Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal)

V SEMESTER B.TECH. (AERONAUTICAL ENGINEERING) **END SEMESTER EXAMINATIONS, DEC 2018**

SUBJECT: ROCKET PROPULSION [AAE 3103]

REVISED CREDIT SYSTEM (28/12/2018)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions. **
- ✤ Missing data may be suitable assumed.
- (Thermodynamic data hand book will be provided from the Department)
- What are the characteristic differences between thrust produced from jet engine and a 2 1A. rocket engine.
- **1B.** An aircraft is flying at a cruising speed of 250 m/s at an altitude of 5000 m where the 4 atmospheric pressure is 54.05 KPa and the ambient air temperature is 255.7 K. The ambient air is first decelerated in a diffuser before it enters the compressor. Assuming both the diffuser and the compressor to be isentropic, determine (a) the stagnation pressure at the compressor inlet and (b) the required compressor work per unit mass if the stagnation pressure ratio of the compressor is 8.
- 1C. Show that velocity of sound in an ideal gas can be given by $c = \sqrt{kRT}$. 4
- 2A. Explain the reasons why pulsejet engine does not require a compressor and turbine. 2
- Describe with simplified diagrams the various grain configurations. Explain their **2B**. 4 characteristics and their advantages.
- **2C.** With the help of neat diagrams explain the working principle and components of a 4 Ramjet engine.
- A rocket operates at sea level (Pa=0.103 MPa) with a chamber pressure of P₁=2.0685 **3A**. MPa, a chamber temperature of T_1 =2222 K with a propellant consumption rate of 1 kg/s. Take γ =1.3, R= 345.7 J/kgK. Tabulate the values of area, velocity and Mach number with respect to pressure values of 1.130 MPa and 0.7 MPa along the nozzle and deduce your inference. Also determine the ideal thrust and ideal specific impulse
- **3B**. Derive the expression for exit velocity of the nozzle from fundamentals. Explain how 5 the equation helps determine the choice of the propellant.
- 4A. What are the desirable characteristics of a solid propellant rocket and a liquid 4 propellant rockets. Which of the characteristics are significant for each of the type of rockets? AAE 3103

4B.	Explain the different types of combustion instabilities which can occur in a rocket motor.	3
4C.	Explain the difference between double base solid propellants and composite solid propellants. Give any two examples each.	3
5A.	With the help of a neat diagram explain the working principle of (i) Arc Plasma Rocket Engine (ii) Ion Rocket Engine	4
5B.	Explain with a neat diagram the working principle of a hybrid propellant rocket.	3
5C.	List any two propellants used in Hybrid propellant rockets. How are they different from those used in solid propellant rockets?	3