Code: 9A21502

R09

B.Tech III Year I Semester (R09) Supplementary Examinations June 2017

FLIGHT MECHANICS - I

(Aeronautical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) What is specific thrust fuel consumption? Write down the formula for it.

(b) The specific fuel consumption for the Teledyne continental voyager 200 liquid-cooled reciprocating engine is 230 g/(kW-h).When installed in an airplane which is flying at 90 m/s with a propeller efficiency of 0.85, calculate the equivalent thrust specific fuel consumption.

2 (a) Explain in detail about NACA 4-digit airfoil nomenclature.

(b) A NACA 4412 airfoil with a 2-ft chord and a 5-ft span is being tested in a wind tunnel at standard sea-level conditions and a test section velocity of 240 ft/sec and an angle of attack of 8 deg. What is the airfoil's maximum thickness, maximum camber, location of maximum camber, and zero-angle of attack? Also, calculate the lift, drag and pitching moment about the aerodynamic center.

3 (a) Determine the performance characteristics of ballistic missile using powered flight trajectory.

(b) Detail the procedure involved in long range cruise trajectory which account for missile rate of climb.

4 Define range of an airplane. Derive Breguet range equation.

5 (a) What are the structural limitations in airplane design?

(b) What is V-n diagram of an airplane? Write down the purpose V-n diagram. Draw v-n diagram of typical jet-trainer aircraft and explain it in detail.

6 Derive an expression for optimizing the flight path which is at constant cruise altitude by applying Green's theorem.

7 (a) What are the basic technologies used in flight path control based on ground noise?

(b) When an aircraft flies at supersonic speed, what happens to the propagating medium? How does it affect with the increase in speed from subsonic to supersonic speeds? Write down the hazards of a supersonic flight.

8 Derive the equations of motion for an airplane in descending gliding flight (T = 0) in a vertical plane. First, draw a free body diagram showing an aircraft in gliding flight and all the coordinate systems, angles and forces. Here, assume that the velocity vector is at an angle φ below the horizon and that the aircraft is at a positive angle of attack α. Show that these equations have one mathematical degree of freedom.

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