

Seat No: _____

Enrollment No: _____

PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
B.Tech. Summer 2022 - 23 Examination

Semester: 4th
Subject Code: 203101261
Subject Name: Aerodynamics-I

Date: 20-3-2023
Time: 2.00 pm to 4.30 pm
Total Marks: 60

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Objective Type Questions – (All are compulsory) (Each of one mark)

(15)

1. Define center of pressure.
2. Why NACA 0009 airfoil is said to be symmetric airfoil?
 - a) Because of zero camber
 - b) Because negative camber
 - c) Because of zero thickness
 - d) None of the above
3. If $\nabla \times V \neq 0$ at every point in a flow, the flow is called rotational
 - a) Rotational
 - b) Irrotational
 - c) Both of the above
 - d) None of the above
4. The vorticity (ξ) is simply _____ of the angular velocity.
 - a) Twice
 - b) Half
 - c) Thrice
 - d) None of the above
5. Which of the following has more viscosity?
 - a) Water
 - b) Air
 - c) Honey
 - d) None of the above
6. The downward velocity induced by the trailing vortex in the vicinity of the wing-tips is called as _____.
 - a) Downwash
 - b) Local relative velocity
 - c) Effective velocity
 - d) Wing velocity
7. What is the unit of drag coefficient?
8. Write down the equation of taper ratio.
9. When both the source and sink are of equal strength and located at same point, it is called _____.
 - a) sink
 - b) source
 - c) doublet
 - d) None of the above
10. Write down the equation of Aspect ratio.
11. If $\nabla \cdot V \neq 0$, the flow is called _____.
 - a) Compressible
 - b) Incompressible
 - c) Both of the above
 - d) None of the above
12. Which theorem relates the circulation around an airfoil to the lift it produces?
 - a) Bernoulli's theorem
 - b) Kutta-Joukowski theorem
 - c) Kelvin's theorem
 - d) None of the above
13. What is the value of taper ratio for a rectangular wing?
 - a) 0
 - b) 0.5
 - c) 1
 - d) None of the above
14. According to thin airfoil theory, $c_l =$ _____.
 - a) $2\pi\alpha$
 - b) $4\pi\alpha$
 - c) $\pi\alpha$
 - d) None of the above
15. Define aerodynamic centre.

- Q.2** Answer the following questions. (Attempt any three) **(15)**
- A) How lift force can be calculated using circulation. Explain using neat sketch.
 - B) With the help of neat sketch explain Kutta conditions.
 - C) Explain following drag: Profile drag and induced drag.
 - D) Derive the equation of angular velocity (ω_z) using a neat sketch.

- Q.3** A) With the help of neat sketch explain how the flow separation takes place and how to delay it. **(07)**

B) Explain the superposition of a uniform flow and doublet flow. Make suitable comments. **(08)**

OR

C) Using general lift distribution theory derive the equation of Induced drag coefficient. **(08)**

- Q.4** A) Draw and explain lifting flow over a circular cylinder. Make suitable comments. **(07)**

OR

A) Explain the Biot-Savart law and Helmholtz's theorem using neat sketches. **(07)**

B) Explain how pressure distribution changes with angle of attack. Draw required sketches and make critical comments. **(08)**