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C14–M–304

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BOARD DIPLOMA EXAMINATION, (C–14)

MARCH/APRIL—2016

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. State Zeroth's law of thermodynamics.

2. Define extensive property and intensive property. 1½+1½

3. Define heat and specific heat. 1½+1½

4. State Joule's law.

5. Explain each term in the relation, $C_p - \frac{R}{1}$

6. Show that heat transferred is equal to change in internal energy, for a constant volume process.

7. Represent isentropic process on *P-V* and *T-S* diagram. 1½+1½

8. Define air-fuel ratio and excess air. 1½+1½

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

Carbon = 91%, hydrogen = 3%, sulphur = 0·8%, the remainder being ash.

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

PART—B 10×5=50

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

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

(3) Assume missing data wherever necessary.

11. In a steady flow open system, a fluid substance flows at the rate of 10 kg/sec. It enters the system at a pressure of 600 kN / m^2, a velocity of 150 m/sec with internal energy 2000 kJ/kg and specific volume of 1 m^3/kg. It leaves the system at a pressure of 125 kN/m^2, a velocity of 100 m/sec with internal energy 1600 kJ/kg and specific volume of 2 m^3/kg. During its passage through the system, the substance lost heat of 40 kJ/kg to the surroundings. Determine the power of the system stating whether it is from or to the system. 8+2

12. *(a)* A vacuum gauge in the condenser reads 630 mm of Hg and the barometer stands at 760 mm of Hg. Determine the absolute pressure in the condenser tank in kPa. 5

(b) Derive that $C_p \quad C_v \quad R$. 5

13. 2 kg of an ideal gas is heated from 25° C to 150° C. Assuming $R = 0{\cdot}265$ kJ/kg°K and 1 5 for the gas, find— 2+2+3+3

(a) specific heat at constant pressure;

(b) specific heat at constant volume;

(c) change in internal energy;

(d) change in enthalpy.

14. Derive the expression for work transfer in an adiabatic process.

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

(a) the change in entropy;

(b) work transfer to the gas;

(c) heat transfer from the gas.

Take C_p 1 045 kJ/kg°K and C_v 0 743 kJ/kg°K

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 volume of 5 m^3 at constant pressure. Find the— 5+5

(a) work done;

(b) heat transfer during the process.

Take $R = 0{\cdot}287$ kJ/kg°K and C_v 0 717 kJ/kg°K

17. Write about bomb calorimeter with a neat sketch.

18. The mass analysis of exhaust gases of an oil engine is CO_2 21 6%, CO 2 2%, O_2 1 7% and N_2 74 5%. Convert this analysis into volumetric analysis.

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