

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-II Examination July 2010

Subject code: 722102

Subject Name: Thermal Power Plant Engineering

Date: 06 /07 /2010

Time: 11.00am – 1.30pm

Total Marks: 60

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Discuss various energy management techniques. 06
 (b) What are the requirements of peak load plants? Name power plant which are commonly used as peak load plant. With neat sketch explain the working of pump storage peak load plant. 06

- Q.2** (a) The loads of a group of industries are tabulated below for 24 hrs. Sketch the load duration curve. If the capacity of the plant is 25 MW, find the capacity factor of the plant. 06

Time Hrs.	6 – 8 am	8-9 am	9-11 am	11 am – 2 pm	2 - 5 pm	5-8 pm	8 pm – 12 mid night	12 - 5 am	5 – 6 am
Load MW	8	16	20	12	14	20	10	5	6

If the load is supplied by two power plants, one acting as base load plant having a capacity of 15 MW and other as peak load plant having a capacity of 10 MW, find the load factor, capacity factor and use factor of both plants.

- (b) Explain the performance and operating characteristics of power plants. 06
- OR**
- (b) Explain how load division between two generators is done to give maximum overall efficiency and show that (with usual notations) 06

$$\frac{d I_A}{d L_A} = \frac{d I_B}{d L_B}$$

- Q.3** (a) A peak load on a thermal power plant of 12 MW capacity is 10 MW. The plant annual load factor is 0.7. Taking the following data, design a two part tariff and overall cost of generation in Rs/kW-hr. 06

Cost of plant = Rs. 17,000 / kW installed capacity,
 Interest, depreciation and insurance = 10% of capital cost,
 Cost of transmission and distribution system = 5%,
 Operating cost = Rs. 3×10^6 per year,
 Cost of coal = Rs. 800 per ton,
 Plant maintenance cost = Rs. 0.3×10^6 per year (fixed) and Rs. 3,50,000 per year (running),
 Coal used = 50×10^3 ton per year,
 Assume transmission and distribution costs are to be charged to generation.

- (b) Explain with help of neat diagram – a combined cycle plant incorporating closed cycle gas turbine plant using helium as working medium and a steam power plant. 06

OR

- Q.3 (a) A gas turbine plant consists of a two stage compressor with perfect intercooling in between and a single stage turbine. The isentropic efficiency of each stage of compression is η_c and isentropic efficiency of turbine is η_t . Prove that the overall pressure ratio of the cycle for maximum specific output is given by 06

$$r_p = \left[\eta_c \eta_t \frac{T_{\max}}{T_{\min}} \right]^{\frac{2}{3r-1}}$$

- (b) In a gas turbine plant, air at 283 K and 1.0 bar is compressed to 4.0 bar, the isentropic efficiency of the compressor being 80%. The compressed air is first heated in a regenerator and then in a combustion chamber till its temperature is raised to 973 K and during this the pressure falls by 0.14 bar. The gases are then expanded in a turbine and the exhaust gases pass through a regenerator, to heat the compressed air, to atmospheric pressure of 1.0 bar. The drop in pressure in the regenerator while passing the exhaust being 0.14 bar. The effectiveness of the regenerator is 0.75 and isentropic efficiency of the turbine is 85%. Determine the thermal efficiency of the plant. Take C_p for air as 1.005 kJ/kg K, C_p for exhaust gases as 1.147 kJ/kgK 06

- Q.4 (a) What is enrichment? Explain three different methods which are used for the enrichment with neat sketch. 06
- (b) Draw a neat diagram of CANDU reactor and give advantages and disadvantages over other types. Under what circumstances this reactor is more preferable than PWR and BWR? 06

OR

- Q.4 (a) Discuss with the help of diagram the method used for treating the low, medium and high radioactive wastes. 06
- (b) Explain arrangement of different FBC plants with neat sketch. Draw a flow diagram for proposed 360 MW plant with pressurized fluidized bed air heater. 06

- Q.5 (a) Explain clearly sinking fund method. With usual notations show that annual deposit in reserved fund is given by 06

$$A = (P - S) \left[\frac{r}{(1+r)^n - 1} \right]$$

- (b) What are the outstanding features of diesel power plant over thermal power plant. Why diesel power plant are not used for high capacity? What are the drawbacks when used for high capacity compared to steam power plants? 06

OR

- Q.5 (a) What factors are mainly considered in the design of boiler used in power plant? Discuss the significance of each with details. 06
- (b) Explain with line diagram a binary vapour cycle for steam power plant and analysis for such a plant. 06
