**Question Paper Code: 54A05**

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

Fourth Semester

Agricultural Engineering

15UAG405- FUNDAMENTALS OF THERMODYNAMICS

(Regulation 2015)

(Provide Scientific Calculator, Steam table & Psychrometric Chart)

Duration: 1:15hrs                                                     Maximum: 30 Marks

PART A - (6 x 1 = 6 Marks)

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

1. The first law of thermodynamics  is law of                                    CO1-R

   (a) Conversion of mass                    (b) Conversion of energy

   (c) Conversion of momentum            (d) Conversion of heat

2.  Which of the following is true in regard to the energy of an isolated          CO1-R
   system?

   (a) $dQ \neq 0$       (b)$dW \neq 0$      (c) ) E=constant            (d) all of the mentioned

3. A  Carnot engine operates between $327^0$ and $27^0$ .If the engine          CO2-R
   produces 300KJ of work, the entropy change during heat addition is

   (a) 0.5KJ/K           (b)1 KJ/K              (c)1.5KJ/K                    (d)2KJ/K

4.  A serious  of operations, which take place in a certain order and          CO2-R
   restore the initial condition is known as

   (a)  reversible cycle                    (b) irreversible cycle

   (c) Thermodynamic cycle               (d) non of the above

5. Thermal power plant works on                                             CO3-R

   (a) Carnot cycle        (b) Joule cycle        (c) Rankine cycle        (d) Otto cycle

6. The point at which three phases of water vapour exists is called as          CO3-R
   _____

   a) Triple point        (b) Freezing point     (c) Boiling point        (d) Gaseous point

7.  The heating and expanding of gas is called                                           CO4-R

    (a) Thermodynamic system                (b) Thermodynamic cycle

    (c) Thermodynamic process               (d) Thermodynamic law

8.  When a real gas undergoes Joule-Thomson expansion the                   CO4-R
    temperature

    (a) may remain constant                 (b) always decrease

    (c) always increase                     (d) may increase or decrease

9.  When the rate of evaporation of water is zero, the relative humidity      CO5-R
    of the air is

    (a) 0%              (b) 100%            (c) 50%           (d) unpredictable

10. The dew point temperature is less than the wet bulb temperature for       CO5-R

    (a) saturated air                       (b) unsaturated air

    (c) both saturated and unsaturated air  (d)  none of the above

### PART – B (3 x 8= 24 Marks)

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

11. In an isentropic flow through nozzle, air flows at the rate of 600   CO1-App      (8)
    kg/hr. At inlet to the nozzle, pressure is 2 MPa and temperature is
    127°C. The exit pressure is 0.5 MPa. Initial air velocity is 300 mig
    Determine
        (i) Exit velocity of air
        (ii) Inlet and exit area of nozzle

12. A reversible heat engine operates between two reservoirs at 820 ºC   CO2-App      (8)
    and 27 º C engines drives a reversible refrigerator which operates
    between reservoirs at temperature of 27 ºC and -15 ºC. The heat
    transfer to the engine is 2000kJ and network available for the
    combined cycle is 300kJ.
    (a) How much heat is transferred to the refrigerant and also
    determine the total that rejected to the reservoir at 27 ºC.
    (b) If the efficiency of the heat engine and COP of the refrigerator is
    each 40% of their maximum values, determine heat transfer to the
    refrigerator and also heat rejected to the reservoir at 27  ºC

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13  In a thermal power plant operating on a Rankine cycle, superheated   CO3-Ana        (8)
    steam at 50 bar and 500 ºC enters the turbine, the isentropic
    efficiency of which is 0.8. The condenser pressure is 0.05 bar and it
    delivers the saturated liquid to a feed pump, the isentropic efficiency
    of which is 0.7. Determine the thermal efficiency of the power plant
    and the mass flow rate of steam required for 50MW net power
    generation.

14.  Derive Maxwell's equation                                          CO4-U          (8)

15.  Consider a room that contains air at 1atm, 35°C and 40% relative   CO5-U          (8)
     humidity. Using psychometric chart determine i. The specific
     humidity ii. The enthalpy iii. The wet- bulb temperature iv. The dry-
     bulb temperature v. Specific volume of air.

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