Code No: 07A62104 **R07** **Set No. 4**

III B.Tech II Semester Regular/Supplementary Examinations,May 2010
FLIGHT VEHICLE DESIGN
Aeronautical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Prove that in the case of a gliding flight, the lift - to - drag ratio is the inverse of the tangent of the glide angle.
   (b) Assuming the gliding angle to be small, derive the expression for sink rate of the aircraft.
   (c) Derive the expression for minimum sink rate. [4+6+6]

2. Describe the lift distribution over an elliptic wing. What is the effect of changing the wing plan form from elliptic to rectangular? Hence define Oswald's wing efficiency factor'e'. What is its value for a rectangular plan form of the wing? Draw neat sketches to explain the answers. [16]

3. Explain the major differences in the designs of the fuselages of a fighter and a bomber plane. Justify your answer. Draw neat sketches. [16]

4. Write short notes, with neat sketches, on
   (a) Leading edge suction of an airfoil
   (b) Drag - due - to - lift factor (K)
   (c) Oswald's efficiency factor (e)
   (d) Ground effect on induced drag [4+4+4+4]

5. Detail out the considerations in the design of a passenger airplane with a cruise velocity of 500 km / hour, crew of 6 and 100 passengers, with 50 kg baggage each. Draw neat sketches and graphs in support of your answer. [16]

6. (a) Match the following statements:

Statements A	Statements B
A1. Maximum lift co - efficient	B1. lift dependent
A2. Cruise	B2. Stall
A3. Induced drag	B3. shock induced
A4. Wave drag	B4. proportional to lift-to-drag ratio
A5. Range	B5. Level flight

   (b) True or False? Write 'T' for true and 'F' for false against the following statements:
      i. For static stability of an aircraft in pitch, center - of - gravity must lie ahead of the neutral point.
      ii. Engine specifications primarily depend on the climb thrust requirement.

iii. Horizontal tail contributes to pitch stability of aircraft.

iv. Wing sweep can be used to delay drag divergence.

v. High thickness to chord ratio airfoil is usually preferable for the wing root for high bending stiffness. [16]

7. Explain clearly.

   (a) What is meant by technology availability in the context of aircraft design.

   (b) How overly optimism affects the design of aircraft.

   (c) How utter pessimism affects the design of aircraft.

   (d) Which path you would choose between b and c above, and why? [4+4+4+4]

8. (a) Derive the Breguet Range equation R = (V/C) (L/D) ln (W_{i-1} / W_i)for airplane. Explain all the terms involved.

   (b) An aircraft has a range of 6,000 km at a cruising speed of 900 kmph. It is powered by a Jet engine with a specific fuel consumption of 0.015 grams per Newton per second. The maximum value of (L/D) is 16. Compute the ratio of the take-off fuel weight to take-off total weight. Stop the calculations after one or two iterations. [8+8]

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