[Total No. of Questions - 9] [Total No. of Printed Pages - 4]

Dec.-23-0498

ME-605 (Thermal Engineering)

B.Tech. 6th (CBCS)

Time : 3 Hours **Max. Marks : 60**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all Sections, selecting one question from each Section A, B, C and D. Section E is compulsory. Assume any suitable missing data if any. Use of steam tables is allowed.

SECTION - A

1. (a) What is the purpose of fitting the fusible plug in a boiler? What is its location in the boiler? Name the mountings that give warning of low water in a boiler. (5)

   (b) What do you understand by the term 'boiler draught'? What are the various types of draughts used in usual practice? (5)

OR

2. A chimney of 40 m of height discharges hot gases at 350°C, when the outside air temperature is 30°C, 15 kg of air per kg of fuel is required to burn the coal on the grate. Calculate the following:

   (a) Draught in mm of water column.

   (b) Equivalent draught in m of hot gas column.

   (c) Volume flow rate of hot gases passing through the chimney if 1350 kg of coal is burnt per hour over the grate. (10)

SECTION - B

3. Dry and saturated steam enters a nozzle at a pressure of 11 bar and velocity of 80 m/s. The discharge pressure is 5 bar and discharge velocity is 500 m/s. The quantity of steam flowing is 2 kg/s and heat loss from the nozzle is 8 kJ/s. Determine the heat drop and final dryness fraction of steam. (10)

OR

4. In a reheat cycle, the initial steam pressure and the maximum temperature are 150 bar and 550°C respectively. If the condenser pressure is 0.1 bar and the moisture at the condenser inlet is 5%, and assuming ideal processes, determine (a) the reheat pressure, (b) the cycle efficiency, and (c) the steam rate. (10)

SECTION - C

5. An impulse turbine with a single row wheel is to develop 99.3 kW, the blade speed being 150 m/sec. A mass of 2 kg of steam per second is to flow from the nozzles at a speed of 350 m/sec. The velocity coefficient of the blades may be assumed to be 0.8 while the steam is to flow axially after passing through the blades ring. Determine the nozzle angle and the blade angles at inlet and exit assuming no shock. Estimate also the diagram efficiency of the blading. (10)

OR

6. Write short note on the following, giving sketches wherever necessary:

   (i) Governing of steam turbines.

   (ii) "Re-heat factor" used in connection with steam turbines.

   (iii) Back-pressure steam turbines.

   (iv) Steam extraction turbines. (4×2½=10)

[P.T.O.]

SECTION - D

7. (a) What is the function of a condenser in a modern steam condensing power plant?

   (b) The vacuum in the condenser is 716 mm of Hg when the barometer reads 748 mm. In another case, the vacuum in the condenser is 705 mm of Hg when the barometer reads 754 mm. Correct these vacuum gauge readings to a standard barometer of 760 mm. (3+7=10)

OR

8. The following data refer to surface condenser:

Mean temperature of condenser is 40°C,	Temperature of condensate is 35°C
Barometer reading 760 mm of Hg,	Condenser vacuum 650 mm of Hg
Condensate collected 980kg/h,	Cooling water used 36850 kg/h
Cooling water inlet temperature 18°C,	Rise in cooling water temperature 15°C

Calculate

(i) Condenser efficiency, (ii) dryness fraction of steam entering the condenser (iii) capacity of air pump in m^3/min. (iv) mass of air handled in kg/h. (10)

SECTION - E (Compulsory)

9. Attempt the following questions. (2 marks each)

   (i) "Water is not an ideal working fluid Rankine Power Cycle". Justify the statement.

   (ii) Distinguish between 'water-tube' and lire-tube' boilers and state under what circumstances each type would be used.

(iii) Differentiate between pressure compounding and velocity compounding.

(iv) Define the term condenser efficiency of a steam condensing plant. What factors contribute to loss of efficiency in a surface condenser?

(v) What do you understand by "Equivalent evaporation" from and at 100°C as applied to a steam boiler?

(vi) What do you understand by 'partial pressure' as applied to the condenser of a steam plant and what is the law connecting them?

(vii) Explain the expansion of steam under the conditions of supersaturation.

(viii) Distinguish between artificial and natural draught. Why an artificial draught is considered advantageous over a natural draught?

(ix) Explain what do you understand by bleeding as applied to steam turbine practice.

(x) Explain the term "Degree of Reaction" of the reaction turbine. (10×2=20)