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

Elective - I : Power Plant Engineering

P. Pages : 2 **KNT/KW/16/7471**

Time : Three Hours * 0 8 7 5 * 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. Assume suitable data whenever necessary.
9. Illustrate your answers whenever necessary with the help of neat sketches.
10. Use of non programmable calculator is permitted.
11. Use of steam table & Mollier chart is permitted.

1. a) Name and explain various sources of energy. **4**

b) A power station has a maximum demand of 80,000 kw and daily load curve is defined as follows : **9**

Time (Hr)	0 – 6	6 – 8	8 – 12	12 – 14	14 – 18	18 – 22	22 – 24
Load (MW)	40	50	60	50	70	80	40

i) Determine load factors of power station.
ii) What is the load factor of stand by equipment rated at 25 MW that takes all the load in excess of 60 MW? Also, Calculate its use factor.

OR

2. a) Determine the generating cost per unit of 80 MW power station with the following data : **9**

Capital Cost = Rs. 160×10^7

Annual cost of fuel = Rs. 32×10^6

Annual Wages and Taxes = Rs. 36×10^6

Interest and Depreciation = 10% of the capital cost.

Annual Load factor = 45%

b) What is Load Curve? Give its significance. **4**

3. a) A steam power plant uses the following cycle steam at boiler outlet; 150 bar, 550ºC **14**
Reheat at 40 bar to 550ºC
Condenser at 0.1 bar
Assuming Ideal Processes Find :
a) The quality at the turbine exhaust
b) Cycle efficiency
c) Steam rate

OR

4. A 10 MW steam turbine operates with steam at 40 bar, 400ºC at the inlet and exhausts at 0.1 bar 10000 kg/hr of steam at 3 bar are to be extracted for process work. The turbine has 75% isentropic efficiency throughout. Find the boiler capacity required. **14**

5. a) What is fluidization? How fluidized combustion is achieved. **7**

b) Write a short note on analysis of coal. **6**

OR

6. a) Derived the relation to find out minimum quantity of air required for the combustion of 1 kg of coal. **7**

b) Draw the layout of steam power plant and explain different circuit in it. **6**

7. Average monthly run – off data of two rivers for 12 months is tabulated given below : **14**

Month	1	2	3	4	5	6	7	8	9	10	11	12
River A	40	30	30	20	20	160	180	180	100	80	50	50
River B	50	50	60	80	100	100	90	90	70	60	60	60

The run – off is given in millions of $m^3/month$. The head available for River A & B are 80m and 82m respectively. Draw Hydrograph and flow duration curve and find :

a) Which river is more suitable for storage type? hydroelectric power plant?

b) At what percentage of time, the run – off rate of both the sites is same.

OR

8. a) Give the detail classification of hydroelectric power plant. **7**

b) An hydroelectric station having catchment area of $150 km^2$ with an annual rainfall of 150 cm and effective head of 300 m. Assume yield factor of 40%. Calculate available power and rating of generator installed. **7**

9. a) What is radioactive decay? Explain in detail. **6**

b) Explain Neutron life cycle in detail. **7**

OR

10. a) What do you understand by 'Binding Energy'? **3**

b) Explain nuclear power plant with Pressurised Water Reactor (PWR). **7**

c) Explain Nuclear Fission. **3**

11. a) Explain Diesel engine power plant with neat sketch showing all its components along with its advantages and disadvantages. **7**

b) Explain the MHD power generation. **6**

OR

12. A gas turbine power plant consists of two stage compressor with inter cooling and a single stage turbine with regenerator. Air enters the compressor at 1 bar 20ºC. The maximum temperature of the cycle is limited to 900ºC and the maximum pressure ratio is 6. The effectiveness of the regenerator is 0.7. The rate of air flow through the plant is 210 kg/s and calorific value of the fuel used is 40.8 MJ/kg. The isentropic efficiency of the turbine is 0.95 and for compressor is 0.92, combustion efficiency is 0.95, the mechanical efficiency is 0.96 and generator efficiency is 0.95. Take for air Cp = 1.005 kJ/kg ºk and r = 1.4 and for gases Cp = 1.08 kJ/kg ºk and r = 1.33. **13**

Assuming perfect intercooling and neglecting pressure and heat losses, estimate :

a) Air fuel ratio

b) Cycle efficiency

c) Power supplied by the plant

d) Specific fuel consumption of the plant and fuel consumption per hour.

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