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

Question Paper Code: 54A05

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2021

Fourth Semester

Agricultural Engineering

15UAG405- FUNDAMENTALS OF THERMODYNAMICS

(Regulation 2015)

(Provide Scientific Calculator, Steam table & Psychrometric Chart)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Which of the following is an extensive property of a thermodynamic system? CO1- R

   (a) Pressure (b) Volume. (c) Temperature (d) Density

2. First law of thermodynamics deals with CO1- R

   (a) Conservation of heat (b) Conservation of momentum

   (c) Conservation of mass (d) Conservation of energy

3. The state of a substance whose evaporation from its liquid state is complete, is known as CO2- R

   (a) Vapour (b) Perfect gas (c) Air (d) Sream

4. The heat flows from a cold body to a hot body with the aid of an external source. This statement is given by CO2- R

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

5. The substance temperature remains constant but phase change occur is called CO3- R

   (a)Sensible heat (b) Sensible cooling (c) Latent heat (d) Dryness fraction

6. The unite of mass flow rate CO3- R

   (a) Kg (b) Kg/s (c) N (d) N/s

7. The unite of gas constant R is CO4- R

(a) KJ/kgk (b) KJ/kg mol k (c) KJ/ kg (d) KJ/s

8. Helmholtz function is expressed as CO4- R

(a) T-US. (b)S-UT. (c) U-T. (d) U-TS

9. In psychrometric chart horizontal lines are called CO5- R

(a) Dry bulb temperature (b) Wet bulb temperature

(c) Dew point temperature (d) Specific humidity

10. The unit of specific enthalpy is CO5- R

(a) KJ (b) KJ/kg. (c) KJ/Kg K (d) KJ/s

PART – B (5 x 2= 10 Marks)

11. What is PMM-I? CO1 R

12. Write two statement of second law of thermodynamics. CO2 R

13. List the advantages of reheating of steam. CO3 R

14. State Dalton' law of partial pressure. CO4 R

15. Define dew point temperature. CO5 R

PART – C (5 x 16= 80 Marks)

16. (a) 0.35 m^3 of air at 22^O C and under atmospheric pressure is heated under constant volume to a temperature of 100^O C. Determine: mass of air, the final pressure, heat transfer, the change in internal energy, the work done , the change in enthalpy and the change of entropy. Assume C_p = 1 KJ/kg K and C_v = 0.71 KJ/Kg K. CO1- App (16)

Or

(b) Air undergoes a cyclic process in a cylinder and piston arrangement. Atmospheric air at 1 bar and 27^0 C is compressed adiabatically to 10 bars, expanded isothermally to initial pressure and brought to initial condition at constant pressure. Find the change in internal energy, enthalpy change, heat transfer, work transfer for each process and efficiency of the cycle. CO1- App (16)

17. (a) A reversible heat engine operating between reservoirs at 900 K and 300K drives a reversible refrigerator operating between reservoirs at 300 K and 250 K. The engine receives 1800 KJ heat. The net output from the combined engine and refrigerator is 360 KJ. Find the heat transferred to the refrigerant and the net heat rejected to the reservoir at 300 K. CO2- App (16)

Or

(b) An insulated vessel of capacity 0.05 m^3 is divided into two compartments A and B by a conducting diaphragm. Each compartment has a capacity of 0.02 m^3. The compartment A contains air at a pressure of 1.5 bar and 25^0 C and the compartment B contains air at a pressure 4.2 bar and 175^0 C. Find: Final equilibrium temperature, final pressure on each side of the diaphragm and change of entropy of the system. CO2- App (16)

18. (a) A cylinder contains 150 liters of steam at 400 Kpa and 0.5 dry. The steam is compressed hyperbolically to 0.06 m^3. Find: mass of vapour, the final dryness fraction and the heat transferred. CO3- Ana (16)

Or

(b) In a regenerative cycle, the inlet conditions are 4 MN/m^2 and 400^0C. Steam is bled at 1 MN/m^2 in a regenerative heating. The exit pressure is 80 KN/m^2.Neclecting pump work, determine the efficiency of the cycle. CO3- Ana (16)

19. (a) A mixture of ideal gases consists of 2.5 kg of N_2 and 4.5 kg of CO_2 at a pressure of 4 bar and a temperature of 25^0C. Determine
(i) Mole fraction of each constituent
(ii) Equivalent molecular weight of the mixture
(iii) Equivalent gas constant of the mixture
(iv) The partial pressure and partial volume
(v) The volume and density of the mixture. CO4- Ana (16)

Or

(b) Obtain expressions of Maxwell equations. CO4- Ana (16)

20. (a) The sling – psychrometer reads 40^0C DBT and 28^0C WBT. Calculate the following: CO5- U (16)

(i) Specific humidity

(ii) Relative humidity

(iii) Vapour density in air

(iv) Dew point temperature

(v) Enthalpy of mixture per kg of dry air and Degree of saturation.

Or

(b) Atmospheric air at a dry bulb temperature of 16^0C and 25 % RH passes through a furnace and then through a humidifier, in such a way that the final dry bulb temperature is 30^0C and 50% RH. Find the heat and moisture added to the air. Also determine the sensible heat factor of the process. CO5- U (16)