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Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(ANE) (Sem.-5)

**AERODYNAMICS – II**

Subject Code : ANE-312

M.Code : 60521

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

**SECTION-A****Q1. Attempt the following :**

- a) Define Kutta condition.
- b) Draw lift curves for symmetrical and cambered airfoil sections.
- c) What do you mean by formation flying?
- d) Distinguish between upwash and downwash.
- e) Define induced drag.
- f) Define Critical Mach number.
- g) Define supersonic and subsonic leading edges.
- h) Define supercritical airfoils.
- i) What do you mean by HAA aerodynamics?
- j) Define Conformal transformations.

**SECTION-B**

- Q2 Explain the complete vortex system.
- Q3 Consider a finite wing with an aspect ratio of 8 and a taper ratio of 0.8. The airfoil section is thin and symmetric. Assume that  $\delta = \tau = 0.055$ . Calculate the lift coefficient and induced drag coefficients for this wing at a geometric angle of attack of  $5^\circ$ .
- Q4 Explain Prandtl's classical lifting line theory.
- Q5 Explain the Helmholtz's theorems of vortex motion.
- Q6 Write a note on : '*Vortex Panel Method*'.

**SECTION-C**

- Q7 Consider an NACA airfoil whose mean camber line is given by :

$$z/c = 2.6595 [(x/c)^3 - 0.6075 (x/c)^2 + 0.1147 (x/c)] \quad \text{for } 0 \leq (x/c) \leq 0.2025$$

$$z/c = 0.02208 [1 - (x/c)] \quad \text{for } 0.2025 \leq (x/c) \leq 1$$

**Calculate :**

- a) The angle of attack at zero lift (8)
- b) The lift coefficient when  $\alpha = 6^\circ$  (2)
- Q8 Write notes on the following :
- a) Prandtl - Glauert compressibility correction. (5)
- b) Leading edge suction analogy. (5)
- Q9 Define Kutta-Juokowski transformation and use it to transform a circle into a cambered airfoil. Calculate the theoretical lift coefficient of a Zhukovsky airfoil having thickness ratio of 0.2 and camber of 3%, set at  $3^\circ$  incidence in a two dimensional irrotational flow. (2, 5, 3)

**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**