Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY

VII SEMESTER B.TECH MECHANICAL/IP ENGG. END SEMESTER

EXAMINATIONS, NOVEMBER 2017

SUBJECT: JET PROPULSION AND ROCKET TECHNOLOGY [PE-V] [MME 4011]

REVISED CREDIT SYSTEM

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- Missing data may be suitably assumed.
- **1A.** Derive an expression for thrust equation of a gas turbine and hence thrust **4** power. Also give expression for specific thrust.
- **1B.** Explain the variation of thrust, pressure, temperature and velocity of working **3** fluid inside a turbojet with a neat sketch.
- **1C.** What is Thrust Augmentation in Turbojet engines? Explain the three **3** methods of Thrust Augmentation.
- 2A. An unmixed two spool turbofan engine has the following data as given in 4 Table 2a. The low pressure turbine drives the intake fan. The high pressure turbine drives the compressor.

	Pressure (kPa)	Temperature (°C)			
Fan Inlet	101.3	15			
Fan Outlet	160	62.7			
Compressor Outlet	2392	501			
Combustion Chamber Outlet	2289	1286			
High Pressure Turbine Outlet	595.7	906			
Low pressure Turbine Outlet	147.5	512			

Table 2a

The fan and turbine nozzle have isentropic efficiencies of 0.9. Combustion efficiency is 0.96. C.V of fuel used is 45000 kJ/kg.

Neglect polytropic efficiencies. Take C_{pa} = 1.005 kJ/kgK and Y = 1.4, C_{pg} = 1.147 kJ/kgK and Y = 1.33.

Calculate: (i) Fan isentropic efficiency (ii) Compressor efficiency (iii) Fuel to air ratio (iv) Thrust developed

- **2B.** Explain the Ideal Brayton cycle having an Intercooler, Reheating and **3** Regeneration.
- **2C.** With a neat sketch, explain the working of a Mixed Flow turbofan engine. **3**

3A. A three stage rocket has the following data as given in table 3a. Calculate **4** the total change in incremental velocity of the rocket. Assume each stage is ejected after its use.

		l able 3a				
		Propellant Load (kg)	Structural Load (kg)			
	Useful Load	NA	40			
	Stage 1	9000	1500 550			
	Stage 2	3500				
	Stage 3	1700	250			
3B.	Define Propuls Propulsive effici	sive efficiency and hence derive an expression for the				
3C.	Derive an expression for Characteristic Exhaust Velocity of a rocket.					
4A.	Define the following with respect to grain configurations: (a) Sliver (b) 2 Burning time (c) Action Time (d) Deflagration Limit					
4B.	With a neat sketch, explain the working of a Turbopump feed system for 3 Liquid Propellant rockets.					
4C. 4D.	What are Gelled Propellants? List its advantages and disadvantages.Explain Cigarette burning and Neutral burning with sketches.					
5A.	With a neat sl Thruster.	ketch, explain the working c	of an Electron Bombardment	4		
5B.	With a neat sket	tch, explain the working of an <i>i</i>	Arcjet electrical rocket.	3		
5C.	With a neat ske a solid core.	tch, explain the working of a N	uclear Thermal Rocket having	3		

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