* 4252 *

C14–M–304

4252

BOARD DIPLOMA EXAMINATION, (C–14)

OCT/NOV—2017

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 where ever necessary.

1. Define state and system. 1½+1½

2. Define enthalpy and internal energy. 1½+1½

3. State Kelvin-Planck statement.

4. State Avogadro's law.

5. Explain each term in the relation

$$C_V \quad \frac{R}{1}$$

6. Show that heat transferred is equal to change in enthalpy, for a constant pressure process. 1½+1½

7. Define entropy and write its unit. 2+1

8. Define higher calorific value.

9. Write the solutions used to absorb CO_2, O_2 and CO in Orsat apparatus. 1+1+1

10. Write any three advantages and three disadvantages of liquid fuels. ???????????? 1½+1½

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 where ever necessary.

11. The pressure of the fluid in a system is the linear function of volume 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 the final condition of 500 kN / m^2 and volume of 0·4 m^3, determine the work transfer.

12. *(a)* Heat is supplied to a heat engine at the ratio of 70 kJ/s giving an output of 30 kW. Calculate thermal efficiency and the rate at which heat is rejected. 5

(b) Derive characteristic gas equation. 5

13. A mass of air has an initial pressure of 2·3 MN / m^2, volume of 0·016 m^3 and temperature = 150 °C. It is then expanded until

its final pressure is 475 kN / m^2 and its volume becomes 0 078 m^3. Determine—

(a) the mass of air;

(b) the final temperature of air.

Take R 0 287 kJ / kg°k 2+2+3+3

14. Derive the expression for *(a)* work transfer and *(b)* change in entropy in an isothermal process. 5+5

15. A quantity of gas has an initial pressure, volume and temperature of 240 kN / m^2, 0·4 m^3 and 25 °C respectively. It is expanded to a pressure of 140 kN / m^2 according to the law $PV^{1\,35}$ C. Determine—

(a) the change in entropy;

(b) work transfer to the gas;

(c) heat transfer from the gas.

[Take C_p 1 005 kJ/kg°k and C_V 0 715 kJ/kg°k] 2+4+4

16. A 2 kg of air at a pressure of 850 kN / m^2 occupies a volume of 2 m^3. The air is then expanded to a pressure of 300 kN / m^2 at constant volume. Find the—

(a) work done;

(b) heat transfer;

(c) change in entropy during expansion.

[Take R 0 287 kJ/kg°k and C_v 0 717 kJ/kg°k] 2+5+3

17. Write about Junker's calorimeter with a neat sketch. 5+5

18. The percentage composition of a sample of fuel by mass is found to be C = 76%, H_2 5 2%, O_2 12 8%, N_2 2 7%, S_2 1 2% and remaining ash. Calculate—

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

(b) percentage composition by mass of dry products of combustion. 5+5

★ ★ ★