Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – III • EXAMINATION – SUMMER • 2013

Subject code: 731002 **Date: 15-05-2013**

Subject Name: Advanced Cryo Coolers

Time: 10.30 am – 01.00 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)**	Describe the major manufacturing considerations of rare earth powder used in cryocoolers regenerators.	**07**
	(b)	Explain working of He^3-He^4 dilution Cryocooler to attain the temperature of 0.040 K in mixing chamber with schematic diagram.	**07**
Q.2	**(a)**	Describe the difference between recuperative and regenerative Cryocooler with suitable examples.	**07**
	(b)	Differentiate between three different geometries for pulse tube Cryocoolers with their merits and demerits.	**07**
		OR	
	(b)	Explain approximate design method for single stage pulse tube Cryocooler.	**07**
Q.3	**(a)**	Discuss the advantages and disadvantages of J-T coolers.	**07**
	(b)	Discuss the advantages of MR J-T over J-T cryocooler for low temperature applications.	**07**
		OR	
Q.3	**(a)**	Explain with neat sketch the construction of He^3-He^4 dilution refrigerator precooled by G-M two stage Cryocooler to achieve temperature of 0.015 K.	**07**
	(b)	Write briefly on (a) Electrochemical compressor, (b) Sorption compressor	**07**
Q.4	**(a)**	Describe the working of Ideal Sterling Cycle with necessary diagrams. Also draw the displacement diagrams for displacer and piston.	**07**
	(b)	Explain pressure-volume variations phenomenon for the Sterling Cryocooler.	**07**
		OR	
Q.4	**(a)**	Write about Phase Shift Mechanisms and DC flow applicable to a typical PTR.	**07**

	(b)	Describe about Physical Model and governing equations along with boundary conditions for numerical simulation of the two stage double inlet OPTR with Helium-4 gas.	**07**
Q.5	**(a)**	Write short notes on followings. (i) Cryocooler Reliability (ii) Military space cryogenic cooling	**07**
	(b)	Explain with flow diagram the mixed gas J-T Cryocooler with precooling.	**07**

OR

Q.5	**(a)**	Explain construction and working of a typical rotary valve used for PTR with neat figure.	**07**
	(b)	Discuss the effects of valve timing on performance of the pulse tube cryocooler.	**07**

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