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Reg. No. : .....

Name : .....

# Eighth Semester B.Tech. Degree Examination, October 2014
## (2008 Scheme)
## 08.806.1 : PROPULSION ENGINEERING (MPU)

Time : 3 Hours Max. Marks : 100

***Instructions** : Answer **all** questions from **Part – A** and **one full** question from **each** module in **Part – B.***



PART – A

1. What is an Air screw ? What are its limitations ?
2. Briefly explain the working of a pulse jet engine.
3. Distinguish between air breathing engine and rocket engine.
4. With the help of neat sketch describe any one combustion chamber for a turbojet engine.
5. Explain turbine-compressor matching in turbojet engines.
6. Sketch the different types of nozzles used in rocket engines and specify their applications.
7. Explain progressive burning, Regressive burning and neutral burning with reference to solid propellants.
8. Distinguish between composite propellants and double base propellants.
9. What are the benefits gained by multistaging of rockets ? Can we employ air-breathing stages in rockets.
10. What are hypergolic propellants ? Give examples. **(4×10=40 Marks)**

P.T.O.

PART – B

**Module – I**

11. a) Explain the difference between a turboprop and a turbofan engine ? In what way turbofan engine is advantageous over turboprop engine. 8

    b) A turbojet aircraft flies at 850 km/h at an altitude of 10000 m above mean sea level where the ambient pressure and temperature are 0.2649 bar and 176.81 k respectively. The pressure and velocity of gases at the exit are 0.3 bar and 500 m/s. The fuel air ratio for the engine is 40, calculate (i) air flow rate through the engine (ii) thrust (iii) specific thrust (iv) fuel specific impulse (v) thrust power (vi) TSFC. 12

12. a) Show that for a turbojet engine, for maximum thrust power, the ratio of flight to jet speed is 0.5. 5

    b) The following data apply to a turbojet engine flying at an altitude of 6.1km where the ambient conditions are 0.458 bar and 248 k

| | |
|---|---|
| Speed of aircraft | : 805 km/h |
| Pressure ratio of compressor | : 4 : 1 |
| Combustion chamber pressure loss | : 0.21 bar |
| Turbine inlet temperature | : 1100 k |
| Intake duct efficiency | : 95% |
| Isentropic efficiency of compressor | : 85% |
| Isentropic efficiency of turbine | : 90% |
| Mechanical efficiency of transmission | : 99% |
| Nozzle efficiency | : 95% |
| Nozzle outlet area | : 0.0935 $m^2$ |
| LCV of fuel | : 43 MJ/kg |

Find the thrust and specific fuel consumption is kg/Nh of thrust. Assume convergent nozzle. Take $C_{pa}$ = 1.005 kJ/kgK, $\gamma_a$ = 1.4, $C_{pg}$ = 1.147 kJ/kgK and $\gamma_g$ = 1.33. 15

## Module – II

13. a) Explain thrust augmentation applied to turbojet engine. Discuss various methods used for thrust augmentation. 10

    b) Explain the working of variable geometry nozzle with figure. What are the basic requirements of a supersonic nozzle. 10

14. a) With the help of neat sketch explain the working of solar rocket. 10

    b) With a neat sketch explain the working of an axial compressor, used in aero engines. 10

## Module – III

15. a) With a neat sketch, explain the working of a gas pressure feed system for liquid propellant rocket engines. 10

    b) Explain combustion instability in solid propellant rockets and liquid propellant rockets. 10

16. a) Discuss the various tests performed in rocket propulsion systems before they are put into operational use. 10

    b) A rocket flies at 10,080 kmph with an effective exhaust jet velocity of 1400m/s and propellant flow rate of 5.0 kg/s. If the heat of reaction of the propellants is 6500 kJ/kg of the propellant mixture determine (a) propulsion efficiency and propulsive power (b) engine output and thermal efficiency (c) overall efficiency. 10