M.E. Second Semester (Mechanical Engineering (Thermal Engg.)) (New-CGS)
13521 : Elective-I : Gas Turbine and Jet Propulsion : 2 MTE 4

P. Pages : 2

Time : Three Hours

1003

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Max. Marks :

Notes :
1. All question carry equal marks.
2. Answer **three** question from Section A and **three** question from Section B.
3. Due credit will be given to neatness and adequate dimensions.
4. Assume suitable data wherever necessary.
5. Illustrate your answer necessary with the help of neat sketches.
6. Use of slide rule logarithmic tables, Steam tables, Moller's Chart, Drawing instrument, Thermodynamic table for moist air, Psychrometric Charts and Refrigeration charts is permitted.
7. Use of D.A. Lows "Pocket Book for Mechanical Engineers" is permitted.
8. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION – A

1. a) Describe with neat sketch the working of a constant – pressure combustion gas turbine cycle. — 7

   b) Write and discuss at least eight differences i.e comparisons between closed cycle and open cycle gas turbines. — 7

2. a) Define, discuss and state merits and demerits of following terms related to gas turbines — 2+
      i) Regenerator   ii) Reheating — 2+
      iii) Intercooling   iv) Back work — 2+ 1

   b) Describe the principle of operation, construction & working of Axial flow compressor. — 6

3. a) With neat sketch explain development of flow in a rotor blade passage of a partial admission turbine and also discus main cascade losses accounted at the sector ends. — 13

4. a) A compressor cascade has the following data: — 13
      Velocity of air at entry = 75 m/s
      Air angle at entry = 48°
      Air angle at exit = 25°
      Pitch – chord ratio = 1.1
      Stagnation pressure loss = 11mm W.G.
      Desity of air = 1.25kg /m²
   Determine loss coefficient, drag and lift coefficient, ideal and actual pressure recovery coefficients, diffuser efficiency and maximum diffuser efficiency.

5. a) Explain the construction and working of a diffuser in a centrifugal compressor. — 6

   b) State, explain & define the following terms w. r. t. centrifugal compressor — 1+
      i) Degree of reaction — 2+
      ii) Losses and efficiencies — 2+
      iii) Slip & slip factor — 2
      iv) Surging

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SECTION – B

6. Considering the generalized thrust producing device, derive general equations for thrust and efficiency of air-breathing jet engines.   14

7. Estimate the propulsion and thermal efficiencies of a turbojet engine during subsonic cruise. The Hight mach number is 0.8 and the ambient temperature is 225 K. The compressor pressure ratio is 12 and the turbine inlet temperature is 1300K. The respective adiabatic efficiencies of the diffuser, compressor, turbine and nozzle are, 0.92, 0.85, 0.85, and 0.95. The burner stagnation pressure ratio is 0.97 and the arrange specific heat during and after combustion is 1.1 KJ/kg K and the average molecular weight is 29.   13

8. a) With neat sketch explain turboprop engine, also derive total thrust equation.   6

   b) Describe the reasons for using Reheater and afterburners used in turbojet engines.   7

9. a) With neat diagrams explain successive steps in acceleration and overspeeding of one dimensional supersonic inlet.   6

   b) With sketch explain working of a turbofan.   6

10. a) Classify rockets as per the following points.   6
    i)   Propellent used   ii)   Fuel used
    iii) Number of stages   iv)   Range
    v)   Applications

   b) Explain construction & working of Nuclear propellent rocket. State its merits & demerits.   7

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