Total No. of Questions—**8**] [Total No. of Printed Pages—**6**

Seat No.	

[5459]-112

S.E. (Mechanical/Automobile/Sandwich) (I Sem.)

EXAMINATION, 2018

THERMODYNAMICS

(2015 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Solve 4 questions, Q. **1** *or* Q. **2**, Q. **3** *or* Q. **4**, Q. **5** *or* Q. **6**, Q. **7** *or* Q. **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, Pscychrometric chart, Mollier Charts, scientific calculator is allowed.

(*v*) Assume suitable data, if necessary.

(*vi*) Figures to the right indicate full marks.

1. (*a*) With the help of simple sketch write down the equation for the application of SFEE to the following engineering devices (any *three*) : [6]

(1) Boiler

(2) Nozzle

(3) Turbine

(4) Pump

(5) Throttling device.

P.T.O.

(*b*) During a closed system under constant pressure process pressure is 105 kPa properties of the system change from volume 0.25 m^3 to 0.45 m^3 and temperature changes from 283 K to 513 K assuming 1 kg of mass and specific heat of 0.44 kJ/kgK. Determine : [6]

(1) Heat transfer

(2) Work transfer

(3) Change in internal energy.

Or

2. (*a*) State and explain increase of entropy principle and write down the change in entropy of universe for reversible process, irreversible process and impossible process. [6]

(*b*) In a system, executing a non-flow process, the work and heat per degree change of temperature are given by dW/dT = 200 Joule/deg. C and dQ/dT = 160 Joule/deg. C. What will be the change of internal energy of the system when its temperature changes from T1 = 55 deg. C to T2 = 95 deg. C. [6]

3. (*a*) Define and explain any *six* of the following terms with neat sketch showing piston and cylinder arrangement for air standard cycle : [6]

(*i*) Clearance volume.

(*ii*) Swept volume.

(*iii*) Total Volume

(*iv*) TDC

(*v*) BDC

(*vi*) Compression ratio

(*vii*) Cylinder bore.

(*b*) 2 kg of steam is at 8 bar pressure and 0.8 dry.

Determine :

(1) Total enthalpy of the steam,

(2) Total volume of the steam,

(3) Total entropy of the steam.

This steam is further heated at the same pressure till it becomes completely dry saturated. Estimate, a. total change in enthalpy (or heat added) to the steam during the process. [6]

Or

4. (*a*) Define dryness fraction. Draw neat sketch of throttling calorimeter and derive the formula for dryness fraction measurement by throttling calorimeter. [6]

(*b*) 1 kg of air at 500 K is heated reversibly at constant pressure till 2000 K. Find the available and unavailable part of energy. Take Cp = 1.005 kJ/kgK, surrounding Temp. (T_0) = 300 K. [6]

5. (*a*) Draw the block diagram of boiler plant layout showing location of different accessories and distinctly show the water, air and flue gas circuit. [6]

(*b*) The boiler trial following observations are recorded mass of steam generated is 1520 kg/hr. 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 burnt per hour = 200 kg, CV of coal is 27300 kJ/kg. The unburnt 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 RT is 27 deg. C. Specific heat of the flue gases 1 kJ/kgK. Draw Boiler heat balance sheet per kg of fuel burnt and calculate the efficiency of the boiler. [7]

Or

6. (*a*) List down different boiler mountings for :

(*i*) Boiler Safety,

(*ii*) Steam Control,

(*iii*) Maintenance.

Also discuss their function in short. [6]

(*b*) Determine the Air-Fuel ratio for an oil fired steam generator for the following data recorded : [7]

Chimney height = 40 m

Chimney draught measured = 25 mm of water column

Flue gases temperature coming out through chimney = 367 deg. C

Ambient air temperature = 20 deg. C

Also calculate the velocity of flue gases through chimney neglecting flow losses.

7. (*a*) Define the following terms : [6]

(*i*) DBT

(*ii*) Specific humidity

(*iii*) WBT

(*iv*) Relative humidity

(*v*) Degree of saturation

(*vi*) DPT.

(*b*) Moist air at 40 deg. C DBT and 20 deg. C WBT is sensibly cooled to 26 deg. C DBT. Plot the process on Psychrometric chart (attach the chart to answer sheet) and determine :

(1) Final WBT

(2) Total heat transferred in kW for air flow rate of 100 m^3/min

(3) Bypass factor of cooling coil if the coil surface temperature is 22 deg. C. [7]

Or

8. (*a*) Draw neat labelled diagram for the following Psychrometric processes (any *three*) : [6]

(*i*) Sensible heating and write the equation for heat added.

(*ii*) Sensible cooling and write the equation for heat removed.

(*iii*) Humidification and write the equation for moisture added.

(*iv*) Dehumidification and write the equation for moisture removed.

(*b*) The moist air at 30 deg. C DBT and 75% RH enters the refrigeration coil at the rate of 120 m^3/min. The coil DPT is 14 deg. C and Bypass factor of coil is 0.1. Plot the process on Psychrometric chart (attach the chart to answer sheet) Determine :

(1) Air temperature leaving the coil

(2) Capacity of cooling coil in kW and Tons of Refrigeration (TR). [7]