MODEL QUESTION PAPER

VIII SEMESTER B.TECH. DEGREE EXAMINATION

(ELECTIVE V)

13.806.12 PROPULSION ENGINEERING (MP)

Time: 3 Hrs   Maximum Marks:100

Part A
Answer *All* questions
Each question carries 2 marks

1. Distinguish between air breathing engines and rocket engines
2. Explain why the use of turboprop engines is limited to aircrafts having flight speed less than 700 km/hour.
3. Explain why the use of pulsejet engines is restricted to pilot less aircrafts
4. List the methods used for thrust augmentation in turbojet engines
5. Explain stalling of compressors
6. What are the desirable properties of liquid propellants
7. List the factors on which the burning rate of solid propellant grain depend
8. Distinguish between storable and cryogenic propellants
9. What is meant by multi stage rockets
10. Discuss combustion instability applied to Liquid Propellant Rocket (LPR) engines

(2X10)

Part B
Answer *one full* question from each module
Each full question carries 20 marks

Module I

11. (a) Explain the working of a centrifugal turbojet engine   (10)
    (b) Explain the working of a ramjet engine. Explain how a SCRAM jet engine is different from ramjet engine   (10)

12. (a) Explain (i) propulsive efficiency (ii) thermal efficiency(iii) overall efficiency applied to turbojet engine   (9)
    (b) A turbojet inducts 50 kg/s of air and propels an aircraft at a flight speed of 900km/hr. The isentropic enthalpy change for the nozzle is 200 kJ/kg and velocity coefficient is 0.94. The fuel air ratio is 0.012. The calorific value of fuel is 45 MJ/kg. Calculate (i) thermal efficiency (ii) Thrust power (iii) propulsive efficiency (iv) overall efficiency   (11)

Module II

13. The following data apply to a turbojet unit of an aircraft flying at an altitude
of 6000 m where ambient conditions are 0.4 bar and - 25 ^{o}C.
Speed of the aircraft = 800 km/hr, Pressure ratio of the compressor = 4:1
Turbine inlet temperature = 1100 K,
Combustion chamber pressure drop = 0.2 bar, Ram efficiency = 0.85
Isentropic efficiency of the compressor = 0.85
Isentropic efficiency of the turbine = 0.90
Nozzle efficiency = 0.95, Exit area of the nozzle = 0.094 m^2
Calorific value of fuel = 45 MJ/kg
Calculate the thrust and thrust specific fuel consumption   (20)

14. (a) Discuss the various types of intakes used in turbojet engines   (10)
(b) Explain the various types of combustion chambers used in turbojet engines
                                                                        (10)

Module III

15   (a) Explain neutral, progressive and regressive burning of solid propellant grain
                                                                        (8)
(b) Explain with figures the solid propellant grain shapes commonly used   (12)

16   (a) Explain expander cycle turbopump feed system used in LPR engine   (10)
(b) Explain the working of a nuclear rocket engine. What are the features of it
                                                                        (10)

Module IV

17   (a) Explain the working of a hybrid rocket engine   (10)
(b) Discuss regenerative cooling used in LPR engines   (10)

18   (a) Derive rocket equation   (10)
(b) Explain the various types of tests a rocket is subjected to before it is put into
   operational use.   (10)