Reg. No. : E N G G T R E E . C O M

Question Paper Code : 50026

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Fourth Semester

Aeronautical Engineering

AE 3401 – AERODYNAMICS I

(Regulations 2021)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Bernoulli's equation.

2. Define streamline and streakline.

3. Draw the ideal flow over circular cylinder.

4. What do you mean by starting vortex?

5. Explain the importance of airfoil theory in Aerodynamics?

6. How complex potential functions are useful in aerodynamics?

7. What are the sub–functions of Biot and Savarts law in subsonic wing theory?

8. State the limitations of lifting-line theory.

9. With the help of neat diagram brief boundary layer separation on flat plate.

10. Describe the term 'Critical Reynolds number'.

PART B — (5 × 13 = 65 marks)

11. (a) Derive the expression for Euler's equation, and further derive the energy equation from Euler's equation. (13)

Or

(b) With the help of neat diagrams explain the concept of streamline, streakline, stream function, potential function and equipotential lines. (13)

12. (a) Derive the aerodynamic flow parameters over circular cylinder. Also explain the term 'magnus effect'. (13)

Or

(b) Derive the Kutta Joukowski's theorem. Also explain about D'Alemebert's paradox. (13)

13. (a) Derive the Cauchy–Riemann relations. (13)

Or

(b) Explain the methodology of conformal transformation. Also explain about airfoil theory applications. (13)

14. (a) Explain the concept of vortex filament. Also explain about bound vortex and trailing vortex. (13)

Or

(b) Describe the term 'horse shoe vortex'. Also explain the concept of lifting line theory. (13)

15. (a) Derive the expression for 'Boundary layer thickness' and 'Displacement thickness'. (13)

Or

(b) Derive the expression for 'momentum thickness' and 'energy thickness'. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Consider any aircraft wing and prepare a case study, considering the following:

(i) Basics physics for low speed flows. (5)

(ii) Concept of 2D, incompressible flows in low-speed aerodynamics. (5)

(iii) Lifting-line theory for solving flow properties. (5)

Or

(b) Consider any aircraft part and prepare a case study. Covering the following:

(i) Boundary layer equations for a steady, two dimensional incompressible flow. (8)

(ii) Properties of turbulent flow. (7)

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