00744

B.TECH. (AEROSPACE)

Term-End Examination

June, 2014

BASE-002 : ROCKET PROPULSION

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any **seven questions**. **All** questions carry **equal** marks. Use of scientific calculator is **permitted** .*

1. Explain all the forces and moments acting on the two separating stages in a multi-stage rocket. Draw neat sketches showing details. **10**

2. What is the meaning of cross - sectional loading ? Find it for 250 mm outer diameter multi - perforated propellant grain with 10 holes of 20 mm diameter each. **10**

3. Explain the following internal ballistic parameters **10**
(a) thrust coefficient
(b) characteristic velocity
(c) specific impulse

4. Explain in detail difference between rocket propulsion and air - breathing propulsion. **10**

5. Derive the expression for the burn - out range distance covered by the time of burn - out by a single stage rocket. **10**

6. Describe in detail, how the quantity of charge of an igniter for a solid rocket motor is decided. **10**

7. What is the role of nozzle in rocket propulsion ? Discuss in detail. **10**

8. An Aircraft flies at 960 kmph. One of its turbojet engines takes in 40 kg/s of air and expands the gases to the ambient pressure. The air fuel ratio is 50 and the lower calorific value of the fuel is 43 MJ/kg. For maximum thrust power determine **5x2=10**

   (a) Jet velocity
   (b) thrust
   (c) specific thrust
   (d) thrust power
   (e) propulsive, thermal, overall efficiencies and TSFC.

9. A ramjet engine has the following data. Altitude = 6.5 km. Flight Mach number = 4.0 Air fuel ratio = 50. Calorific value of the fuel used = 44.18 MJ/kg. Diffuser inlet diameter = 0.5, $\gamma = 1.4$, R = 287 J/kg K for both air and the products of combustion. Efficiencies of the diffuser, combustor and the nozzle are 0.85, 0.98 and 0.95 respectively. **10**