Reg. No. : | | | | | | | | | | |

Question Paper Code: 33703

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2020

Third Semester

Mechanical Engineering

01UME303 - ENGINEERING THERMODYAMICS

(Use of steam tables, charts may be permitted)

(Regulation 2013)

Duration: One hour   Maximum: 30 Marks

PART A - (6 x 1 = 6 Marks)

(Answer any six of the following questions)

1. As differentials, heat and work would be described mathematically as

   (a) inexact   (b) exact   (c) discontinuity   (d) point function

2. The measurement of thermodynamic property known as temperature is based on

   (a) Zeroth law of thermodynamics   (b) First law of thermodynamics
   (c) Second law of thermodynamics   (d) None of these

3. The heat flows from a cold body to a hot body with the aid of an external source. This statement is given by

   (a) Kelvin   (b) Joule   (c) Clausius   (d) Gay-Lussac

4. The condition for a reversible cyclic process is

   (a) $\oint \frac{dQ}{T} = 0$ (b) $\oint \frac{dQ}{T} < 0$ (c) $\oint \frac{dQ}{T} > 0$ (d) None of these

5. The heat absorbed by water at its saturation temperature to get converted into dry steam at the same temperature is called

   (a) sensible heat   (b) specific heat   (c) total heat   (d) latent heat

6. Determine the entropy per kg of steam at 2 MPa when the condition of the steam is dry saturated

   (a) 6.336 kJ/kgK   (b) 5.2 kJ/kgK

   (c) 7.233 kJ/kgK   (d) 0 kJ/kgK

7. For a given mass of gas at constant pressure, its volume is directly proportional to the absolute temperature. It belongs to which law

   (a) Gay Lussa's law   (b) Charle's law

   (c) Joule's law   (d) Boyle's law

8. Isothermal compressibility α

   (a) $\alpha = -\frac{1}{V}\left(\frac{\partial V}{\partial P}\right)_T$ (b) $\alpha = -\frac{1}{V}\left(\frac{\partial P}{\partial V}\right)_T$

   (c) $\alpha = \frac{1}{V}\left(\frac{\partial V}{\partial T}\right)_P$ (d) $\alpha = -\frac{1}{V}\left(\frac{\partial V}{\partial P}\right)_T$

9. A humidification process means

   (a) Decrease in relative humidity   (b) An increase in specific humidity

   (c) A decrease in temperature   (d) An increase in temperature

10. The relation between relative humidity (Φ) and degree of saturation (μ) is given by

   (a) $\mu = \frac{(P_b - P_v)}{(P_b - P_s)}\Phi$ (b) $\mu = \frac{(P_b - P_s)}{(P_b - P_v)}\Phi$ (c) $\mu = \frac{P_v}{(P_b - P_s)}\Phi$ (d) $\mu = \frac{(P_b + P_s)}{(P_b - P_v)}\Phi$

PART – B (3 x 8= 24 Marks)

(Answer any three of the following questions)

11. Air flows steadily at the rate of 0.4 *kg/s* through an air compressor, entering at 6 *m/s* with a pressure of 1 *bar* and a specific volume of 0.85 *m³/kg* and leaving at 4.5 *m/s* with a pressure of 6.9 *bar* and a specific volume of 0.16 *m³/kg*. The internal energy of air leaving is 88 *kJ / kg* greater than that of the air entering. Cooling water in a jacket surrounding the cylinder absorbs heat from the air at the rate of 59 *W*. Calculate the power required to drive the compressor and the inlet and outlet cross sectional areas.

                                                                    (8)

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12. Two reversible heat engines *A* and *B* are arranged in series. Engine *A* rejecting heat directly to engine *B,* receives 200*kJ* at a temperature of $421\,^{\circ}C$ from a hot source, while engine *B* is in communication with a cold sink at a temperature of $4.4\,^{\circ}C$. If the work output of *A* is twice that of *B*, find (i) The intermediate temperature between *A* and *B* (ii) the efficiency of each engine (iii) The heat rejected to the cold sink. (8)

13. A vessel of volume 0.04 m^3 contains a mixture of saturated water and saturated steam at a temperature of $250^{o}C$. The mass of the liquid present is 9 *kg*. Find the pressure, the mass, the specific volume, the enthalpy, the entropy and the internal energy of the mixture. (8)

14. Explain and derive the (i) Joule-Thomson co-efficient (ii) Clausius Clapeyron equation. (8)

15. Air at $20^{o}C$, *40%* R.H is mixed with air at $40^{o}C$, *40%* R.H in the ratio of (former) 1:2 (later) on dry basis. Determine the final condition of air. (8)

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