Total No. of printed pages = 3

ME 181 PE 13

Roll No. of candidate | | | | | | | | | | |

31/12/2022

2022

B.Tech. 7th Semester End-Term Examination

Mechanical Engineering

POWER PLANT TECHNOLOGY

(New Regulation (w.e.f. 2017-2018) & New Syllabus w.e.f. 2018-19)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following : (MCQ/ Fill in the blanks) (10 × 1 = 10)

(i) Plant use factor is the ratio of kWh generated to the product of plant capacity and the ———— for which the plant was in operation.

(ii) The mounting used to discharge mud, scale or sediments from the boiler is

(a) Fusible Plug (b) Feed check valve

(c) Blow off cock (d) Steam stop valve

(iii) Which of the following is not a benefit of cogeneration

(a) Increased efficiency of energy conversion and use

(b) Reduced power factor

(c) Reduced greenhouse emissions

(d) None of the above

(iv) Which type of solar panel gives lowest efficiency?

(a) Mono crystalline (b) Polycrystalline silicon

(c) Thin film (d) Polycrystalline germanium

(v) If available water head and discharge in a hydro power plant is 50 m and 100 m^3/s respectively. The generator efficiency is 0.85. The power developed by the plant is ————

[Turn over

(vi) Nacelle in wind power plant is located at

(a) On the tower (b) The base of the tower

(c) Middle of the tower (d) Lower half of the tower

(vii) Graphite and CO_2 is used as moderator and coolant receptively in ————————

(a) Gas cooled reactor

(b) Fast breeder reactor

(c) Pressurized water reactor

(d) Boiling water reactor

(viii) 100 solar panels, each of 200 W and 1.5 m^2 are connected to form a photovoltaic system. The annual energy production approximately is ————————, when efficiency of the system is 0.6 and the average annual solar radiation is 1487 kWh/m^2

(ix) What is the correct flow sequence in feed water cycle

(a) Feed pump, Deaerator, Heater, Economiser, Boiler Drum

(b) Deaerator Feed pump, Heater, Economiser, Boiler Drum

(c) Economiser Feed pump, Deaerator Heater, Boiler Drum

(d) Feed pump, Deaerator, Economiser, Boiler Drum, Heater

(x) Petrol is blended with ———————— to make transport fuel.

(a) Bio diesel (b) Bio methane

(c) Bio butanol (d) Bio ethanol

2. (a) A Power station has the following loads

Time (hours)	0-6	6-12	12-14	14-18	18-24
Load (MW)	40	90	70	110	60

(i) Draw the load curve and load duration curve.

(ii) Calculate the load factor, plant capacity factor and reserve factor. (7)

(b) Find the cost of generation per kWh for the plant of capacity 200 MW from the following data:

(i) Capital cost Rs 20,000 per kW installed.

(ii) Interest and depreciation 10% on capital.

(iii) Fuel consumption = 1.2 kg/kWh.

(iv) Fuel cost Rs. 400 per tonne

(v) Salaries, wages, repair, and maintenance = Rs.150×10^6 per year

(vi) Maximum demand = 120 MW; load factor 50% (8)

3. (a) A hydro power station has a reservoir of 2 km^2 and of capacity 5×10^6 m^3. The net head of the water at the turbine is 50 m. If the efficiencies of the turbine and generator are 85% and 95% respectively calculate the total energy in kWh that can be generated from this station. If a load of 15000kW has been supplied for 4 hours, find the fall reservoir. (8)

(b) How does a combined cycle power plant work? Discuss its environmental impact. (7)

4. (a) Compare the working principle of a gas turbine power plant with the stem power plant. (8)

(b) How does a cogeneration power plant produce heat and power? Discuss application and limitation of the cogeneration. (7)

5. (a) Calculate the amount of coal containing the same energy as in 1 kg of Natural Uranium. Also calculate the number of fissions per second to produce 1 kilo watt power. Where, Energy release from one fission of U^{235} = 200 MeV, Atoms in one-grain pure $U^{235} = 25.64 \times 10^{20}$, Calorific value of coal 7800 kcal/kg, U^{235} content in Natural Uranium = 0.72%, Fission deficiency = 45 %, One Joule 0.239 cal. (10)

(b) Discuss how fast breeder reactors differ from regular nuclear power plant? (5)

6. (a) A wind mill is designed to generate an output of 1500 W at wind speed of 5m/s at 1 atm pressure and temperature of 25 °C. What will be the output the same wind null is installed on the top of the mill where the temperature is 10 °C, pressure is 0.85 atm. and wind speed is 6 m/s? (8)

(b) What are the thermoelectrical materials and how does a thermoelectric generator utilize the Seebeck Effect? (7)

7. Write short notes on: (any *three*) $(3 \times 5 = 15)$

(a) Boiler mounting and accessories

(b) Photovoltaic cell

(c) Fluidized bed combustion

(d) Fuel cell

(e) Electrostatic Precipitators