Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER–II EXAMINATION – SUMMER 2015

Subject Code: 2721001 Date: 26/05/2015

Subject Name: Cryogenic systems

Time: 02:30 PM to 05:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Figures to the right indicate full marks.**
3. **Make suitable assumptions wherever necessary and mention it clearly in your solution.**

Q.1	**(a)**	Write difference between Refrigeration and Liquefaction. Explain Kapitza Gas liquefaction system.	**07**
	(b)	Briefly explain Absorbents, their properties and features.	**07**
Q.2	**(a)**	State principle of adsorption. Explain BET equation for physical adsorption.	**07**
	(b)	Explain in brief Joule Thomson effect. With neat sketch explain precooled Joule-Thompson refrigerator.	**07**
		OR	
	(b)	Enlist various gas liquefaction systems. Discuss methods used for the liquefaction of Hydrogen.	**07**
Q.3	**(a)**	Discuss ñTheoretical overview of Cryogenic systems.ò	**07**
	(b)	Explain concept of Pulse tube refrigeration. Enlist various types of Pulse tube refrigerators with their configurations.	**07**
		OR	
Q.3	**(a)**	What modification in Claude system was carried out by Heylandt? Explain the modified system with neat diagram.	**07**
	(b)	Write note on Cascade system for gas liquefaction.	**07**
Q.4	**(a)**	Explain in brief PSA and VSA adsorption systems.	**08**
	(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 %. Calculate its COP.	**06**
		OR	
Q.4	**(a)**	Write short note on : (1) Importance of inversion curves in Cryogenic liquefaction systems (2) Thermal valves	**08**
	(b)	Write comparison between Philips and G-M refrigeration cycles. Also state the desirable features of a regenerative heat exchanger of Philips refrigerator.	**06**
Q.5	**(a)**	Calculate 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**
	(b)	With neat sketch discuss the simple Linde-Hampson system for gas liquefaction.	**07**
		OR	
Q.5	**(a)**	What do you understand by isothermal-source and isobaric-source system with reference to cryogenic refrigeration systems? Compare both the systems.	**07**
	(b)	Write note on Magnetic refrigeration and Nuclear Demagnetization.	**07**