C14-M-304

4251

BOARD DIPLOMA EXAMINATION, (C-14)

MARCH / APRIL - 2019

DME - III SEMESTER EXAMINATION

BASIC THERMODYNAMICS

Time : **3** Hours] [Total Marks : **80**

PART - A **3×10=30**

Instructions : *(1) Answer **ALL** questions.*

*(2) Each question carries **THREE** marks.*

(3) Answer should be brief and straight to the point and shall not exceed five simple sentences.

1 Define closed system ? Write one example of closed system.

2 State Clausius statement of second law of thermodynamics.

3 Write the steady flow energy equation and state the meaning of each term.

4 State Joule's law and give mathematical expression.

5 Carbon dioxide gas at 25°C and 101.3 kPa has a density of 1.799 kg/m^3. Determine the gas constant.

6 Derive an expression for work done in an isothermal process.

7 Draw p-V and T-S diagram for constant volume process.

8 List any six desirable characteristics of fuels.

9 Define :

(a) Higher calorific value

(b) Lower calorific value

10 State Stefan-Boltzmann law for radiation.

PART - B **10×5=50**

Instructions : *(1) Answer any **FIVE** questions.*

*(2) Each question carries **TEN** marks.*

(3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

11 A thermodynamic system undergoes a cycle composed of a series of three processes for which Q_1 = +10 kJ, Q_2 = +30 kJ, Q_3 = –5kJ. For the first process, $\Delta E = +20kJ$, and for the third process, $\Delta E = -20kJ$. What is the work in the second process, and net work output of the cycle ?

12 0.15 m^3 of gas at a pressure of 600 kN/m^2 expanded to a pressure of 200 kN/m^2, final volume being 0.2 m^3. Calculate the change in internal energy of the gas. Assume $C_p = 1.02\ kJ/kgk$ and $C_v = 0.726\ kJ/kgk$.

13 (a) Convert the following readings of pressure to kilopascals (kPa).

(i) 100 mm Hg

(ii) 0.2 MN/m^2

(iii) 15 bar

(iv) 0.08 N/mm^2

(b) Derive the relation between specific heats and gas constant.

14 If one kg of gas is heated at constant pressure from 25°C to 200°C. Estimate the heat added, work done, change in internal energy and change in enthalpy, if C_p=0.98 kJ/kgK and C_v=0.73 kJ/kgK.

15 0.12 m^3 of air at 1.5 MPa and 1500°C expands adiabatically to 175 kPa.

Find :

(a) the final temperature

(b) the final volume

(c) Heat transfer and

(d) the workdone.

Take C_p=1.0035 kJ/kgK and C_v=0.7165 kJ/kgK.

16 Show that the change in entropy for a polytropic process is given by the equation.

$$S_2 - S_1 = \frac{(Y-n)}{Y-1} \cdot mR.\log(V_2/V_1)$$

17 Explain the working principle of a Bomb calorimeter with a legible sketch.

18 A fuel consists of the following percentage of weights :

82% C, 12% H_2, 2% O_2, 1% S, and 3% N_2. Determine the minimum air required to completely burn the one kg of this fuel. Also find the products of combustion.