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

Energy Conversion - III

P. Pages : 3 **NKT/KS/17/7595**

Time : Three Hours * 0 7 4 4 * 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) Explain with neat sketch the methods used for improvement in thermal efficiency and specific workdone in open cycle gas turbine power plant. **6**

b) Prove that the pressure ratio for maximum work is a function of the limiting temperature ratio $r_p = [T_{max} / T_{min}]^{r/(r-1)x2}$ **7**

OR

2. Air is taken in a gas turbine plant at 1.1 bar and 293°K. The plant comprises of L.P. and H.P. compressors and L.P. and H.P. turbine stages. The compression in L.P. stage is upto 3.5 bar followed by intercooling and further compression in HP stage upto 15 bar, Regenerator of effectiveness 0.65 is used for preheating of compressed air from HP stage before combustion. The temperature of the gases supplied to the H.P. turbine stage is 700°C. The gases after expansion in HP stage to 3.7 bar, for the reheated to 670°C before entering into LP turbine stage. **13**

Determine :

i) The overall efficiency

ii) The WORK RATIO

iii) Mass flow rate when the power generated is 6000 kW.

Assume isentropic efficiency of compression in both stages and isentropic efficiency of expansion in both stages as 0.85

Take C_P for Air 1.005 kJ / kg°k

C_P for gases 1.15 kJ / kg°k

$r_{air} = 1.4$ & $r_{gas} = 1.33$

Neglect the pressure losses and mass of fuel.

3. a) The following data is related to a turbojet flying at an altitude of 9500 m. **9**

Speed of the turbojet 800 km/hr

Propulsive efficiency 50%

Overall efficiency of the turbine plant 17%

Density of air at 9500 m, 0.17 kg/m^3

Drag. on the plane = 6100 N
Assume C.V. of the fuel 46000 kJ/kg
Determine :

i) Absolute velocity of jet
ii) Diameter of the jet
iii) Volume of air compressed per minute.

b) Write a short note on TURBOPROP engine. **4**

OR

4. Write brief notes on the following **any three.** **13**

i) Turbojet Engine

ii) Site selection for nuclear power plant.

iii) Compare nuclear plant with thermal plant.

iv) Problems and safety measures of nuclear power plant.

5. a) Explain with neat sketch closed type MHD generator. **7**

b) Explain with neat sketch solar water heater with flat plate collector. **7**

OR

6. Write short notes on the following **any three.** **14**

i) Grid connected solar PV plant.

ii) Solar dryer

iii) Fuel cell

iv) Methods of solar energy storage

v) Solar pond.

7. a) Explain in brief how will you conduct energy audit in Industry. **7**

b) Discuss in brief types of energy audit. **7**

OR

8. Write brief notes on the following **any three.** **14**

i) Sankey Diagram.

ii) Equipments required for conducting energy audit.

iii) Need & importance of energy conservation.

iv) Payback period.

9. a) Explain in brief construction and working of the following with neat sketch. **6**

i) Pressure reducing valve

ii) External gear pump.

b) Draw and explain in brief motor in and motor out flow control hydraulic circuit. **7**

OR

10. a) Write short notes on the following : **7**

i) Pressure relief valve.

ii) Vane pump.

b) Draw and describe the regenerative hydraulic circuit. Give its application. **6**

11. a) Draw and describe the working of a pneumatic circuit used for clamping operation. **7**

b) Draw schematic diagram of FRL unit and describe its working. **6**

OR

12. a) Write short notes on **any three.**

i) Time delay valve.

ii) Quick exhaust valve.

iii) Seat and spool type DC valve

iv) 512 DCV

v) Twin pressure valve.

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