

R09**Code: 9A21502**

B.Tech III Year I Semester (R09) Supplementary Examinations December 2015

FLIGHT MECHANICS – I

(Aeronautical Engineering)

Time: 3 hours

Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

- 1 (a) Explain how lift is generated by a cambered airfoil in general and even at zero angle of attack.
(b) Define angle of attack and lift, drag and pitching moment coefficients. Describe with the help of graphs, show the lift, drag and pitching moment coefficients vary with angle of attack over a typical airfoil of the NACA 2412 type.
- 2 (a) Define drag, drag coefficient, Mach number and Reynolds number. What are the different components of drag?
(b) How does a jet engine generate thrust?
- 3 The characteristics of a jet aircraft are as follows:
Weight of the aircraft = 50 tonnes
Reference area for lift and drag coefficients = wing area = 45 sq.m
Coefficient of drag (C_D) = $0.2 + 0.035C_L^2$
Thrust = 250 kN
What is the speed of the aircraft corresponding to the maximum rate of climb if it flies at sea level?
Note: As per ISA, the density of air at sea level is 1.225 kg/cubic meter.
Caution: While weight is expressed in kg (even in SI units), it should be expressed in Newton's in mathematical applications. A mass of 1 kg weighs 9.80665 Newton's unless otherwise specified.
- 4 An aircraft flies at a speed of 750 km/hr. The pilot decides to pull the aircraft up. The limit load factor is 6. What is the maximum permissible angular rate in this case? Calculate in SI units and state the answer in degrees per minute.
- 5 (a) What are the different types of rockets in use? Why is staging necessary for rockets?
(b) What is boost-sustain trajectory?
- 6 Define flight path. What is its effect on the performance of a rocket? What are the possible paths? How do you arrive at an optimal path?
- 7 Describe the variation of aerodynamic parameters in the transonic zone. How is transonic flight hazardous?
- 8 (a) State the equations of motion of a rigid body and explain the parameters clearly.
(b) Simplify these equations for the flight of an aircraft in a steady flight in the vertical plane.
