



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/m².
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, $dH = mc_p (T_2 - T_1)$.
7. Write the expression for entropy of constant temperature process and name the terms involved in it. 2+1

/4252

1

[Contd...

WWW.MANARESULTS.CO.IN

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. $\frac{1}{2} \times 6$

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 $C_V = \frac{R}{\gamma - 1}$. 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 $C_p = 1.025 \text{ kJ/kg K}$ and $C_v = 0.765 \text{ kJ/kg K}$, 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

$$Q = \frac{n}{1-n} W$$

- 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 $C_p = 1.005 \text{ kJ/kg K}$ and $C_v = 0.717 \text{ kJ/kg K}$. 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 $R = 0.328 \text{ kJ/kg K}$ and $\gamma = 1.36$. 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
