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BASE-002

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B.Tech. AEROSPACE ENGINEERING (BTAE)

Term-End Examination

December, 2017

BASE-002 : ROCKET PROPULSION

Time : 3 hours *Maximum Marks : 70*

Note : Attempt any five questions. Each question carry equal marks. Use of scientific calculator is permitted. Assume suitable value, if missing, any.

1. Define the following terms used in Rocket propulsion. **2x7=14**
   (a) Thrust
   (b) Specific Impulse
   (c) Burning rate
   (d) Propulsive efficiency
   (e) TSFC
   (f) Mach No.
   (g) Nozzle area ratio

2. How are regressive, neutral and progressive burning of the solid propellant grain achieved ? Explain with the help of neat sketch. **14**

3. (a) Describe the events heading to pressure oscillation in a rocket combustor. 7+7

(b) A space craft's dry mass is 75,000 kg and the effective exhaust velocity of its main engine is 3100 m/s. How much propellant must be carried if the propulsion system is to produce a total ΔV of 700 m/s ?

4. (a) Derive an expression for thrust developed by a rocket engine and write the conditions for maximum thrust. 7+7

(b) What are different precautions taken to avoid the cavitation in turbo pumps in case of liquid propellant rockets ?

5. Discuss the relative merits and demerits of the following : 7+7=14

(a) Solid propellant rocket and liquid propelling rocket.

(b) Convergent propelling nozzles and Convergent - divergent propelling nozzles.

6. (a) A two - stage rocket has following masses : 7+7

Stage	Propellant mass	Dry mass	Specific Impulse
1	1,20,000 kg	9,000 kg	260 Sec
2	30,000 kg	3,000 kg	320 Sec

Calculate the rocket's total ΔV, If payload mass is 3000 kg.

(b) A solid rocket motor burns along the face of a central cylindrical channel 10 m long and 1 m in diameter. The propellant has a burn rate coefficient of 5.5, a pressure exponent of 0.4, and a density of 1.7 g/ml. Calculate the burn rate and the product generation rate when the chamber pressure is 5 atm.

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

(a) Variation of thrust with rotational speed and forward speed.

(b) P-V diagram for rocket engine.

(c) Hybrid rockets.
