22337

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

Marks

1. **Attempt any FIVE of the following:** 10

a) Define -

(i) Intensive property

(ii) Extensive property. Give one example of each.

b) Represent Isochoric Process on P-V and T-S chart.

c) A sample of 35 Kg of dry steam contains 0.7 Kg of water is in suspension, find its dryness fraction.

d) Suggest the different methods to control the speed of rotation of steam turbine constant at all varying loads.

e) Explain the functions of steam nozzle.

f) Write the elements of forced draught cooling tower.

g) Define -

(i) Thermal conductivity

(ii) Thermal resistance

Marks

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

a) Explain the concept of flow work associated with flow processes.

b) Two leg of gas contained in cylinder at a pressure of 7 bar and temperature 27°C expands four times its original volume at constant pressure. Calculate -

   (i) Work done by gas

   (ii) Heat added

c) In a constant pressure vapour process, the initial condition of steam is wet and final condition is superheated. Represent the process on P–V, T–S, and H–S chart.

d) Explain the working of Lamont boiler with neat sketch.

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

a) Write the criteria for selection of nozzle for given situation.

b) Explain the need of compounding. Suggest the method of compounding for reaction steam turbine with justification.

c) A nitrogen gas is expanded from 8 bar to 1 bar at 47°C according to law $PV = C$. Plot the process on P–V and T–S diagram and state the formulas to be used to find out workdone, Amount of heat supplied and change in entropy.

d) Determine the amount of heat required to convert 2 Kg of water at 25°C into steam at 5 bar and having 90% dry.

Marks

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

a) Explain Dalton's law of partial pressure. How it is applicable to condenser?

b) A system is composed of a gas contained in a cylinder fitted with a piston. The gas expands from the state 1 for which Internal energy U_1 = 75 KJ to state 2 for which U_2 = –25 KJ. During the expansion the gas does 60 KJ of work on the surrounding. Determine the heat transferred to or from the system during the process.

c) 3 m^3 of gas of 30°C and 6 bar pressure is expanded isothermally to 1 bar. Find work done, change in internal energy and heat transferred during the process.

d) Explain construction and working of shell and tube type heat exchanger. A ice plant producing 2000 Kg ice per day required the condenser. Suggest the type of condenser with justification.

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

a) (i) Suggest the methods to improve the performance of steam turbine. Explain any one in brief.

   (ii) Identity the different losses occoured in steam turbine.

b) An exterior wall of house consists 10.6 cm layer of common brick. It is followed by 3.8 cm layer of gypsum plaster and 5.83 cm of rockwool insulation. Estimate the amount of heat transferred through structure it.

Thermal conductivity of brick = 0.7 W/mk

Thermal conductivity of Plaster = 0.48 W/mk

Thermal conductivity of Insulation = 0.065 W/mk

c) The initial condition of steam is 15% wet at a pressure of 7 bar. It expands to 1.2 bar by PV^{1-3} = C. Find

   (i) Quality of steam at the end of expansion

   (ii) Work done.

Marks

6. **Attempt any TWO of the following:** **12**

a) A mass of 0.8 Kg of air at 1 bar and 25°C is contained in a gas tight frictionless piston cylinder device. The air is now compressed to a final pressure of 5 bar. During this process the heat is transferred from air such that the temperature inside the cylinder remains constant. Calculate the heat transferred and work done during process and direction of each in the process.

b) For steam power plant having capacity 600 MW capacity a cooling tower is required to set up with condenser. Suggest the type of condenser and cooling tower with justification.

c) Suggest the type of heat exchangers for following applications -

    (i) Dairy plant (Milk Chilling Plant)

    (ii) Condenser of refrigeration system (House hold system) Justify your answers.

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