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BME-052

DIPLOMA IN MECHANICAL ENGINEERING (DME) / ADVANCED LEVEL CERTIFICATE COURSE IN MECHANICAL ENGINEERING (DMEVI / ACMEVI)

00890

Term-End Examination

June, 2015

BME-052 : BASICS OF THERMAL ENGINEERING

Time : 2 hours *Maximum Marks : 70*

Note : *Question No. 1 is* ***compulsory****. Attempt* ***five*** *questions in all. All questions carry equal marks. Use of scientific calculator and steam tables is allowed.*

1. Choose the correct alternative for the following objective type questions. *7×2=14*

(a) Torr is a unit of

(i) temperature

(ii) pressure

(iii) volume

(iv) energy

(b) Which of the following is ***not*** an extensive property ?

(i) Volume

(ii) Pressure

(iii) Energy

(iv) Entropy

(c) Perpetual motion machine of the second kind violates the

(i) First law of thermodynamics

(ii) Kelvin-Planck statement

(iii) Clausius statement

(iv) Third law of thermodynamics

(d) Heat transferred to a system at constant pressure is equal to

(i) work transfer

(ii) change in internal energy

(iii) change in enthalpy

(iv) change in entropy

(e) The efficiency of a reversible cycle depends upon the

(i) nature of the working substance

(ii) amount of the working substance

(iii) temperature of the two reservoirs between which the cycle operates

(iv) type of cycle followed

(f) The specific heats of an ideal gas C_p and C_v

(i) vary with temperature

(ii) vary with pressure

(iii) vary with both pressure and temperature

(iv) are constant

(g) Two insulated tanks containing ideal gases at different pressures and temperatures are connected to each other and gases are allowed to mix. The process that occurs can be called

(i) free expansion

(ii) constant enthalpy

(iii) constant internal energy

(iv) reversible adiabatic

2. Answer any ***two*** of the following questions : *2×7=14*

(a) What is the Zeroth law of thermodynamics ? What is the difference between the universal gas constant and a characteristic gas constant ?

(b) A mass of 1·5 kg of air is compressed from 0·1 MPa to 0·7 MPa for which

$$pv = \text{constant}.$$

The initial density of air is 1·16 kg/m^3. Find the work done by the piston to compress the air.

(c) The properties of a certain fluid are related as follows :

$$u = 196 + 0{\cdot}718\ t$$

$$pv = 0{\cdot}287\ (t + 273),$$

where u is the specific internal energy (kJ/kg), t is in °C, p is pressure (kN/m^2), and v is the specific volume (m^3/kg).

For this fluid, find C_v and C_p.

3. Answer any ***two*** of the following questions : *2×7=14*

(a) Enumerate the Kelvin-Planck statement of the second law of thermodynamics.

(b) A vessel of volume 0·04 m^3 contains a mixture of saturated water and saturated steam at a temperature of 250°C. The mass of the liquid present is 9 kg. Find the pressure, the mass, the specific volume and the enthalpy.

(c) What do you understand by triple point ? What is quality of steam ?

4. Answer any ***two*** of the following : $2 \times 7 = 14$

(a) What is a heat pump ? How does it differ from a refrigerator ?

(b) What are the four basic components of a steam power plant ? Explain with the help of a block diagram.

(c) How are the maximum temperature and maximum pressure in the Rankine cycle fixed ? When is reheating of steam recommended in a steam power plant ?

5. Write short notes on any ***four*** of the following : $4 \times 3\frac{1}{2} = 14$

(a) Solar Energy

(b) Photovoltaic Cell

(c) Radiation

(d) Enthalpy

(e) Reaction Turbine

(f) Boiler Mountings