PAPER ID-310620

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B. TECH.
(SEM VII) THEORY EXAMINATION 2020-21
POWER PLANT ENGINEERING

Time: 3 Hours ***Total Marks: 70***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 7 = 14

a. What is the scope of an Engineers at a power plant?

b. What is the difference between thermal engineering and power plant engineering?

c. Why is the efficiency of a thermal power plant higher in the winter than the summer?

d. How is a nuclear power plant decommissioned?

e. What is the meaning of a power plant's MW production? When a power plant is described as a "100 MW" plant, what does that mean?

f. Is hydropower conventional or nonconventional? Why?

g. Why hydrogen gas is used for cooling of rotor of a generator in thermal power station?

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

a. A power plant with 100 MW capacity has an annual peak load of 80 MW. The power plant supplies loads having maximum demands of 45 MW, 40 MW, 32 MW and 17 MW. The annual load factor is 0.45. Find the average load, energy supplied per year, diversity factor and demand factor.

b. In a 210 MW steam power plant steam enters through HP turbine at 137 bar, 540^0 C steam is taken out from HP turbine for reheating at optimum pressure and heated up to 540^0 C. An open heater is used to heat up the feed water and placed optimally assuming pump and turbine $\eta = 100\%$ Calculate the cycle efficiency, if the condenser is maintained at 0.07 bar pressure.
Below are all enthalpies from steam table/ Mollier diagram:

h_1	S_1	h_2	h_3	h_4	h_5	h_6
3440	6.56	3070	3540	3120	2235	168.8

c. A closed cycle gas turbine in which air enters at 1bar, 300 K, with pressure ratio in cycle is 6. Calculate the cycle efficiency, if it is heated in heated in the combustion chamber to a maximum temperature of 700^0 C. Take $\gamma = 1.4$, and $C_p = 1.005$ kJ/kg K.

d. Explain the following terms:
(i) Mass number,
(ii) Atomic number,
(iii) Mass defect,
(iv) Binding energy.

e. Two electrical units used for same purpose are compared for their economical working:
(i) Cost of Unit-1 is Rs. 6000 and it takes 120 kW.
(ii) Cost of Unit-2 is Rs. 16800 and it takes 72 kW.
Each of them has a useful life of 40000 hours.
Which unit will prove economical if the energy is charged at Rs. 96 per kW of maximum demand per year and 6 paise per kWh? Assume both units run at full load.

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SECTION C

3. **Attempt any *one* part of the following:** **7 x 1 = 7**

(a) Enumerate and explain the various types of prime movers used in geothermal energy conversion systems.

(b) A power plant unit has the installed capacity of 180 MW. Calculate the cost of generation, other data refer to power plant unit are as follows:
Capital Cost = $Rs\ 300 \times 10^6$
Rate of interest and depreciation = 18%
Annual cost of fuel oil, salaries, and taxation = $Rs\ 36 \times 10^6$
Load Factor = 0.4

4. **Attempt any *one* part of the following:** **7 x 1 = 7**

(a) Draw the Reheat Regenerative Rankine cycle of a thermal power plant with P-V and T-S diagram. Write its various formulas.

(b) Discuss the different types of cooling towers? Explain with a neat sketch.

5. **Attempt any *one* part of the following:** **7 x 1 = 7**

(a) Explain a modern ash handling system with neat block diagram.

(b) Explain how you select engine for a diesel power plant and briefly explain its component with neat sketch?

6. **Attempt any *one* part of the following:** **7 x 1 = 7**

(a) What is the difference between controlled and uncontrolled chain reaction? Explain with neat sketches and with examples.

(b) Explain radioactive decay and half-life of nuclear fuels and moderating power and moderating ratio.

7. **Attempt any *one* part of the following:** **7 x 1 = 7**

(a) Sketch and explain the two-pool tidal power plant and What are the different types of Tidal power plants?

(b) Calculate the installed capacity, Load factor, Plant factor, maximum demand and utilization factor of a power plant. Plant has yearly duration curve as a straight line from 300 MW to 80 MW. Power is supplied with one generation unit of 200 MW capacity and two units of 100 MW capacity each. Also draw the load duration curve.