B. TECH. (CBCS - 2014 COURSE) SEM - VIII (MECHANICAL ENGG.) : SUMMER - 2018

SUBJECT: POWER PLANT ENGINEERING

Day: **Saturday** Time: **02.30 PM TO 05.30 PM**

Date: **02/06/2018** **S-2018-4696** Max Marks.: 60

N.B. :

1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10 and Q.11 or Q.12.
2) Neat diagrams must be drawn **WHEREVER** necessary.
3) Figures to the right indicate **FULL** marks.
4) Assume suitable data, if necessary.

Q.1 With the help of a detailed diagram of 210 MW thermal power plant, explain its construction and working. **(10)**
State function of each component.
State the factors to be considered for installation of such a power plant.

OR

Q.2 **a)** With the help of a neat sketch, explain operation of a combined cycle power plant comprising gas turbine and thermal power cycles. **(05)**

b) What are the operating policies and procedures for Indian Electricity Grid Code (IEGC)? **(05)**

Q.3 Dry saturated steam at 150 bar enters a steam turbine and comes out to the condenser at 0.1 bar, calculate the cycle efficiency. **(10)**
If the steam is superheated to 540°C in the above case, what will be percentage improvement in efficiency of the cycle?
Draw T-S and H-S diagrams for both of these cases.

OR

Q.4 An open cycle gas turbine plant uses heavy oil as fuel. The maximum pressure and temperature in the cycle are 5 bar and 650°C. The pressure and temperature of air entering into the compressor are 1 bar and 27°C. The exit pressure of the turbine is also 1 bar. Assuming isentropic efficiencies of compressor and turbine to be 80% and 85% respectively, find thermal efficiency of the cycle. **(10)**
Take C_p for air and gas = 1 kJ/kg-K and γ for air and gas = 1.4.

Q.5 The following data refers to a 30 MW capacity thermal power plant. **(10)**
Steam condensed = 50,000 kg/hr.
Temperature of steam in condenser = 40°C
Dryness of steam entering into condenser = 0.85
Air leakage in the condenser = 150 kg/hr
Temperature of the condensate = 35°C
Temperature at the suction of air pump = 32°C
Barometer reads 76 cm of Hg = 1.013 bar
Find: **i)** Vacuum gauge reading in condenser
ii) Capacity of dry-air pump
iii) Loss of steam in kg per hr. going with air
iv) Quantity of cooling water passed through the condenser per hour if the rise in temperature of cooling water is limited to 10°C.

OR

Q.6 **a)** What is a cooling tower? **(05)**
What are different types of cooling towers?
Differentiate between induced draft and forced draft cooling towers.

b) Derive the following expression for flow through nozzle : **(05)**

$$\frac{dA}{A} = \frac{dC}{C}(M^2 - 1)$$

Also discuss significance of above relationship with reference to converging, diverging and converging-diverging nozzle.

Q.7 What are different types of solar collectors? **(10)**
Explain any one type with the help of a neat sketch.
Also state its advantages and limitations.
Give examples of two commercial installations for this type of collector

OR

Q.8 **a)** In case of a wind turbine, what is condition of maximum power coefficient? **(05)**

b) What is biomass gasification? **(05)**
What are different types of gasification methods?
Explain any one type with the help of a neat sketch.

Q.9 What do you understand by a 'load curve'? **(10)**
What are different types of load curves?
Define following terms required for design of power plants:
i) Demand factor **ii)** Load factor **iii)** Diversity factor
iv) Plant capacity factor **v)** Plant use factor

OR

Q.10 A power system requires a maximum load of 80 MW at 35% load factor. It can be supplied by any of the following schemes: **(10)**
i) A steam plant capable to supply the whole load
ii) A steam plant with hydel plant where energy supplied by steam plant is 120×10^6 kWh/year with a maximum load of 50 MW.

Cost	Steam plant	Hydro plant
Capital cost	Rs. 18,000/kWh installed	Rs. 30,000/kWh installed
Operating cost	Rs. 0.5 / kWh	Rs. 0.1/kWh
Transmission Cost	Negligible	Rs.0.05/kWh

Assume interest and depreciation at 12% of capital for steam plant and 10% of capital for hydro plant. Calculate the annual cost and cost/kWh for each plant.

Q.11 Name different energy storage techniques available today. **(10)**
With the help of a neat sketch, explain any one of the technique suitable for storage of non-conventional energy.
Give its advantages and limitations.

OR

Q.12 **a)** What are the safety measures to be taken during maintenance of a thermal power plant? **(05)**

b) What do you understand by super-capacitors/ultra capacitors? **(05)**

* * * * *