Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 50886

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017
Fifth/Seventh Semester
Mechanical Engineering
ME 6701 – POWER PLANT ENGINEERING
(Regulations 2013)
(Common to Mechanical Engineering (Sandwich)/Electrical and Electronics Engineering)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions.
Use of Steam Table is permitted.

PART – A (10×2=20 Marks)

1. Why majority of coal based thermal power plants are located near Seashore ?
2. Reason out why Cogeneration is quite viable in Sugar industries compared to that in other industries.
3. Justify : Auxiliary Power Consumption of Brayton Cycle is almost twice that of Rankine Cycle despite the thermodynamic processes adopted are similar.
4. State the significance of Load Factor and Capacity Factor of a Gas based Power Plant.
5. Define "electron Volt" with reference to Nuclear Power Plants.
6. Give typical examples for Control Rods.
7. Define Tidal Range (R).
8. Name 2 types of Geothermal Energy Deposits.
9. Define 'Green House Effect'.
10. How 'smog' is defined ?

PART – B (5×13=65 Marks)

11. a) The following data refer to a simple Steam Power Plant. (13)

No.	Location	Pressure Bar	Quality/Temp°C	Velocity m/s
1	Turbine Inlet	60	380	--
2	Condenser Inlet	0.1	0.90	200

Calculate :
- Power Output of the Turbine
- Heat Transfer Rate in Boiler and Condenser
- Quantity of Cooling Water circulated.

(OR)

b) i) With a neat diagram explain the function of FBC Boilers. (6)
ii) Super Critical Boilers (7)

12. a) i) Enlist the advantages and disadvantages of a Diesel Engine Power Plant. (6)
ii) Compare the merits and demerits of open and closed cycle gas turbine power plant. (7)

(OR)

b) A 4.5 MW gas turbine generating set operates with two compressor stages. The overall pressure ratio is 9 : 1. The high pressure turbine drives the compressor while the low pressure turbine drives the generator. The temperature of gases at entry to the HP turbine is 625°C. The exhaust gases leaving the LP turbine are passed through a heat exchanger to heat the air leaving the HP stage compressor. The compressors have equal pressure ratios and intercooling is complete between the stages. The air inlet temperature is 20°C. The isentropic efficiency of each compressor stage is 0.8 and that of each turbine stage is 0.85. The heat exchanger thermal ratio is 0.8. Assume a mechanical efficiency of 93% for both power shaft and compressor turbine shaft. Neglecting other losses, compute
- Thermal Efficiency
- Work ratio of the plant
- Mass flow rate [Take Cp = 1.0 kJ/kg K, γ = 1.4 for air
Cp = 1.15 kJ/kg K, γ = 1.33 for exhaust gases] (13)

13. a) Compare the working, merits and demerits of P W R and B W R. (13)

(OR)

b) i) What is CANDU Type Reactor ? Explain with a neat sketch its main features. (8)
ii) Name the 4 reactions involving Deuterium in a fusion reactor. Which one is achieved quite early ? (5)

14. a) "Solar Thermal Power cycles can be broadly classified into Low, Medium and High temperature cycles". Elaborate this statement with suitable examples and relevant sketches. (13)

(OR)

b) i) The wind velocity is 10 m/s at 22°C. Turbine diameter is 10 m. The wind machine operates at 35 rpm at a peak efficiency of 40%. (6)

Compute the following :

- Total power density of wind stream.
- Actual power density.
- Turbine power output.

ii) Describe the energy generation cycle of 'Single Basin Single Effect' and 'Single Basin Double Effect' systems. (7)

15. a) List various pollutants released by the coal based thermal power plants and detail the techniques adopted to mitigate them. (13)

(OR)

b) i) Indicate and discuss any 4 methods adopted for the disposal of radioactive waste materials. (7)

ii) A generating station supplies four feeders with maximum demands (in MW) 16, 10, 12 and 7. The overall maximum demand of the station is 20 MW and the annual load factor is 45%. Calculate the diversity factor and number of Units generated annually. (6)

PART – C (1×15=15 Marks)

16. a) i) Develop the procedure you would adopt to establish the unit cost of power generation from coal, solar and wind based power generation systems (Hint : Life cycle cost analysis technique). (8)

ii) Draw the Schematic of Anderson cycle based on OTEC and discuss it. (7)

(OR)

b) i) Explain the terms : i) Breeding ratio ii) Converter iii) Doubling. (8)

ii) What is tariff ? Discuss with suitable examples of two part tariff and three part tariff. (7)