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C09–M–305

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BOARD DIPLOMA EXAMINATION, (C–09)

MARCH/APRIL—2014

DME—THIRD SEMESTER EXAMINATION

THERMAL ENGINEERING—I

Time : 3 hours] [*Total Marks* : 80

PART—A 3×10=30

Instructions : (1) Answer **all** questions.

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

(3) Answer should be brief and straight to the point and shall not exceed *five* simple sentences.

1. Write the classification of thermodynamic system. Explain briefly closed system.

2. One kg of air is heated from 20 °C to 95 °C. Find the change of internal energy. Take C_p 0 72 kJ/kg-K and adiabatic index =1·4.

3. One kg of air expands isothermally at a constant temperature of 127 °C. Find the work done if the initial pressure is 207 kN/m^2 and the final pressure is 69 kN/m^2. Assume R 0 287 kJ/kg-K.

4. Derive an expression for entropy for constant-pressure process.

5. Find the higher calorific value of the fuel whose composition by mass is as carbon = 91%, hydrogen = 3%, sulphur = 0·7% and the remainder is being ash.

6. Define LCV and HCV.

7. An engine working on Otto cycle has a compression ratio of 6. Find the ideal efficiency of the cycle. Take adiabatic index as 1·4.

8. What is the dryness fraction of the steam if the pressure is 10 bar and enthalpy is 2600 kJ/kg.

9. Define the following terms :

(a) Dryness fraction

(b) Sensible heat

10. *(a)* What is meant by one ton of refrigeration?

(b) Define coefficient of performance of refrigerator.

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. 0·3 kg of gas is subjected to change of temperature from 280 K to 470 K at constant pressure. Find the heat transfer, change of internal energy and change of enthalpy. Assume C_p 1 0 kJ/kg-K and adiabatic index = 1·4.

12. *(a)* Derive the relationship between the specific heats and gas constant.

(b) Find the ideal efficiency for a petrol engine of 175 diameter, 300 m stroke with clearance volume of 0·0022 m^3. Assume ratio of specific heats as 1·4.

13. 0·12 m^3 of air at 1·5 MPa and 1500 °C expands adiabatically to 175 kPa. Find the *(a)* final temperature and *(b)* work done. Take C_p 1 0035 kJ/kg-K and C_v 0 7165 kJ/kg-K.

14. A volume of 0·36 m^3 of oxygen initially at a temperature of 220 °C and a pressure of 400 kPa is compressed reversibly and isothermally to a final volume of 0·06 m^3. Calculate *(a)* the mass *(b)* the final pressure and *(c)* the change in entropy. Assume R 0 26 kJ/kg-K for oxygen.

15. Explain the working and construction of a bomb calorimeter with the help of a neat sketch.

16. Find the ideal efficiency of Diesel engine having cylinder dimensions of 250 mm diameter, 385 mm stroke and clearance volume is 0·00156 m^3. The fuel cutoff takes place at 4·5 percent of stroke.

17. Dry saturated steam is cooled in a closed vessel with constant volume of 2 m^3 from initial pressure 10 bar to final pressure 2 bar. Find the *(a)* mass of steam *(b)* final condition of steam and *(c)* heat transfer.

18. Derive expression for COP of Bell-Coleman cycle used in air refrigeration.

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