(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2944   Roll No. ☐☐☐☐☐☐☐☐☐☐

B.Tech.

(SEM. VIII) EVEN THEORY EXAMINATION 2012-13

POWER PLANT ENGINEERING

Time : 3 Hours   *Total Marks : 100*

Note :– (1)   Attempt all questions.

(2)   All questions are of equal marks.

(3)   All symbols have usual meaning.

(4)   Use of steam and gas tables and Mollier charts are permitted.

(5)   Assume any relevant data, if missing.

1.   Attempt any **two** out of the following :   (10×2=20)

(a)   Discuss the Indian energy scenario and list the cost of electricity production from different sources and their energy conservation efficiency. What are the elements that contribute to the cost of electricity ?

(b)   A steam boiler uses pulverized coal in the furnace. The ultimate analysis of the coal (by mass) as received is : $C = 78\%$; $O_2 = 3\%$; $H_2 = 3\%$; $S = 1\%$; ash = 10% and rest is moisture. Excess air supplied is 40%. Calculate the mass of air to be supplied and mass of gaseous product formed per kg of coal burnt.

(c) A rated capacity of a power plant is 400 MW. The peak load on the plant is 350 MW. The various consumer groups having maximum demands of 120 MW, 100 MW, 80 MW and 90 MW are connected to the power plant. The annual load factor is 0.8. Calculate (i) The average load (ii) capacity factor (iii) the energy supplied per year (iv) reverse factor (v) demand factor (vi) diversity factor.

2. Attempt any **two** out of the following :   (10×2=20)

(a) Discuss the working of flange heating system and Vernier Labyrinth gland with neat sketch.

(b) In a boiler trial, the analysis of coal gives : C = 81%; H_2 = 4.5%, O_2 = 8% and remainder incombustible. The analysis of dry flue gas gives : CO_2 = 8.3%, O_2 = 10%, N_2 = 80.3% and CO = 1.4%. Calculate mass of air supplied per kg of fuel and the percentage of excess air.

(c) Explain the working of ash handling system and an electrostatic precipitator.

3. Attempt any **two** out of the following :   (10×2=20)

(a) With sketches discuss working principle of various controls of gas turbine power plant.

(b) Discuss the fuel handling and lubrication systems of a diesel power plant with neat sketch.

(c) Following data refer to a gas turbine power plant using intercooling, regeneration and reheating arrangement. Pressure ratio = 64; compressor inlet temperature = 300 K, turbine inlet temperature = 1500 K, compressor efficiency and turbine efficiency are 0.85 and 0.89 respectively. Regenerator effectiveness = 0.81, inlet pressure of the compressor = 1 bar. Determine (i) thermal efficiency (ii) work ratio (iii) air rate.

4. Attempt any **two** out of the following : (10×2=20)

(a) Classify the solar PV system. With sketches discuss the working principle of stand alone solar PV system of a solar power plant.

(b) With the help of a sketch discuss the working principle, merits and demerits of LMFBR nuclear power plant in short.

(c) The following data relate to a hydroelectric power plant : available head = 30 m, catchment area = 450 km², rainfall = 150 cm/year, percentage of total rainfall utilized = 70%, penstock efficiency = 90%, turbine efficiency = 85%, generator efficiency = 90%, load factor = 45%. Calculate the power developed by the turbine and suggest suitable turbine for the plant.

5. Attempt any **two** out of the following : (10×2=20)

(a) With the help of a sketch discuss the SO_2 recovery process in air pollutant of power generation.

(b) With the help of sketch explain the constructional detail of a generator. Why is there a need of generator cooling ?

(c) With the help of a sketch discuss the Ring and Bridging Bus-Bar arrangement of electrical equipments and cooling system of transformer.