Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–IV (NEW) EXAMINATION – WINTER 2020

Subject Code:2143406 **Date:09/02/2021**

Subject Name:Thermo Dynamics and Thermal Eng.

Time:02:30 PM TO 04:30 PM **Total Marks:56**

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Define: (1) Thermal Equilibrium (2)Mechanical Equilibrium (3)Chemical Equilibrium	**03**
	(b)	Differentiate Heat & Work	**04**
	(c)	Explain phase change for Pure Substance	**07**
Q.2	**(a)**	Write down a Application of First Law of Thermodynamics	**03**
	(b)	Differentiate Otto Cycle & Diesel Cycle	**04**
	(c)	Explain the different variables affecting on an efficiency of Rankine cycle	**07**
Q.3	**(a)**	Define Available and Unavailable Energy	**03**
	(b)	Derive the Maxwell relations and explain their importance in thermodynamics.	**04**
	(c)	Derive Clausius-Claperyon Equation with p-T Diagram	**07**
Q.4	**(a)**	Differentiate between availability function and Gibb's energy function.	**03**
	(b)	Write a Joule-Thomson Co-efficient	**04**
	(c)	Derive first form of entropy equation; $$Tds = C_v dT + T\left(\frac{dp}{dT}\right)_V dv$$	**07**
Q.5	**(a)**	Define Partial Pressure and Mole Fraction	**03**
	(b)	The volume of a high altitude chamber is 40 m3. It is put into operation by reducing pressure from 1 bar to 0.4 bar and temperature from 25°C to 5°C How many kg of air must be removed from the chamber during the process. Express this mass as a volume measured at 1 bar and 25°C. Take R = 287 J/kg K for air.	**04**
	(c)	Show that specific heats of a gas mixture; $$C_p - C_v = R$$	**07**
Q.6	**(a)**	Write a short note on Adiabatic Mixing of Perfect Gases	**03**
	(b)	Explain briefly Dalton's law and Gibbs-Dalton law.	**04**
	(c)	8 Kg of air at 650 K and 5.5 bar pressure is enclosed in a closed system. If the atmospheric temperature and pressure are 300 K and 1 bar respectively, determine: The availability if the system goes through the ideal work producing process. The availability and effectiveness if the air is cooled at constant pressure to atmospheric temperature without bringing it to complete dead state. Take c_v= 0.718 kJ/Kg K; c_p= 1.005 kJ/Kg K	**07**

Q.7 **(a)** Explain Mode of Heat Transfer. **03**

(b) Derive the mathematical expression for the Critical insulation thickness. **04**

(c) The inner surface of a plane brick wall is at 60°C and the outer surface is at 35°C. Calculate the rate of heat transfer per m^2 of surface area of the wall, which is 220 mm thick. The thermal conductivity of the brick is 0.51 W/m°C. **07**

Q.8 **(a)** Write a short note on Radiation **03**

(b) Define Absorptivity, Reflectivity, Transmissivity Emissivity **04**

(c) Derive the condition for minimum resistance and consequently maximum heat flow rate $r_C = \frac{k}{h_o}$ **07**

Where, k = Heat transfer coefficient at the outer surface of the insulation

h_o = Thermal conductivity of insulating material

****