11819

3 Hours / 100 Marks   Seat No.

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

(8) Use of Steam tables, logarithmic, Mollier's chart is permitted.

Marks

1. a) **Attempt any SIX of the following:**   **12**

(i)   Define intensive property. Give two example.

(ii) State Kelvin-plank statement.

(iii) State Boyle's Law.

(iv) Draw P-V and T-S diagram for isothermal process.

(v)   Define boiler mountings with two examples.

(vi) List four losses in steam turbine.

(vii) Define condenser efficiency.

(viii) State Fourier's Law of heat conduction.

Marks

b) **Attempt any TWO of the following:**   **8**

   (i)   Define the following terms.

      (1) Dryness fraction.

      (2) Enthalpy of wet steam.

      (3) Enthalpy of dry saturated steam.

      (4) Enthalpy of superheated steam.

   (ii) Explain function of cooling tower in steam power plant and write its two uses.

   (iii) Classify heat exchanger and state their application.

2.   **Attempt any FOUR of the following:**   **16**

a) Define thermodynamics system. Give its classification and explain each with suitable example.

b) State the limitations of first law of thermodynamics.

c) Two Kg of gas at 250 °K is compressed polytropically from 250 KPa to 400 KPa. The index of compression is 1.25 find

   (i)   Final temperature.

   (ii) Change in internal energy.

d) What is function of air preheater? State its advantages.

e) Explain working principle of reaction steam turbine by using pressure - velocity variation diagram.

f) Explain with neat sketch working of regenerative feed heating system. State any two advantages.

3.   **Attempt and FOUR of the following:**   **16**

a) What is heat pump? How does it differ from refrigerator.

b) Write equation for

   (i)   Workdone

   (ii) Heat transfered

   for isobaric process.

c) Represent steam generation process at constant pressure on T-S diagram and show following on it.

   (i)   Saturated liquid line.

   (ii) Saturated vapour line

   (iii) Wet region.

   (iv) Critical point

d) Explain the concept of mach number. State its significance.

e) Write sources of air leakage and its effect in condenser.

f) Explain working of shell and coil type heat exchanger with neat sketch.

4.   **Attempt any <u>FOUR</u> of the following:**   **16**

a) Explain the following terms

   (i)   State

   (ii) Process

   (iii) Point function

   (iv) Path function

b) 4 kg of steam at pressure of 2 MPa exist in dry and saturated condition. Calculate following:

   (i)   Enthalpy

   (ii) Entropy

   (iii) Volume

   (iv) Internal energy

c) Explain the principle used in forced draught and induced draught in boiler. Also state the advantages.

d) Explain nozzle control governing of steam turbine with neat sketch.

e) Find the condenser efficiency, when cooling water enter a condenser at temperature of 30°C and leaves at 42°C. The vacuume produced is 710 mm of Hg and barometer reads 760 mm of Hg.

f) Explain the following terms
   (i)   Absorptivity
   (ii) Transmissivity
   (iii) Emissivity
   (iv) Black body

5.   **Attempt any TWO of the following:**   16

a) Write steady flow energy equation. State significance of each term in it. Apply SFEE to Boiler, Nozzle, Turbine and Condenser.

b) 3.5 m^3 of gas at 6 bar and 180°C is heated at constant pressure till volume is doubled. If C_p = 1 kJ/Kg K and C_v = 0.715 kJ/Kg K find
   (i)   Work transferred
   (ii) Heat transferred
   (iii) Change in internal energy
   (iv) Change in entropy

c) Give classification of steam condenser and explain with neat sketch of evaporative condenser.

6.   **Attempt any TWO of the following:**   16

a) Explain the construction and working of babcock and wilcox boiler with neat sketch show the path of water, steam and air flue gases.

b) What is compounding of steam turbine? Explain pressure compounding.

c) The wall of refrigerated van of 1.6 mm of steel sheet at outer surface, 13 mm plywood at inner surface and 4 cm of glass wool in between. Calculate the rate of heat if the temperature at the inside and outside surface are –10°C and 25°C.

   Take   K (Steel) = 23.2 w/mk
            K (for glass) = 0.14 w/mk
            K (plywood) = 0.052 w/mk

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