Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E –IIst SEMESTER–EXAMINATION – JULY- 2012

Subject code: 1721001 **Date: XX/07/2012**

Subject Name: Cryogenic Systems

Time: 10:30 am – 13:00 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)**	Compare Philips and G-M refrigeration cycle. Also write the advantages and limitations of G-M cryorefrigerators.	**07**
	(b)	What modification in Claude system was carried out by Heylandt? Describe the modified system with a neat figure.	**07**
Q.2	**(a)**	With a schematic diagram explain the working of pulse tube refrigerator and its configurations.	**07**
	(b)	Write note on "Simon helium liquefier".	**07**
		OR	
	(b)	State and explain the principle of magnetic cooling. Also explain the cryocooler working on this principle.	**07**
Q.3	**(a)**	Define Joule- Thomson coefficient. With usual notations derive the expression for it.	**07**
	(b)	Determine the refrigerating effect, COP and FOM for a simple Linde-Hampson refrigerator operating from 300 K and 101.3 kPa to 10.13 MPa. The overall efficiency of the compressor is 75 % and the heat exchanger effectiveness is 0.960. The working fluid for the refrigerator is nitrogen.	**07**
		OR	
Q.3	**(a)**	Explain Linde dual pressure system. What is the importance of intermediate pressure flow rate in above system?	**07**
	(b)	Determine the liquid yield, work requirement per unit mass compressed in the high-pressure compressor, and work requirement per unit mass liquefied for a Linde dual-pressure system operating with nitrogen as the working fluid between 101.3 kPa and 300 K and 20.3 MPa. The intermediate pressure is 5.07 MPa and the intermediate-pressure flow rate is 0.80.	**07**
Q.4	**(a)**	With neat diagram, explain pressure swing absorption system of separation of Nitrogen from air.	**07**
	(b)	Explain briefly Langmuir Monolayer theory of adsorption process.	**07**
		OR	
Q.4	**(a)**	Write the desirable features of a regenerator of Philips refrigerator. Discuss how ineffectiveness of a regenerator affects the cooling effect.	**07**
	(b)	Explain BET equation with all terms involved in it.	**07**
Q.5	**(a)**	Explain Cascade liquefaction system.	**07**
	(b)	Explain the importance of inversion curves in cryogenic liquefaction systems.	**07**
		OR	
Q.5	**(a)**	Discuss various adsorbents used for cryogenic applications. State its features briefly.	**07**
	(b)	Determine COP for an isobaric source refrigerator operating reversibly between sink temperature of 300 K and minimum source temperature of 80 K and maximum source temperature of 100 K. The working fluid is nitrogen working as perfect gas having source pressure of 1 atm. What will be percentage change in COP when the medium is assumed to be real gas?	**07**

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