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BASE-002

B.Tech. AEROSPACE ENGINEERING (BTAE)

Term-End Examination

00293

December, 2016

BASE-002 : ROCKET PROPULSION

Time : 3 hours *Maximum Marks : 70*

Note :

(i) *Attempt any **five** questions.*

(ii) *Each question carries equal marks.*

(iii) *Use of scientific calculator is permitted.*

(iv) *Assume suitable data, missing, if any.*

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1. (a) How does the shape of nozzle affect performance ? How do you overcome the thrust loss associated with over expansion ?

(b) Draw a neat sketch and briefly explain about electric rocket propulsion technique. *7+7=14*

2. (a) Explain optimal rockets. Distinguish between the two-stage and three-stage rockets.

(b) Explain briefly the various types of igniters with their relative advantages and limitations. *7+7=14*

3. (a) Why is multistaging necessary in rocket propulsion ?

(b) Differentiate between solid propellant rocket and hybrid rocket. *7+7=14*

4. (a) What is the purpose of primary and secondary air in combustion chamber ?

(b) Discuss the important factors affecting combustor design. *7+7=14*

5. (a) Define critical pressure ratio of a nozzle and discuss why attainment of sonic velocity determines the maximum mass rate of flow through a nozzle.

(b) Air enters a frictionless adiabatic converging nozzle at 70 bar, 500 K with negligible velocity. The nozzle discharges to a region at 2 bar. If the exit area of the nozzle is 2·5 cm^2, find the flow rate of air through the nozzle. Assume for the air C_p = 1005 J/kg-K and C_v= 718 J/kg-K. *7+7=14*

6. (a) Discuss the methods of flame stabilization in brief.

(b) Explain the following : *7+7=14*

(i) Combustion rate

(ii) Equilibrium combustion pressure

7. Write short notes on any ***two*** of the following : *7+7=14*

(a) Internal Ballistic Rockets

(b) Ejector and Variable Area Nozzles

(c) Liquid Propellants