ANNA UNIVERSITY – 2007

B.E/B.TECH MODEL EXAMINATION

AERODYNAMICS

(AERONAUTICAL ENGINEERING)

TIME-3HOUR
MARK-100

ANSWER ALL QUESTIONS

PART - A (10 X 2 = 20 MARKS)

1. Define stream line and path line.

2. State the continuity equation for compressible flow.

3. Which causes induced drag?

4. What is meant by circulation?

5. Explain the concept of Magnus effect.

6. Give the basic principles of conformal transformation.

7. Write the Karman–Tsien rule for compressibility corrections.

8. Write the Biot–Savart Law.

9. Explain the Horse Shoe Vortex.

10. Explain the Starting Vortex.

PART - B (5 X 16 = 80 MARKS)

11. A thin airfoil has a mean camberline given by using thin airfoil theory calculate

(i) (ii) when

(iii) (iv) when .

12. (a) (i) Derive the continuity equation in Polar coordinates.

(ii) For an irrotational flow show that Bernoulli's equation is valid between any points in the flow, not just along a stream line.

Or

(b) Explain the concept of source flow and derive velocity potential function from vortex strength .

13. (a) Derive the Blasius theorem for an incompressible flow over a flat plate.

Or

(b) (i) Define coefficient of pressure and plot the variation of coefficient of pressure for the circular cylinder kept in a uniform flow for both real and inviscid flows.

(ii) Sketch the flow pattern around a spinning cylinder in a uniform stream for various circulation strength indicating clearly the movement of stagnation points.

14. (a) Explain briefly the Kutta–Jowkowsky transformations and get the transformation of a cambered airfoil and also find an expression for the thickness to chord ratio for the profile.

Or

(b) (i) For the transformation where b is a constant, show that the length ratio is given by .

(ii) Write short notes on Karman–Trefttz profiles.

(iii) Apply the transformation formula to downward uniform flow parallel to OY axis and interpret the resulting transformations.

15. (a) Derive the Prandtl's Lifting Line theory.

Or

(b) (i) Explain Kelvin's circulation theorem.

(ii) Explain Helmholtz's vortex theorem.

(iii) Explain the concept of downwash velocity component.