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

## Question Paper Code: 43703

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

Third Semester

Mechanical Engineering

14UME303 – ENGINEERING THERMODYNAMICS

(Regulation 2014)

Duration: One hour Maximum: 30 Marks

PART A - (6 x 1 = 6 Marks)

**(Answer any six of the following questions)**

1. Which of the following is point function?

   (a) entropy (b) enthalpy (c) work (d) none

2. The ratio of specific heat capacities at constant volume and constant pressure for air is

   (a) 1.4 (b) 0.714 (c) 1.005 (d) 0.718

3. Which of the following is correct?

   (a) $COP_{HP} = 1+COP_{Ref}$ (b) $COP_{Ref} = 1+COP_{HP}$
   (c) $COP_{HP} + COP_{Ref} = 1$ (d) none

4. No engine which gives higher efficiency other than Carnot engine when working at same temperature limits is called

   (a) Kelvin statement (b) Clausius statement
   (c) Carnot theorem (d) Clausius inequality

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. For a given set of operating pressure limits of a Rankine cycle the highest efficiency occurs for

(a) Saturated cycle (b) Superheated cycle
(c) Reheat cycle (d) Regenerative cycle

7. The difference of specific heats for the ideal gases is

(a) Joule - Thomson coefficient (b) Characteristics gas constant
(c) Molecular mass (d) None

8. Isothermal compressibility $\alpha$

(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. In an adiabatic saturation process

(a) The enthalpy remains constant (b) The temperature remains constant
(c) The absolute humidity remains constant (d) The relative humidity remains constant

PART – B (3 x 8= 24 Marks)

**(Answer any three of the following questions)**

11. A steam power plant generates 180,000 *kg/h* of steam. Heat input required to raise this amount of steam in the boiler of the plant is 2600 *kJ/kg* of steam. The power output of the plant is 55 *MW*. What is the thermal efficiency of the plant? (8)

12. A heat pump working on a Carnot cycle takes in heat from a reservoir at $5^0C$ and delivers heat to a reservoir at $60^0C$. The heat pump is driven by a reversible heat engine which takes in heat from a reservoir at $840^0C$ and rejects heat to a reservoir at $60^0C$. The reversible heat engine also drives a machine that absorbs 30 *kW*. If the heat pump extracts 17 *kJ/s* from the $5^0C$ reservoir, determine (a) the rate of heat supply from the $840^0C$ source, and (b) the rate of heat rejection to the $60^0C$ sink. (8)

13. Explain steam formation with relevant sketch and label all salient points and explain every point in detail. (8)

14. The specific heats of a gas are given by $C_p = a + kT$ , and $C_v = b + kT$ . Where *a, b* and *k* are constants and *T* is in *K*. Show that for an isentropic expansion of this gas $T^b \ V^{(a-b)} \ e^{kT} = C$. (8)

15. An industrial process requires an atmosphere having a *RH* of 88.4% at 22 $^0C$, and involves a flow rate of 2000 $m^3/h$. The external conditions are 44.4% *RH*, 15$^0C$. The air intake is heated and then humidified by water spray at 20$^0C$. Determine the mass flow rate of spray water and the power required for heating, if the pressure throughout is1 bar. (8)