Total No. of Questions—8] [Total No. of Printed Pages—3

Seat
No.

[5352]-513

S.E. (Mechanical/Automobile/Sandwich) (I Sem.) EXAMINATION, 2018
THERMODYNAMICS
(2015 PATTERN)

Time : Two Hours Maximum Marks : 50

N.B. :— (i) Solve Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

(ii) Answer for the four questions should be written in same answer-book attach supplement if required.

(iii) Neat diagrams should be drawn wherever necessary.

(iv) Use of steam tables, Psychrometric chart, Mollier charts, scientific calculator allowed.

(v) Use of pocket calculator and different gas charts as applicable is allowed.

(vi) Assume suitable data, if necessary.

(vii) Figures to the right indicate full marks.

Q1) a) Explain the concept of i) Heat Engine, ii) Heat Pump and iii) Refrigerator with neat sketch and write down the expression for Efficiency or COP as applicable. [6]

b) A copper block of mass 1 kg at 500 K is immersed in lake at 300 K till it reaches thermal equilibrium with water. Find the total i) Total heat transferred to the lake, ii) Change in entropy of the lake, iii) Change in entropy of Copper (Cp of copper=0.386 kJ/kg K, Cp of water= 4.187 kJ/kg-K). [6]

OR

Q2) a) Explain the principle of increase of entropy and write down the formula for change in entropy for i) Reversible process, ii) Irreversible process and iii) Impossible process. [6]

b) During a Thermodynamics cycle heat transfer during various processes is: 120 kJ, -16 kJ, -48 kJ and 12 kJ. Find the net work done during the cycle. [6]

P.T.O.

Q3) a) Show the following cycles with neat sketch, [6]
1. Carnot Cycle on T-s diagram.
2. Otto Cycle on P-v diagram.
3. Diesel Cycle on P-v diagram.
4. Dual Cycle on P-v diagram.
5. Brayton cycle on P-v diagram.
6. Reversed Brayton cycle on P-v diagram.

b) Find the enthalpy of 1 kg of steam at 12 bar when, [6]
i) Saturated liquid condition, ii) Steam is dry saturated, iii) steam is 22 % dry, iv) steam is 50 % dry v) steam is superheated to 250 deg. C, v) sub-cooled to 100 deg. C (Cp=2.25 kJ/kg K)

OR

Q4) a) Explain process of formation of steam on T-h diagram starting from -10 deg. C [6] (ice state) to 120 deg. C (Superheated condition) at atmospheric pressure.

b) An engine is working on Otto cycle. The pressure and temperature at the [6] beginning of compression stroke are 1 bar and 300 K and the temperature at the end of compression stroke is 600 K. If the temperature at the end of constant volume heat addition process is 1800 K. Calculate the air standard efficiency, heat addition per kg of air and heat rejected per kg of air.

Q 5) a) Give the function and location of any 3' of the following, [6]
i) Super heater.
ii) Air pre heater
iii) Fusible plug
iv) Water level indicator.
v) Spring loaded safety valve.

b) 5500 kg/hr steam is produced at a pressure of 76 bar in a boiler with a dryness [7] fraction of 0.98. The feed water temperature is 51 deg. C. The amount of coal burnt is 650 kg having C.V. of 3500 kg. Determine the following,
i) Boiler efficiency ii) Equivalent evaporation per kg of fuel burnt.

OR

Q 6) a) Explain the Boiler heat balance sheet with formulas used. [6]

b) The boiler trial following observations are recorded mass of fuel is 1520 kg/hr. [7] The temperature of feed water is 30 deg. C. Dryness fraction of steam is 0.95. The pressure of steam is 8.5 bar, Coal burns per hour = 200 kg, CV of coal is 27300 kJ/kg. The un burnt coal collected is 60 kg/hr with a CV of 2000 kJ/kg. The mass of flue gases is 17.73 kg/kg of coal burnt. The temperature of flue gases is 330 deg. C. The boiler room temperature is 27 deg. C. Specific heat of the flue gases 1 kJ/kg K. Draw Boiler heat balance sheet per kg of fuel burnt and calculate the efficiency of the boiler.

Q 7) a) Define Human comfort condition and discuss the factors affecting human comfort. [6]

b) Atmospheric air at 30 deg. C DBT and 18 deg. C WBT is cooled to 20 deg. C DBT without changing its moisture content. Find i) initial enthalpy and specific humidity of air, ii) Final relative humidity of air and WBT, iii) Sensible heat removed per kg of air. [7]

OR

Q8) a) Draw following processes on sketch of Pscychrometric chart [6]
    i) Sensible cooling.
    ii) Sensible heating.
    iii) Heating and Humidification.
    iv) Heating and Dehumidification,
    v) Cooling and Humidification.
    vi) Cooling and Dehumidification.

b) Moist air enters a steam heating coil at 10 deg. C, 50 % RH which is heated sensibly and leaves the coil at 30 deg. C. The mass flow rate of the moist air is 50 kg/s. Find: 1. Sensible heat gained by air, ii) Mass flow rate of the steam in the coil if the steam enters the coil as saturated steam and the condensate leaves the coil at 85 deg. C at atmospheric pressure. [7]