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

Question Paper Code: U4A02

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2024

Fourth semester

Agricultural Engineering

21UAG402-FUNDAMENTALS OF THERMODYNAMICS FOR AGRICULTURE ENGINEERS

(Regulations 2021)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Find the workdone for the constant pressure process if the volume difference is 0.4 m^3 at 1 atmospheric pressure CO2-App

   (a) 40 kJ (b) 20 k J (c) 10 kJ (d) 30 kJ

2. What is the SI unit of pressure? CO1 -U

   (a) bar (b) kPa (c) Pascal (d) fsi

3. Find the COP of refrigerator which operates between the heat rejection is 4200 kJ and the work input is 840 kJ CO2-App

   (a) 3 (b) 2 (c) 4 (d) 5

4. The entropy of reversible adiabatic process is CO1 -U

   (a) 0 (b) 1 (c) 2 (d) 3

5. Critical point is called as CO1 -U

   (a) meet liquid and vapour (b) meet air and liquid

   (c) meet vapour and air (d) meet vapour and gas

6. Find the $h_f$value of 5° C CO2-App

   (a) 30 kJ/ kg (b) 21 kJ/ kg (c) 15 kJ/ kg (d) 10 kJ/ kg

7. The formula for real gas equation is CO1 -U

   (a) pv=RT (b) pv= ZRT (c) pv= ¥ RT (d) pv= JRT

8. Regnault' s law states that CO1 -U

(a) Cp and Cv both are same (b) Cp and Cv value always constant

(c) Cp and Cv value is not constant (d) ratio Cp and Cv is less than 1

9. Which branch of science deals with properties of air CO1 -U

(a) geometry (b)audiometry (c) physhrometry (d) trigonometry

10. For comfort zone what should be the range of RH CO1 -U

(a) 50-60% (b) 20-30% (c) 30-40% (d) 40-50%

PART – B (5 x 2= 10 Marks)

11. Define temperature and its units CO1 -U

12. Find the heat rejection of the heat engine, if the heat supplied is 100 kJ and work output is 200 kJ CO2-App

13. State phase rule of pure substances CO1 -U

14. What is significance of ClasiusClapeyron Equation? CO1 -U

15. How do you state the dew point temperature? CO1 -U

PART – C (5 x 16= 80 Marks)

16. (a) Derive the expression for adiabatic process $pv^{\gamma} = C$ CO2-App (16)

Or

(b) A piston and cylinder machine contains a fluid system which passes through a complete cycle of four processes. During a cycle, the sum of all heat transfers is -170 kJ. The system completes 100 cycles per min. Complete the following table showing I.he method for each item and computes the net rate of work output in kW. CO2-App (16)

Process	Q (kJ/min)	W(kJ/min)	dE ((kJ/min)
1-2	0	2170	-
2-3	21000	0	-
3-4	-2100	-	-36600
4-1	-	-	-

17. (a) Explain the following CO2-App (16)

i. Derive entropy- a property of the system (8)

ii. Explain clausius inequality in detail (8)

Or

	(b)	A reversible heat engine operates between two reservoirs at temperature of 900 K and 300 K. The Engine drives a reversible refrigerator which operates between reservoirs at temperature of 300 K and 250 K. The heat transfer to the heat engine is 1800 kJ and network output of combined engine refrigerator plant is 360KJ. Evaluate the heat transfer to the refrigerator and the net heat transfer to the reservoir at 300 K	CO2-App	(16)
18.	(a)	Find the specific volume and enthalpy of steam at 9 bar when the condition of steam is (a) wet with dryness fraction 0.98 (b) dry saturated (c) superheated, the temperature of steam is 240 ° C	CO2-App	(16)
		Or		
	(b)	Dry saturated steam is supplied to a steam turbine at 12 bar and after the expansion its condenser pressure is 1 bar. Find the Rankine cycle efficiency, specific steam consumption. Neglect pump work.	CO2-App	(16)
19.	(a)	Derive the Joule Thomson coefficient with neat sketches.	CO2-App	(16)
		Or		
	(b)	A vessel of volume 0.3 m3 contains 15 kg of air at 303 K. determine the pressure exerted by the air by suing Perfect gas equation Vander walls equation Generalized compressibility chart	CO2-App	(16)
20.	(a)	Dry bulb& wet temperatures of 1 atm air steam are 40 ° C and 30° C respectively. Determine (a) humidity ratio (b) relative humidity (c) specific enthalpy	CO2-App	(16)
		or		
	(b)	The moist air is at 45 ° C dry bulb temperature and 30° C wet bulb temperature. Calculate (a) vapour pressure (b) dew point temperature (c) specific enthalpy (d) relative humidity (e) degree of saturation (f) vapour density (g) enthalpy of mixture	CO2-App	(16)