B.E. (Mechanical Engineering) Eighth Semester (C.B.S.)

Energy Conversion-III

P. Pages : 3 **NRT/KS/19/3677**

Time : Three Hours * 0 7 0 9 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.

1. A Following data referes to a gas turbine set employing separate power turbine, regenerator and intercooler between two stages of compression. **14**

Isentropic efficiency of compressor = 80%
Isentropic efficiency of compressor turbine = 90%
Isentropic efficiency of Power turbine = 88%
Mechanical efficiency to drive the compressor = 98%
Pressure ratio in each stage of compressor = 3:1
Temperature after intercooler = 297k
Air flow rate = 15kg/s
Regenerator efficiency = 80%
Regenerator gas side pressure loss = 0.1bar
Maximum temperature at the turbine = 1000k
Ambient conditions = 1 bar, 327k
C_V of fuel = 43100 kJ/kg

$C_{P_a} = 1.005\,kJ/kg\,k,\ y_a = 1.4$

$C_{P_g} = 1.147\,kJ/kg\,k,\ y_g = 1.33$

Calculates:
1) Net power output
2) Specific fuel consumption
3) Overall thermal efficiency

OR

2. a) Classify gas turbine and explain with neat sketch working of constant volume gas turbine. **7**

b) Derive the expression for optimum pressure ratio for maximum specific work output for gas turbine. **7**

3. a) Explain with neat sketch various processes and working of Ramjet engine. **6**

b) Explain with neat sketch construction and working of CANDU. **7**

OR

4. Determine the specific thrust and specific fuel consumption for a simple turbojet engine having following components performance at the designed point at which cruising speed is 270m/s and altitude of 5000m **13**

compressor pressure ratio = 8:1
Turbine inlet temperature = 1200k
Compressor efficiency (isentropic) = 87%
Isentropic turbine efficiency = 90%
Diffuser efficiency = 93%
Nozzle efficiency = 95%
Mechanical efficiency to drive compressor = 98%
Combustion efficiency = 98%
combustion pressure dosses = 4% of compressor delivery pressure at 5000m altitude.
Intake pressure of air at altitude of 5000m $P_i = 0.5405\,\text{bar}$, $T_i = 255.7\text{k}$

Assume

C_v of fuel = 44000 kJ/kg

$C_{P_a} = 1.005\text{kJ/kg k}$, $y_a = 1.4$

$C_{P_g} = 1.147\text{kJ/kg k}$, $y_g = 1.33$

5. Write short notes on following. **13**

a) Solar radiation geometry.
b) Solar pond
c) Solar refrigeration

OR

6. a) What is the principle of MHΔ generator? Explain with neat sketch working of closed loop MHΔ. **7**

b) Explain with neat sketch construction and working of Flat plate solar collector. **6**

7. a) Write short notes on following. **8**

i) Need and importance of energy management.
ii) Sankey diagram.

b) Discuss the energy scenario in India. **6**

OR

8. a) Explain the terms payback period and return on investment in detailed. **6**

b) Define energy audit and explain steps in detailed energy audit. **8**

9. a) What is the role of pump in hydraulic system? Explain working with neat sketch of any one type of hydraulic pump. **6**

b) Explain the working of following with neat sketch. **7**

i) Pressure relief valve.
ii) Pressure and temperature compensated valve.

OR

10. Explain the working of following Hydraulic circuits with neat sketch. **13**

i) Pressure dependent sequencing circuit.

ii) Hydraulic circuit per milling machine.

11. a) Explain with neat sketch construction and working of time delay valve. **6**

b) What are the functions of air preparatory unit in pneumatic circuit? Explain working of air lubricator with neat sketch. **7**

OR

12. a) Explain with neat sketch the working of throttle-in throttle-out pneumatic circuit for double acting cylinder. **6**

b) Prepare and explain the pneumatic circuit for actuation of double acting cylinder using double pilot operated DCV and single acting cylinder using single pilot operated DCV. **7**

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