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

Seat No.	

[4957]-1012

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

EXAMINATION, 2016

THERMODYNAMICS

(2012 PATTERN)

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

N.B. **:—** (*i*) Answer 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 requried.

(*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 concept of point function and path function. Explain with examples and suitable diagram. [6]

(*b*) Steam at a 6.87 bar, 205°C, enters in an insulated nozzle with a velocity of 50 m/s. It leaves at a pressure of 1.37 bar and a velocity of 500 m/s. Determine the final enthalpy of steam. [6]

P.T.O.

Or

2. (*a*) Draw the P-v diagram of various thermodynamic processes for ideal gas; clearly indicating polytrophic index or slope of each process. [6]

(*b*) In an I.C. Engine during the compression stroke heat rejected to the cooling water is 50 kJ/kg and work input is 100 kJ/kg. Calculate the change in internal energy of the working fluid stating that whether it is gain in internal energy or loss of internal energy. [6]

3. (*a*) Derive the relation for efficiency for Otto gas power cycle. [6]

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

Or

4. (*a*) Discuss the principle and working of Throttling Calorimeter with neat labelled diagram and show the process on h-s diagram. [6]

(*b*) An engine of 250 mm bore and 375 mm stroke works on Otto cycle. The clearance volume is 0.00263 m^3. The initial pressure and temperature are 1 bar and 50°C. If the maximum pressure is limited to 25 bar, find the following : [6]

(*i*) The air standard efficiency of the cycle.

(*ii*) The pressure ratio or exposion ratio.

Assume the ideal conditions.

5. (*a*) Discuss the Boiler plant layout indicating loation of various accessories and water, air and flue gas circuit. [6]

(*b*) 5400 kg of steam is produced per hour at a pressure of 750 kPa in a boiler when feed water is at 41.5 deg. C. The dryness fraction of the steam is 0.98. The amount of the coal burnt per hour is 670 kg with CV of 31000 kJ/kg. Determine the boiler efficiency and equivalent evaporation. [7]

Or

6. (*a*) Show in tabular form boiler heat balance sheet and the formulas involved for estimating each component. [6]

(*b*) A boiler is equiped with a chimney of 24 m height. The ambient temperature is 25 deg. The temperature of flue gases passing through the chimney is 300 deg. C. If the air flow thruogh the combustion chamber is 20 kg/kg of fuel burned, find :

(*i*) The theoretical draught in cm of water column and

(*ii*) The velocity of the flue gases passing through the chimney if 50% of the head is lost in friction. [7]

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

(*b*) The percentage composition by mass of a solid fuel used in a boiler is given below :

$C = 90\%$, $H_2 = 3.5\%$, $O_2 = 3\%$,

$N_2 = 1\%$, $S = 1\%$ remaining is ash.

Find the mass of air required for complete combustion and mass analysis of dry products of combustion. [7]

Or

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

(*b*) The following observations were made durnig the test for finding the calorific value of gaseous fuel with the help of Boys gas calorimeter : [7]

Volume of gas consumed = 0.0535 m^3,

Mass of water circulated = 20 kg,

Rise in temperature of water = 10 deg.

Condensate collected during the test = 60 gm,

Find HCV and LCV of the gas.