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C14-M-304

4251

BOARD DIPLOMA EXAMINATION, (C-14)

OCT/NOV—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. Define 'thermodynamic system'. List out the types of thermodynamic systems.

2. State and explain the 'zeroth law of thermodynamics'.

3. A mixture of gases expands from 0·042 m^3 to 0·076 m^3 at a constant pressure of 800 kPa and absorbs 75 kJ of heat during the process. Determine the change of internal energy.

4. State any three characteristics of perfect gases.

5. The density of nitrogen at NTP is 1·25 kg/ m^3. Calculate the gas constant.

6. Show the heat transferred during constant pressure process is equal to the change in enthalpy.

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7. Represent the following processes on the same temperature-entropy diagram :

   (a) Constant volume process

   (b) Constant pressure process

   (c) Adiabatic process

8. Define the term 'fuel'. What are the constituents of fuel?

9. Define the terms 'higher calorific value' and 'lower calorific value' of fuel.

10. Define (a) conduction and (b) convection.

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. In a gas turbine unit, the gases flow through the turbine is 10 kg/sec and the power developed by the turbine is 12500 kW the enthalpies of gases at the inlet and outlet are 1400 kJ/kg and 450 kJ/kg respectively, and the velocity of gases at the inlet and outlet are 60 m/sec and 150 m/sec respectively. Calculate the rate at which the heat is rejected to the turbine.

12. (a) The gauge pressure of steam in a boiler is 60 bar; the condenser vacuum is equal to 685 mm of mercury. Determine the absolute pressure in the boiler and condenser in bar, if the barometer indicates the pressure of 750 mm.

    (b) Define 'universal gas constant'. Write a short note about universal gas constant.

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13. One kg of ideal gas is heated from 20 °C to 100 °C. Assuming $R = 285$ J/kgK and $\gamma = 1{\cdot}39$ for the gas. Find *(a)* both the specific heats, *(b)* change of internal energy and *(c)* change of enthalpy.

14. One kg of air occupies $0{\cdot}6\ m^3$ at 3·0 bar and 427 °C. It is then compressed isothermally to a final volume of $0{\cdot}12\ m^3$. Calculate—

(a) pressure at the end of compression;

(b) work done during compression and state whether work is done by the system or on the system;

(c) change in internal energy;

(d) heat transferred.

15. One kg of air at a pressure of 10 bar and a temperature of 373 K undergoes a reversible process which may be represented by $pV^{1{\cdot}15}$ = constant. The final pressure is 2 bar. Assume $R = 0{\cdot}287$ kJ/kgK and $\gamma = 1{\cdot}4$. Find *(a)* the final volume, *(b)* the final temperature and *(c)* the increase in entropy.

16. A gas at 1 bar and 15 °C has a specific volume of $0{\cdot}75\ m^3/kg$. It is compressed adiabatically through a volume ratio of 6 : 1. During the compression, the work energy transfer is 7·5 kJ, and the final temperature of the gas is 320 °C. Calculate the value of adiabatic index, gas constants, two specific heats and mass of the gas involved.

17. A sample of liquid petroleum contains the following composition by mass :

Carbon—93%, Hydrogen—4%, Oxygen—3%

Determine the minimum air required for complete combustion of 1 kg of fuel and composition of dry products of combustion.

18. Explain the working principle of Junkers gas calorimeter with a line diagram.

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