Roll No. ⬜⬜⬜⬜⬜⬜⬜⬜⬜⬜⬜   **Total No. of Pages : 02**

Total No. of Questions : 09

B.Tech. (ANE)   (Sem.–7,8)
AIRPLANE DESIGN
Subject Code : ANE-413
Paper ID : [A2068]

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 Define and explain briefly the effect of following terms using sketches wherever required :

a) Dihedral angle

b) Camber

c) Sweep angle

d) Wash-in

e) Supercritical airfoil

f) Taper ratio

g) Aspect Ratio

h) High wing configuration

i) Leading edge slat

j) Wing loading

SECTION-B

Q2 Explain the difference between 'Flight Envelope' and 'Gust Envelope' of a typical fighter aircraft with help of neat & labeled diagrams. (5)

Q3 Explain the features of various types of inlets used in supersonic aircrafts using neat sketches. (5)

Q4 What are boundary layer diverters? Give two examples with brief description. (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 = $N_{gear} = 3$

Also calculate the weight on wheel for a given pressure of 15 bar. (4,1)

Q6 Write a note on UAV's. (5)

SECTION-C

Q7 A 150 seated low-bypass turbofan aircraft, with six crew members and following given data, is to be designed to fly at 10 km altitude.

M_{cruise}=0.75Mach M_{loiter}=0.5 Mach   Cruise=4000 km   Loiter=30 minutes

$(L/D)_{max}$=16 C_{cruise}=23 mg/(N-s) C_{loiter}=20 mg/(N-s) ρ=0.4135 kg/m^3

p=26000 N/m^2 W_e/W_0=0.97$W_0^{-0.06}$ W_{misc}=1000 kg $W_{Passenger}$=65 kg/passenger

$W_{luggage}$ = 20kg/passenger

a) Draw Mission segment. (1)

b) Estimate weight of the aircraft. (7)

c) Find out the length and diameter of the fuselage. Use Length = 0.287* $W_0^{0.43}$ where W_0 is in kg. (2)

Q8 For the aircraft in Q.7,

a) Find out the length and diameter of the fuselage using seating arrangement with proper seat pitch, seat width and other allowances. 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 50 passengers? (5)

Q9 Write notes on the following :

a) Airworthiness and its responsibility. (5)

b) Role of composite material in modern aircrafts. (5)