22223

3 Hours / 70 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. **Attempt any <u>FIVE</u> of the followings:**   **10**

a) Define and give one example of each

i)   Energy

ii) Work

b) Represent Isentropic process on P-V and t-s chart

c) A sample of 10 kg of wet steam contains 0.5 kg of water, which is in suspension. Find its dryness fraction.

d) What is compounding of steam turbine.

e) Write continuity equation for the nozzle.

f) Draw neat sketch of induced draught cooling tower.

g) Define and write unit for followings

i)   Absolute temperature

ii) Heat

Marks

2. **Attempt any THREE of the followings:** **12**

   a) Explain the First Law of Thermodynamics with an example.

   b) Write statements of following Laws and write equation for it.

       i) Ideal gas Law

       ii) Boyle's Law

       iii) Charle's Law

   c) Represent the following processes on p-V, t-S and n-S charts.

       i) In a constant volume process A-B, initial condition of steam is superheated and final condition is wet.

       ii) In a constant volume process B-C, initial condition of steam is wet and final condition is liquid.

   d) Explain the working of Babcock and wilcox Boiler with neat sketch.

3. **Attempt any THREE of the followings:** **12**

   a) Define Mach Number. How it affects performance of steam nozzle.

   b) Explain construction and working of steam turbine.

   c) A nitrogen is expanded from 10 bar to 1 bar at 50°C according to PV = constant. Plot the process on P-V and t-s chart and state formula to find out amount of heat released, work done and change in entropy.

   d) Determine quantity of heat required to convert 100 Kg of water at 30°C into dry steam at 10 bar.

Marks

4. **Attempt any THREE of the followings:** 12

   a) Define vacuum. How it is necessary to operate condensers?

   b) Draw schematic and show heat-work interaction for heat engine, heat pump and refrigerator.

   c) 10 m^3 of a gas at 30°C and 5.0 bar is expanded isothermally to 1 bar. Find out heat transferred during process, change in internal energy and work done.

   d) Explain construction and working of shell and tube-type heat exchanger. Write its different industrial applications.

   e) Explain throttling process with neat sketch.

5. **Attempt any TWO of the followings:** 12

   a) Describe construction and working of

     i) Impulse turbine

     ii) Reaction turbine

   b) The initial condition of steam is 100%. dry at 10 bar pressure. It expands to 1.0 bar by $P.V = c$. Find

     i) Find saturation temperature

     ii) Quality of steam.

   c) An outer wall of office consists of 20 cm layer of brick. It is followed by 4 cm layer of gypsum plaster and 6 cm of rockwool insulation Estimate quantity of heat transfer through wall.

   Take thermal conductivity of brick = 0.7 W/(m.k.)

     thermal conductivity of gypsum plaster = 0.5 W/(m.k.)

     thermal conductivity of insulation = 0.065 W/(m.k.)

Marks

6. **Attempt any <u>TWO</u> of the followings:** **12**

a) Write modes of heat transfer. Explain each with suitable example and neat sketch.

b) Describe construction and working of forced circulation cooling tower.

c) Classify parallel flow and counter flow heat exchangers with respect to parameters.

    i) Definition

    ii) Flow of fluids

    iii) Capacity

    iv) Maintenance

    v) Applications

    vi) Cost

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