Code No: 45045 **R07** **Set No - 2**

III B.Tech I Semester Regular Examinations,Nov/Dec 2009
FLIGHT MECHANICS-I
Aeronautical Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. How does a rocket differ from a missile? Describe the components of a rocket engine. Make use of sketches and plots. [16]

2. Describe for Wave drag of an airplane
   (a) The physics of its generation,
   (b) How it may be estimated,
   (c) Measures to be taken for its reduction and
   (d) What the favorable and also adverse effects of the measures at 'c' above on the performance of the aircraft will be. [4 × 4]

3. (a) Derive an expression for the maximum angle of steady climb of a reciprocating engine-propeller powered low subsonic airplane.
   (b) Discuss the variation of the maximum rate of climb of the airplane with wing loading, power / weight ratio, the constants of the drag polar, density of the ambient air. [8+8]

4. (a) Name two aerodynamic characteristics of wings that are affected by the aspect ratio of a wing and describe how.
   (b) Discuss how each of these aerodynamic characteristics in turn affect the performance characteristics of the airplane.
   (c) Discuss how each of these aerodynamic characteristics in turn affect the performance characteristics of the airplane.
   (d) Name two geometric parameters of a wing section (airfoil) that most significantly affect the 'lift curve slope' and describe how. [4+4+4+4]

5. In steady and level flight, derive the expression for Velocity of airplane for minimum power. Derive the corresponding values for C_L and drag. [16]

6. (a) For an airplane of Gross Weight = 10 tonnes, gross wing area =33 m^2 in steady, coordinated turn, at normal load factor = 2, C_L = 1.2, at sea level, determine the radius of turn in meters. If the drag polar is(C_D = 0.01 + 0.05*C_L^2), estimate the power required for sustained level turn.
   (b) Describe how a pilot would, while approaching for landing in cross wind, align the aircraft flight path along the runway and how he would execute touch down (the runway) to initiate ground roll. [8+8]

7. Using Newton's second law of motion derive L (roll moment), M (pitch moment) and N (yawing moment) for an aircraft. [16]

8. (a) Classify the different flight regimes in detail with neat sketches.

   (b) What are the flow conditions before and after an oblique shock wave? Draw neat sketches. [8+8]

⋆ ⋆ ⋆ ⋆ ⋆