

Roll No.

Total No. of Pages : 02

Total No. of Questions : 09

B.Tech. (ANE) (Sem.-7,8)

AIRPLANE DESIGN

Subject Code : ANE-413

M.Code : 70495

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 Distinguish between the following terms (use sketches wherever required) :**

- a) Dihedral & Anhedral angle
- b) Lift curves for symmetric & cambered airfoils
- c) Wash-in & wash-out
- d) Freestream Mach number & critical Mach number
- e) Low & High wing loading
- f) Equivalent airspeed & true airspeed
- g) Geometric angle of attack & absolute angle of attack
- h) Cruise & loiter
- i) Slat & Slot
- j) Equilibrium condition & stability

SECTION-B

- Q2 Explain the difference between 'Flight envelope' and 'gust envelope' of an aircraft with help of a neat & labeled diagram. (5)
- Q3 Explain the features of various types of inlets used in high subsonic & supersonic aircrafts with the help of neat and labeled sketches. (5)

- Q4 Explain various factors affecting the selection of airfoil section. (5)
- Q5 Calculate the stroke of oleo-type shock absorber with the help of data given below for an aircraft making a touchdown on a runway at sea level at forward and vertical speeds of 35 m/s and 5 m/s respectively.
- Rolling radius = 40 cm Wheel width = 20 cm Wheel diameter = 90 cm
- $\eta = 0.8$ Tire efficiency = $\eta_T = 0.45$ Gear Load factor = $N_{\text{gear}} = 3$
- Also calculate the weight on wheel for a given pressure of 15 bar. (4,1)
- Q6 What are boundary layer diverters? Give two examples with brief description. (5)

SECTION-C

- Q7 A 250 seated jet aircraft with the following given data is flying at 10 km altitude. (1, 5, 2, 2)
- $M_{\text{cruise}} = 0.7 \text{ Mach}$ $M_{\text{loiter}} = 0.5 \text{ Mach}$ Cruise = 6000 km Loiter = 80 minutes
- $(L/D)_{\text{max}} = 16$ $C_{\text{cruise}} = 0.54/\text{hour}$ $C_{\text{loiter}} = 0.44/\text{hour}$ $\rho = 0.4135 \text{ kg/m}^3$
- $p = 26000 \text{ N/m}^2$ $W_e/W_0 = 0.97 W_0^{-0.06}$ $W_{\text{Payload}} = 5000 \text{ kg}$ $W_{\text{Passenger}} = 65 \text{ kg/passenger}$
- Draw Mission segment.
 - Estimate weight of the aircraft.
 - Estimate empty weight
 - Estimate fuel weight
- Q8 a. For the aircraft in Q.7, what will be the weight and %age change in weight if the aircraft is to be designed for additional payload of 2000 kg? (4, 1)
- b. Discuss different types of seating arrangements in passenger aircrafts using sketches. (5)
- Q9 Write notes on the following : (5,5)
- Airworthiness and responsibilities of airworthiness authorities.
 - Role of composite material in modern aircrafts

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.