c) Trailing Edge becomes thin  
d) Trailing Edge becomes cusped and kutta condition not satisfied.
6. For a stationary cylinder kept with axis perpendicular to the floor of an ideal fluid  
a) Lift and drag force not felt.                      b) Lift and drag force felt.  
c) Lift force felt.                      d) Drag force felt.
7. The vector line of the vortex field is called  
a) Bound vortex.                      b) Strength of the vortex.                      c) Circulation.                      d) Vortex line.
8. Lifting theory is only applicable for  
a) Finite Wing.                      b) Swept Wing forward.  
c) Swept Wing backward.                      d) Delta Wing.
9. The variation of velocity due to adhesive effect is called  
a) Boundary layer.                      b) Momentum Thickness.  
c) Displacement Thickness.                      d) Boundary layer separation.

10. The distance from the body surface up to the flow of free stream air is called
- a) Boundary layer.
  - b) Momentum Thickness.
  - c) Displacement Thickness.
  - d) Boundary layer separation.

**PART B (10 x 2 = 20 Marks)**

- 11. Differentiate Steady Vs Unsteady flow.
- 12. What is circulation?
- 13. Define D'Alembert Paradox.
- 14. State the relation between streamline and potential line.
- 15. Mention the basic principle of conformal transformation.
- 16. State Blasius Theorem.
- 17. What are the applications of thin aerofoil?
- 18. Differentiate: Vortex sheet Vs Vortex line.
- 19. Define : Biot-Savorts law.
- 20. State the Newton's Law of Viscosity.

**PART C (5 x 14 = 70 Marks)**

21. a) Derive the continuity equation for steady flow for an incompressible fluid
- (OR)**
- b) Explain Briefly : Stream function and Velocity potential
22. a) Derive Kutta-Zhukowsky theorem.
- (OR)**
- b) Explain pressure and velocity distribution over cylindrical body without circulation.
23. a) Based on the principle of conformal transformation show that a circle can be transformed into a cambered aerofoil and obtain an expression for its thickness to chord ratio.
- (OR)**
- b) (i) Explain the various limitations and application of Joukowski transformation. (7)
- (ii) What is Blasius Theorem and explain briefly. (7)

24. a) The mean camber line for thin aerofoil is given by

$$\frac{z}{c} = 2.6595 \left[ \left( \frac{x}{c} \right)^2 - 0.6075 \left( \frac{x}{c} \right) + 0.1147 \right]$$

And  $\frac{z}{c} = 0.02208 \left( 1 - \frac{x}{c} \right)$  and  $0.2025 \leq \frac{x}{c} \leq 1.0$

A1=0.0954

A2=0.0792

Calculate

- (i) Angle of attack at zero lift
- (ii) Lift coefficient when  $\alpha=4^\circ$
- (iii) Location of the center of pressure in terms of  $x$   $C_p/C_r$  at  $\alpha=4^\circ$

**(OR)**

b) State and explain lifting line theory.

25. a) (i) Derive Navier stoke equation. (8)

(ii) Explain Displacement Thickness. (6)

**(OR)**

b) Explain the following terms used in viscous flow

(i) Boundary layer separation (7)

(ii) Moment of thickness (7)

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