Roll No. ..... Total Pages : 2

BT-5/D-21 **45039**

STEAM GENERATION & POWER

Paper–ME-311E
Option–I

Time Allowed : 3 Hours] [Maximum Marks : 100

Note : Attempt **five** questions in all, selecting at least **one** question from each Unit. All questions carry equal marks. Unless stated otherwise, the Symbols have their usual meaning in context with the subject. Use of steam tables and Mollier diagram is allowed. Assume suitable data, if required.

UNIT-I

1. Explain the following in context with steam and power generation:

   (a) Steam table and its applications

   (b) Natural draught and efficiency of chimney

   (c) Power input to forced draught fan

   (d) Effect of leakage in condenser 5×4=20

2. With a neat sketch explain working of a Wilcox boiler. What are its merits & demerits? Also, explain in detail, the principle of operation of "overfeed & underfeed stokers". 20

UNIT-II

3. Feed-water enters the economizer of a power station steam generator at 180 bar 250°C and with a flow rate of 1500 T/h. The flue gas flow rate is 2200 T/h and the temperatures of the flue gas entering and leaving the economizer coil are 530°C and 360°C, respectively. The overall heat transfer coefficient based on the inside area of the economizer tube is 70 W/m²K. If the velocity of water entering the economizer is 1 m/s and the internal diameter of the tube is 50 mm, find out the number of coils in the economizer and the length of one coil. Take specific heat of flue gas as 1.1 kJ/kg°C. 20

4. Why is it necessary to control the steam temperature at superheater outlet? Also, state the effects of the variations in load and feed water inlet temperature on the outlet steam qualities in steam generator. 20

UNIT-III

5. Explain with the help of suitable derivations, why a subsonic nozzle is convergent while a supersonic nozzle is divergent. 20

6. Find the necessary throat area of a nozzle supplied with steam at 10 bar and 200°C. The rate of mass flow is 1.2 kg/s. Neglecting friction and assuming the speed at the inlet to be low, calculate the speed at the throat, if the steam enters the nozzle at 100 m/s. Take throat pressure 0.545 times the inlet pressure. 20

UNIT-IV

7. A reaction turbine uses 15 kg/s steam at 780 rpm. Its drum diameter is 2.2 m, blade height is 0.2 m and discharging angle is 25°. The pressure at this place is 0.2 bar and dryness fraction 0.96. Estimate power developed in this particular ring. Find heat drop and also pressure drop, assuming the turbine efficiency of 75%, while the steam passes through turbine. 20

8. Explain the difference between impulse and reaction turbines with the help of velocity and pressure variations. Also, discuss their merits and demerits. 20