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**SEVENTH SEMESTER B.TECH. (ENGINEERING) [09 SCHEME] DEGREE EXAMINATION, NOVEMBER 2016**

ME/PTME 09 704—POWER PLANT ENGINEERING

Time : Three Hours Maximum : 70 Marks

## Part A

*Answer* **all** *questions.*

1. List out various types of combined cycle plants.
2. What is governing of steam turbine ?
3. Differentiate boiler accessories with mountings.
4. Define the term Radioactivity.
5. What are the elements which contribute to the cost of electricity ?

(5 × 2 = 10 marks)

## Part B

*Answer any* **four** *questions.*

6. In a thermal power plant, employing ideal Rankine cycle, superheated steam at 20 bar and 400°C is produced in the boiler and the condenser is operated at 0.2 bar. Calculate the quality of steam at the turbine outlet and cycle efficiency.
7. Describe the steps involved in the inplant handling of coal.
8. State the role of condenser in steam plant along with its classification.
9. Define and write the significance of the term 'equivalent evaporation' in a boiler.
10. Write the principle of MHD plant with sketch.
11. What do you mean by the term power plant economics ?

(4 × 5 = 20 marks)

## Part C

*Answer* **all** *questions.*

12. In a thermal power plant operating on a regenerative Rankine cycle superheated steam at 50 bar and 500°C enters a turbine. A suitable fraction of the steam is withdrawn from the turbine at 10 bar and the rest of the steam expands to the condenser pressure 0.05 bar. Calculate the thermal efficiency of the steam power plant and the mass flow rate of steam if the net power output of the plant is 100 MW. Also compare this efficiency with ideal Rankine cycle efficiency.

*Or*

**Turn over**

13. When does reheating of steam become necessary ? Explain the effect of reheat on cycle output and efficiency with neat sketch.

14. In an impulse steam turbine, steam is accelerated through nozzle from rest. It enters the nozzle at 9.8 bar dry and saturated. The height of the blade is 10 cm and the nozzle angle is 15°. Mean blade velocity is 144 m/s. The blade velocity ratio is 0.48 and blade velocity coefficient is 0.97. Find :

    (i) Energy lost in the nozzles and in moving blades due to friction.

    (ii) Energy lost due to finite velocity of steam leaving the stage.

    (iii) Mass flow rate.

    (iv) Power developed per stage.

    (v) Diagram and stage efficiency. Take : Nozzle efficiency = 92 %

    Blade angles at inlet = Blade angles at out let Speed = 3000 rev/min.

*Or*

15. Draw the layout of a modern steam power plant and explain its working principle. State its limitations.

16. (a) 5,400 kg of steam is produced per hour at a pressure of 750 kPa in a boiler feed with water at 41.5°C. The dryness fraction of steam at exit is 0.98. The amount of coal burnt per hour is 670 kg. of calorific value 31,000 kJ/kg. Determine the boiler efficiency and equivalent evaporation.

(5 marks)

(b) A boiler generates 7.5 kg of steam per kg of coal burnt at a pressure of 11 bar, from feed water having a temperature of 70 °C. The efficiency of boiler is 75 % and factor of evaporation 1.15, specific heat of steam at constant pressure is 2.3 kJ/kgK. Calculate degree of superheat and equivalent evaporation in kg of steam per kg of coal.

(5 marks)

*Or*

17. Describe fluidized bed boiler with neat sketch. List out advantages and disadvantages.

18. Explain with the help of neat sketch, the construction and working of Nuclear power plant.

*Or*

19. A power station has to supply load as follows :

| Time (hours) | 0–6 | 6–12 | 12–14 | 14–18 | 18–24 |
|---|---|---|---|---|---|
| Load (MW) | 45 | 135 | 90 | 150 | 75 |

    (i) Draw load duration curve.

    (ii) Choose suitable generating unitsto supply the load.

    (iii) Calculate the load factor.

    (iv) Calculate the plant capacity factor.

(4 × 10 = 40 marks)