Code No: 5221AU

R15

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech II Semester Examinations, February - 2017
JET PROPULSION AND ROCKET ENGINEERING
(Thermal Engineering)

Time: 3hrs

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

5 × 5 Marks = 25

1.a)   What are the forces acting on vehicle? Explain.   [5]
  b)   What is trust coefficient? Explain.   [5]
  c)   What is meant by Equivalent ratio? Explain.   [5]
  d)   List out different types of injectors and its applications.   [5]
  e)   Write the advantages and disadvantages of ramjet engine.   [5]

PART - B

5 × 10 Marks = 50

2.a)   Explain with neat sketche the working of a simple constant pressure open cycle gas turbine.
  b)   In a closed cycle gas turbine the working fluid at 40^0C compressed with an adiabatic efficiency of 0.82. It is then heated at constant pressure to 1000K, the fluid is then expands down to initial pressure in a turbine with an adiabatic efficiency of 0.85. After expansion fluid is cooled to 40^0C, for a pressure ratio, of 4. Calculate the work done and cycle efficiency. The working fluid is air having C_p =1.01 kJ/kgK and γ=1.38. [5+5]

OR

3.a)   What are the advantages and disadvantages of a closed gas turbine over open cycle gas turbine? What are the desirable properties of working fluid suitable for closed cycle operation?
  b)   Discuss the methods of improving the specific output and thermal efficiency of the simple open cycle gas turbine plant.   [5+5]

4.a)   Explain the essential differences between rocket propulsion and turbojet propulsion.
  b)   What is the importance of specific impulse in rocket engines?   [5+5]

OR

5.   A rocket nozzle has a throat area of 18 cm^2 and combustion chamber pressure of 25 bar. If the specific impulse is 127.42 sec and weight flow rate 44.145 N/s. Determine a) Thrust coefficient b) Propellant weight flow coefficient c) Specific propellant consumption d) Characteristic velocity.   [10]

6. The leaving velocity is 1750 km/hr from a jet and inlet velocity is 88 km/hr. The specific fuel consumption is 12 kg/hr for each kg of thrust. Fuel of 42385 kJ/kg lower heating value is used. For 2000 kg thrust, compute the air flow in kg/sec. Also calculate the probable propulsion and thermal efficiencies and finally determine the overall efficiency of this unit. [10]

OR

7. Give the classification of Solid propellant rocket engines and explain homogeneous and heterogeneous propellants. [10]

8.a) Compare liquid propellant rocket engine with solid propellant rocket engine.
 b) Give the classification of liquid propellant rocket engines. [5+5]

OR

9.a) What are different applications of solid propellant rocket engines?
 b) With the help of a neat diagram, explain the working of a liquid bi-propellant rocket engine. [5+5]

10. A ramjet engine operates at M=1.5 at an altitude of 6500 m. The diameter of the inlet diffuser at entry is 50 cm and the stagnation temperature at the nozzle entry is 1600 K. For air ($\gamma = 1.4$, R = 287 J/kgK). The velocity of air at the diffuser exit is negligible. Calculate (a) the efficiency of ideal cycle (b) flight speed (c) air flow rate (d) diffuser pressure ratio (e) fuel air ratio (f) nozzle pressure ratio. (g) nozzle jet mach number, (h) propulsive efficiency and (i) thrust. Assume the following values $\eta_D = 0.9$, $\eta_s = 0.98$, $\eta_j = 0.96$, stagnation pressures loss in the combustion chamber = 0.02 P_{02}. [10]

OR

11. Briefly explain the air intakes and their classification of ramjet propulsion system. [10]

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