* 4252 *

C14–M–304

4252

BOARD DIPLOMA EXAMINATION, (C–14)

MARCH/APRIL—2018

DME—THIRD 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) Answers should be brief and straight to the point and shall not exceed *five* simple sentences.

(4) Assume missing data wherever necessary.

1. Define temperature and absolute zero. 1½+1½

2. Convert 740 mm of Hg into kN/m^2.

3. State Clausius statement related to second law of thermodynamics.

4. State Boyle's law and represent it on a *P-V* diagram. 2+1

5. If characteristic gas constant of a gas is 0·348 kJ/kg K, find the molecular weight of the gas.

6. Prove that change in enthalpy, $dH \quad mc_p (T_2 \quad T_1)$.

7. Write the expression for entropy of constant temperature process and name the terms involved in it. 2+1

8. Define lower calorific value and justify that it is always less than higher calorific value. 2+1

9. Find the higher calorific value of the fuel whose composition by mass is as follows :

Carbon 75%
Hydrogen 5%
Sulphur 3%
Oxygen 9%
Nitrogen 4%

and the remainder being ash. 1+1+1

10. Write any six desired characteristics of fuel. ½×6

PART—B 10×5=50

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

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

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

(4) Assume missing data wherever necessary.

11. A system undergoes a cycle composed of four processes and the energy transfers are tabulated below :

Process	Q kJ/min	W kJ/min	du kJ/min
1–2	550	200	—
2–3	130	—	280
3–4	–400	—	—
4–1	0	90	—

(a) Complete the table. 5

(b) Determine the rate of work in kW. 5

12. *(a)* Write steady flow energy equation for an open system and state the terms involved in it. 5

(b) Derive the relation $C_V \quad \frac{R}{1}$. 5

13. An ideal gas is expanded from 400 kN/m^2 and 0·04 m^3 to 120 kN/m^2 and 0·1 m^3. The temperature fell down during this process was observed as 150 °C. If C_P 1 025 kJ/kg K and C_V 0 765 kJ/kg K, find *(a)* the change in internal energy and *(b)* the mass of the gas. 5+5

14. Show that for a polytropic process heat transfer

$$Q \quad \frac{n}{1} \quad W$$

15. A quantity of gas has an initial pressure, volume and temperature of 60 kN/m^2, 0·2 m^3 and 35 °C respectively. It is expanded to a pressure of 40 kN/m^2, according to the law PV C. Determine—

(a) the mass of the gas;

(b) work transfer to the gas;

(c) heat transfer from the gas;

(d) change in entropy.

Take C_P 1 005 kJ/kg K and C_V 0 717 kJ/kg K. 2+3+3+2

16. 5 kg of an ideal gas is connected in a rigid cylinder. 35 kJ of heat is added to the gas, which has an initial temperature of 40 °C. Determine—

(a) final temperature;

(b) change in entropy.

Take R 0 328 kJ/kg K and 1 36. 5+5

17. Write about Orsat apparatus with a neat sketch. 5+5

18. The percentage composition of a sample of fuel by mass is found to be C 90%, H_2 5%, O_2 2%, S_2 0 8% and remaining ash. Calculate—

(a) the minimum amount of air required for complete combustion of one kg of fuel;

(b) the percentage composition by mass of dry products of combustion, if 40% excess air is supplied. 5+5

★ ★ ★