Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – SUMMER • 2014

Subject code: 1721001 **Date: 16-06-2014**

Subject Name: Cryogenic Systems

Time: 02:30 pm - 05:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Explain Pulse tube refrigerating system with a suitable diagram.	**07**
	(b)	Explain Linde dual pressure system with a schematic diagram.	**07**
Q.2	**(a)**	Calculate the liquid yield, the total work per unit mass of gas compressed and the work to liquefy a unit mass of gas for the Claude system using Nitrogen as the working medium. The system operates between 101.3 kPa and 300 K and 5.066 MPa. The expander flow rate ratio is 0.60 and the expander work is utilized to aid in compression of the gas. The condition of the gas at the inlet of the expander is 270 K and 5.066 MPa.	**07**
	(b)	Write note on ñCascade system for gas liquefactionò.	**07**
		OR	
	(b)	Write note on ñAbsorbents, their features and propertiesò.	**07**
Q.3	**(a)**	Derive an equation for performance factor in thermodynamically ideal isobaric refrigerator.	**07**
	(b)	A Gifford-Mcmahon refrigerator works between the pressure limits of 1 atm and 10 atm using helium as the working medium. The maximum cooling temperature is 70 K and the temperature of gas leaving the compressor is 300 K. Assume that the regenerator is 100 % effective, and compressor overall efficiency is 90 %. Estimate the COP of the refrigerator.	**07**
		OR	
Q.3	**(a)**	Enlist different gas liquefaction systems. Describe briefly methods used for the liquefaction of Hydrogen and helium	**08**
	(b)	List a few applications of low temperature refrigeration. Write the basic criteria for cryogenic fluid selection.	**06**
Q.4	**(a)**	Explain BET equation for physical adsorption.	**07**
	(b)	Write the desirable features of a regenerative heat exchanger of Philips refrigerator. Explain desirable properties of regenerator for higher cooling effect.	**07**
		OR	
Q.4	**(a)**	Write note on (1) Thermal valves (2) Adiabatic expansion process to produce low temperature	**08**
	(b)	Explain the role of Joule Thomson effect in cryogenic engineering.	**06**
Q.5	**(a)**	What do you mean by Magnetic refrigeration? With a neat sketch explain Magnetic refrigeration cycle.	**07**
	(b)	Explain briefly Langmuir Monolayer theory of adsorption process	**07**
		OR	
Q.5	**(a)**	Discuss the contribution of Claude, Kapitza in Gas liquefaction systems.	**07**
	(b)	Explain pressure swing adsorption system for separation of nitrogen from air.	**07**

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