* 4252 *

C14–M–304

4252

BOARD DIPLOMA EXAMINATION, (C–14)

SEPTEMBER/OCTOBER - 2020

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.

1. Define 'thermodynamic system' and classify the thermodynamic systems.

2. Write the first law of thermodynamics for a closed system undergoing a process.

3. State Clausius statement of second law of thermodynamics.

4. Write the characteristic gas equation. What are the parameters involved in it? Mention the units for each parameter.

5. The density of air at NTP is 1·29 kg/m^3. Calculate the gas constant for air.

6. 2 kg of air at STP is compressed isothermally to 1/8th of its initial volume. Find the work done. Take $R = 0{\cdot}287$ kJ/kg K.

7. Derive the expression for change of entropy in constant pressure process.

8. Define HCV and LCV of the fuels.

9. Write any three advantages and limitations of solid fuels.

10. What is the purpose of Bomb calorimeter?

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.

11. The pressure of the fluid in a system is the linear function of volume and given by the equation, $p \quad a \quad bV$, where a and b are constants and p is in kN/m^2 and V is in m^3. If the system changes from initial condition of 200 kN/m^2 and 0·1 m^3 to the final condition of 500 kN/m^2 and volume of 0·4 m^3, determine the work transfer.

12. *(a)* Calculate the absolute pressure in 'kPa' of a gas in a vessel if the vacuum gauge indicates 300 mm of Hg while the barometer pressure is equal to 760 mm of Hg. 4

(b) Derive characteristic gas equation. 6

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 180 °C. If the values of C_p and C_v are 1·025 kJ/kg K and 0·726 kJ/kg K respectively, find *(a)* the change in internal energy and *(b)* the mass of gas.

14. $0{\cdot}12\ m^3$ of air at 1·5 MPa and 1500 °C expands adiabatically to 175 kPa. Find *(a)* the final temperature and *(b)* the work done. Take C_p = 1·0035 kJ/kg K, C_v = 0·7165 kJ/kg K.

15. A certain gas has initial volume $0{\cdot}56\ m^3$ at 400 °C and 28 bar. It expands isothermally to a final volume of $2{\cdot}8\ m^3$. Find the *(a)* work done, *(b)* mass of gas, *(c)* heat transfer and *(d)* change of entropy. 3+2+2+3

16. 3 kg of air at a pressure of 14 bar and a temperature of 100 °C undergoes a reversible process which may be represented by $pV^{1\,3}$ = constant. The final pressure is 3 bar. Assume R = 0·287 kJ/kg K and = 1·4. Find the *(a)* final volume, *(b)* final temperature and *(c)* increase in entropy.

17. Explain the working of Junker's gas calorimeter with a neat sketch.

18. The volumetric analysis of a flue gas is CO = 4%, CO_2 = 10%, O_2 = 8%, H_2 = 4% and N_2 = 74%. Convert volumetric analysis into mass analysis.

★ ★ ★