

Code No: 126BU

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD****B.Tech III Year II Semester Examinations, May - 2016****AEROSPACE PROPULSION- II****(Aeronautical Engineering)****Time: 3 hours****Max. Marks: 75****Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

**PART - A****(25 Marks)**

- 1.a) Distinguish between missile and space launch vehicle. [2]
- b) Classify various Hypersonic transport vehicles. [3]
- c) Explain the internal physics of an isolator in supersonic combustion. [2]
- d) Describe various flow losses encountered in nozzle. [3]
- e) Explain the characteristic features of liquid and solid propellants. [2]
- f) Define the terms thrust coefficient and specific impulse. [3]
- g) Explain Mono propellant and Bi-propellant with example combinations. [2]
- h) Explain erosive burning and end burning of a solid rocket motor. [3]
- i) What is the function of solar cell arrays in Propulsion system? [2]
- j) Explain the problem of gravity loss. [3]

**PART - B****(50 Marks)**

- 2.a) Explain the Reaction control system for space flight propulsion and its applications.
- b) Explain how the power is generated for an in-space spacecraft and how momentum thrust is produced. [5+5]

**OR**

- 3.a) With neat sketches explain Low-level strike and Strategic Bombing mission profile for a jet aircraft.
- b) How is forward motion of an aircraft achieved by propeller action? How does the aircraft lift off the ground? Explain with the help of illustrative sketches. [5+5]

- 4.a) Explain in detail the constructional features and working principle of Liquid Air Collection Engine (LACE).
- b) What is after burning in turbojet engines? Explain briefly with the aid of a diagram. [5+5]

**OR**

- 5.a) Calculate the air flow rate through the engine, cross section area of the propelling nozzle exit, thrust, thrust power, propulsive efficiency of a turbojet engine from the following data:

Flight mach number = 0.85

Flight altitude = 12000 m

Cross sectional area of the inlet diffuser at entry = 0.5 m<sup>2</sup>

Air/fuel ratio = 60

**Conditions at the exit of the exhaust jet:**

Pressure = 477 Mbar

Temperature = 1000 K

Velocity = 660 m/s

Calorific value of the fuel = 43 MJ/Kg

- b) Describe the working of a scramjet engine. What are its advantages over ramjet engine? [6+4]

- 6.a) Describe the over expanded and under expanded nozzle for a rocket engine.
- b) A rocket nozzle has a throat area of  $18 \text{ cm}^2$  and combustion chamber pressure of 25 bars. If the specific impulse is 130 seconds and weight flow rate is 44.145 N/s. Determine:
- Thrust Coefficient
  - Propellant Weight Flow Coefficient
  - Specific Propellant Consumption and
  - Characteristic Velocity.
- [5+5]

**OR**

- 7.a) Describe the various factors considered for the design of a rocket.
- b) Consider a rocket engine where the combustion chamber pressure and temperature are 30 atm and 3756 K respectively. The area of the rocket nozzle exit is  $15 \text{ m}^2$  and is designed so that the exit pressure exactly equals ambient pressure at a standard altitude of 25 km. For the gas mixture, assume  $\gamma = 1.18$  and the molecular weight is 20. At a standard altitude of 25 km, calculate:
- Specific impulse,
  - Exit velocity,
  - Mass flow,
  - Thrust and
  - Throat area.
- [5+5]

- 8.a) Explain the solid propellant grain design considerations and the features of various grain configurations.
- b) Explain briefly the following terms in solid propellant rockets:
- Linear Burning rate
  - Combustion rate
  - Propellant area ratio.
- [5+5]

**OR**

- 9.a) Write a short note on following related to liquid rocket engines:
- Steady state cooling methods
  - Transient cooling methods.
- b) Why does heat transfer increase during combustion instability in a liquid rocket engines?
- [5+5]

- 10.a) What do you understand by electrostatic thrusters? Explain the working principle and various types with the help of suitable diagrams.
- b) Compare the performances of chemical, Nuclear and electro dynamic rockets and discuss their application.
- [5+5]

**OR**

- 11.a) What do you understand by electro-thermal thrusters? Explain the working principle and various types with the help of suitable diagrams.
- b) Write a short note on microwave thermal propulsion system.
- [5+5]

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