Ref. No. : Ex/ME/5/T/524H/2024(S)

BACHELOR OF ENGINEERING (MECHANICAL ENGINEERING) FIFTH YEAR SECOND SEMESTER SUPPLEMENTARY EXAM- 2024

STEAM GENERATORS

Time: 3 hours | Full Marks: 100

Answer any five questions. *Different parts of the same question should be answered together. Assume any relevant data if necessary. Use of Steam tables and charts are allowed.*

1. *Answer the following questions*: 4x5=20
   a) What are the requirements of boilers? Classify the different types of boilers.
   b) Why indirect method of determining boiler efficiency is more useful than direct method?
   c) List the boiler mounting and accessories.
   d) Describe the function of Fusible plug?
   e) Explain the function of air-preheater in a steam boiler installation. Discuss its location.

2. a) Explain the construction and working of a La Mont boiler with the help of a net sketch. 10
   b) Explain the working of Bourdon's pressure gauge with the help of a net sketch. 10

3. The A 40-m high chimney is discharging flue gases at 350°C, when the ambient temperature is 30°C. The quantity of air supplied is 18 kg per kg of fuel burnt. Determine (a) draught produced in mm of water, (b) equivalent draught in metres of hot-gas column, (c) efficiency of the chimney, if minimum temperature of artificial draught is 150°C: the mean specific heat of flue gases is 1.005 kJ/kg- K, (d) the percentage of the heat spent in natural draught system, if the net calorific value of the fuel supplied be 30600 kJ/kg, and (e) the temperature of chimney gases for maximum discharge in a given time and what would be the corresponding draught in mm of water produced. 20

4. a) Calculate the equivalent evaporation from and at 100^0C for a boiler, which receives water at 60^0C and produces steam at 1.5 MPa and 300^0C.The steam generation rate is 16000kg/h. Coal is burnt at the rate of 1800 kg/h. The calorific value of coal is 34750 Kj/kg. Also calculate the thermal efficiency of the boiler.
   If the thermal efficiency of the boiler increases by 5% due to use of an economiser, find the saving in coal consumption per hour. 10

   (b) Write the function of a steam separator and a steam trap with neat sketch. 10

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5. a) Derive an expression for maximum discharge through a chimney. 10

   b) Define equivalent evaporation, factor of evaporation, boiler efficiency. 10

6. a) What is the harmful effect of silica in water? How it is removed? 6
   b) Explain a steam jet draught with its features. 8

   c) State the advantages of artificial draught over natural draught. 6