C14–M–**304**

# 4252

**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, $C_p \quad \dfrac{R}{1}$

**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

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**PART—B** 10×5=50

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*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/m², 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 $C_p$  $C_v$  $R$. 5

**13.** 2 kg of an ideal gas is heated from 25° C to 150° C. Assuming $R = 0.265$ kJ/kg°K and $\gamma = 1.5$ 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 $R = 0.287$ 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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