Total No. of Questions—**8**] [Total No. of Printed Pages—**7**

Seat No.	

[5057]-2012

S.E. (Mechanical/Automobile/Sandwich) (First Semester)

EXAMINATION, 2016

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** and 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 must be drawn wherever necessary.

(*iv*) Use of steam tables, Mollier Charts, scientific calculator is 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.

1. (*a*) Discuss the important points of similarities and differences between heat and work. [6]

P.T.O.

(*b*) A reversible heat engine operates between three heat reservoirs. The engine receives 80 kW heat from reservoir A at 800 K and develops 20 kW power. The engine rejects heat to sink B and sink C. The sink B and sink C are at 300 K and 400 K respectively. Determine the heat rejected to the sink. [6]

Or

2. (*a*) Derive the following equations for an ideal gas undergoing isobaric process : [6]

(*i*) Work done

(*ii*) Heat transfer

(*iii*) Change in entropy

(*iv*) Change in internal energy and enthalpy

(*v*) Polytropic index of the process.

(*b*) A heat pump is used to maintain the house at 23 deg. C. The house is losing heat to outside air through walls at 60,000 kJ/hr. Heat generated by various appliances inside the house is 4000 kJ/hr. For a COP of 1.5, find required power input in kW supplied to the heat pump. [6]

3. (*a*) Derive the expression of efficiency for air standard Otto cycle. [6]

(*b*) In a standard vapor compression refrigeration cycle, operating between evaporator of –10 deg. C and condenser of 40 deg. C, the enthalpy of the refrigerant R134a at the end of the compression is 440 kJ/kg. Draw the cycle on P-h chart. Assume exit of the condenser to be saturated liquid and entry of the compressor to be dry vapor. hf (at –10 deg. C) = 186.78 kJ/kg, hg (at –10 deg. C) = 392.75 kJ/kg, hf (at 40 deg. C) = 256.35 kJ/kg, hg (at 40 deg. C) = 419.58 kJ/kg.

Calculate :

(*i*) Refrigerating effect

(*ii*) Compressor power and

(*iii*) COP. [6]

Or

4. (*a*) Explain with neat labeled diagram separating calorimeter. [6]

(*b*) An Otto Cycle engine has a bore of 80 mm and stroke of 85 mm. The clearance volume of the engine is 0.06 litre. The actual thermal efficiency of the engine is 22%. Determine : [6]

(*i*) Compression ratio

(*ii*) Air standard efficiency

(*iii*) Relative efficiency of the engine.

Assume, gama = 1.4.

5. (*a*) List down and discuss the function of at least 3 mountings and 3 accessories. [6]

(*b*) A gas fired boiler operates at a pressure of 100 bar. The feed water temperature is 256 deg. C. Steam is produced with a dryness fraction of 0.9 and in this condition it enters a superheater. Superheated steam leaves the superheater at a temperature of 450. Deg. C. The boiler generates 1200 Tonne of steam per hour with a thermal efficiency of 92%. The gas used has a calorific value of 38 MJ/m^3.

Determine :

(*i*) Heat transfer per second in producing wet steam in the boiler.

(*ii*) Heat transferred per second in producing superheated steam in superheater.

(*iii*) Volume of gas used in m^3/hr. [7]

Or

6. (*a*) Discuss the functions and location of various boiler mounting and accessories. [6]

(*b*) Calculate the height of the chimney, velocity of flue gases and mass of flue gases flowing through the chimney when the draught is produced equal to 1.9 cm of water. Temperature of flue gases is 290 deg. C and ambient temperature is 20 deg. C. The flue gases formed per kg of fuel burnt are 23 kg. Neglect the losses and take the diameter of the chimney as 1.8 m. [7]

7. (*a*) Define : [6]

(*i*) Degree of saturation

(*ii*) Saturated air

(*iii*) Relative humidity

(*iv*) Dry bulb temperature

(*v*) Wet bulb temperature

(*vi*) Wet bulb depression.

(*b*) Moist air of mass flow rate 200 m^3/min at 15 deg. C DBT and 75% RH is heated until its temperature reaches to 25 deg. C. Find the following : [7]

(*i*) RH of heated air,

(*ii*) WBT of heated air,

(*iii*) Heat added to air in kW.

Or

8. (*a*) With a neat sketch represent any *three* of the following processes on Pscychrometric chart : [6]

(*i*) Sensible heating and Sensible cooling

(*ii*) Humidification and Dehumidification

(*iii*) Cooling and Dehumidification

(*iv*) Heating and Humidification.

(*b*) On a particular day, the atmospheric air conditions are recorded as 30 deg. C, DBT and 40% RH. Determine the due point temperature and wet bulb temperature of air. If this air cooled in the air washer using recirculated spray water and having a humidifying efficiency of 90%, what is dry bulb temperature and dew point temperature of air leaving the air washer ? [7]