Total No. of Questions—**8**] [Total No. of Printed Pages—**4**

Seat No.	

[5152]-113

S.E. (Mechanical/Automobile/Sandwich)

(First Semester) EXAMINATION, 2017

THERMODYNAMICS

(2012 PATTERN)

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

N.B. **:—** (*i*) Solve **4** questions, 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 of 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*) Apply the second law of thermodynamics to heat engines, refrigerators and heat pumps and derive the formula for efficiency or COP of the device. [6]

P.T.O.

(*b*) A mass of 0.8 kg of air at 1 bar and 25 deg. C is contained in a gas tight friction less piston cylinder device. The air is now compressed till final pressure of 5 bar. During the process, heat is transferred from the air in such a manner that temperature inside the cylinder remains constant throughout. Calculate the heat transferred, work done and change in entropy during the process and direction of each in the process. [6]

Or

2. (*a*) Prove that entropy is the property of the system. [6]

(*b*) A small turbine runs an aircraft refrigeration system. Air enters the turbine at 4 bar and 40 deg. C and velocity of 40 m/s. At the exit air is at 1 bar, 2.5 deg. C and having velocity of 200 m/s. If the work output of the turbine is 52 kJ/kg of the air, calculate the heat transferred per kg of air, Assume C_P for air 1.005 kJ/kgK. [6]

3. (*a*) Discuss the concept of Available energy, Unavailable energy and total heat input and represent the same on T-s diagram for Carnot cycle. [6]

(*b*) Determine the amount of heat that should be supplied to 2 kg of water at 25 deg. C to convert into steam at 5 bar and 0.9 dry. [6]

Or

4. (*a*) Explain with neat labeled T-s diagram Rankine vapor power cycle and derive the equation for efficiency of Rankine cycle. [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 :

(*i*) Compression ratio,

(*ii*) Air standard efficiency,

(*iii*) Relative efficiency of the engine.

Assume, gamma = 1.4. [6]

5. (*a*) Define and explain the concept of :

(*i*) Boiler efficiency and

(*ii*) Equivalent evaporation in case of boiler plants. [6]

(*b*) The following readings were recorded during a trial of six hours duration :

(*i*) Steam pressure 12 bar,

(*ii*) Mass of steam generated 40.000 kg,

(*iii*) Mean dryness fraction 0.85,

(*iv*) Mean feed water temperature 30 deg. C,

(*v*) Coal used 4000 kg,

(*vi*) CV of coal 33400 kJ/kg.

Calculate :

(*i*) Equivalent evaporation from and at 100 deg. C.

(*ii*) Efficiency of the boiler. [7]

Or

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

(*b*) Calculate the height of Chimney required to produce a draught equivalent to 1.7 cm of water of the flue gas temperature is 270 deg. C and ambient temperature is 22 deg. C and minimum amount of air per kg of fuel is 17 kg. [7]

7. (*a*) Derive the relation for minimum amount of air required per kg of fuel for complete combustion. [6]

(*b*) A fuel consists of 72% carbon, 20% hydrogen and 8% oxygen by mass. Determine stoichiometric mass of air required to burn 1 kg of fuel completely. [7]

Or

8. (*a*) Discuss the construction and working of Bombs Calorimeter with neat sketch and thus derive the formula for HCV. [6]

(*b*) Determine the air fuel ratio and the theoretical amount of air required by mass for complete combustion of a fuel containing 85% carbon, 8% hydrogen, 3% oxygen, 1% sulphur and remaining is ash. If 40% of excess air is used. [7]