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MANIPAL INSTITUTE OF TECHNOLOGY

*A Constituent Institute of Manipal University, Manipal*

## VII SEMESTER B.TECH. (MECHANICAL ENGG.)

## END SEMESTER MAKE UP EXAMINATIONS DEC 2016/JAN 2017

SUBJECT: JET PROPULSION AND ROCKET TECHNOLOGY [MME 449]

**REVISED CREDIT SYSTEM**

**(02/01/2017)**

Time: 3 Hours MAX. MARKS: 50

**Instructions to Candidates:**

- Answer **ANY FIVE FULL** questions.
- Missing data may be suitably assumed.

**1A.** Explain the variation of thrust, pressure, temperature and velocity of working fluid inside a turbojet with a neat sketch. **5**

**1B.** Derive an expression for thrust equation of a gas turbine and hence thrust power. Also give expression for specific thrust. **5**

**2A.** An aircraft flies at a Mach number of 0.75 ingesting an airflow of 80 kg/s at an altitude where the ambient temperature and pressure are 222 K and 10 kPa, respectively. The inlet design is such that the Mach number at the entry to the inlet is 0.60 and that at the compressor face is 0.40. The inlet diffuser has an isentropic efficiency of 0.95. Find (a) the area of the inlet entry (b) the inlet pressure recovery (c) the compressor face diameter. **6**

**2B.** Explain the working of an Unmixed Flow Turbofan Engine with a neat sketch. **4**

**3A.** Derive expressions for propulsive, thermal and overall efficiency of a rocket system. **6**

**3B.** Explain the importance of using a Bell curve nozzle over regular conical nozzle with neat sketches. **4**

**4A.** Explain the working of a solid propellant rocket and describe linear burning rate. **5**

**4B.** Explain Staged Combustion cycle and Expander Cycle used in liquid propellant systems with neat sketches. **5**

**5A.** What is restricted burning? Explain the two types of restricted burning with sketches. **5**

**5B.** Give the desired properties, advantages and disadvantages of liquid propellants. **5**

**6A.** Explain with a neat sketch the working of a Nuclear Thermal Rocket having a solid core. **5**

**6B.** Explain with a neat sketch the working of an Ion propulsion system. **5**