Roll No. | | | | | | | | | | | | **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°.

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 :

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

$$z/c = 0.02208\,[1 - (x/c)] \qquad \text{for } 0.2025 \le (x/c) \le 1$$

Calculate :

a) The angle of attack at zero lift (8)

b) The lift coefficient when $\alpha = 6°$ (2)

Q8 Write notes on the following :

a) Prandtl - Glauert compressibility correction. (5)

b) Leading edge suction analogy. (5)

Q9 Define Kutta-Juokowaski 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° 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.