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Total No. of Pages : 02

Total No. of Questions : 09

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

1. Distinguish between the following terms (use sketches wherever required) : (10×2)

- a. Anhedral & dihedral angle.
- b. Camber & camber line.
- c. Wash-in & wash-out.
- d. Critical & drag divergence Mach number.
- e. Low & high wing loading.
- f. Equivalent airspeed & true airspeed.
- g. Geometric & aerodynamic twist.
- h. Range & endurance.
- i. Slat & slot.
- j. Trim & stability.

**SECTION-B**

2. Explain the 'gust envelope' of a typical fighter aircraft with help of a neat & labeled diagram. (5)
3. Explain the features of various types of inlets used in high subsonic & supersonic aircrafts with the help of neat and labeled sketches. (5)

4. Explain the various factors affecting the selection of airfoil section and wing planform. (5)
5. 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 35m/s and 5 m/s respectively.

Rolling radius = 40cm

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)

6. What are boundary layer diverters? Give two examples with brief description. (5)

### SECTION-C

7. A 250 seated jet aircraft with the following given data is flying at 10km altitude. (2,8)

$M_{\text{cruise}} = 0.7$  Mach  $M_{\text{loiter}} = 0.5$  Mach Cruise = 6000 km Loiter = 80minutes

$(L/D)_{\text{max}} = 16$   $C_{\text{cruise}} = 0.54/\text{hour}$   $C_{\text{loiter}} = 0.44/\text{hour}$   $\rho = 0.4135 \text{ kg/m}^3$

$P = 26000 \text{ N/m}^2$   $W_e/W_0 = 0.97$   $W_0^{-0.06}$   $W_{\text{Payload}} = 80000\text{N}$   $W_{\text{Passenger}} = 65 \text{ kg/passenger}$

- a. Draw Mission segment.
- b. Estimate weight of the aircraft.
8. For the aircraft in Q.7.,
  - a. Find out the length and diameter of the fuselage. Use  $\text{length} = 0.287 * W_0^{0.43}$  where  $W_0$  is in kg. Suggest and sketch the seating arrangement for this aircraft. (5)
  - b. What will be the %age change in weight if the aircraft is to be designed for additional payload of 20000 N? (5)
9. Write notes on the following :
  - a. Airworthiness and its responsibility. (5)
  - b. Role of composite material in modern aircrafts. (5)

**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.**