Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. Sem. – II[nd] - Examination – June/July- 2011

Subject code: 1721002

Subject Name: Cryogenic Plants & Equipments

Date:24/06/2011 **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)**	With neat sketch explain horizontal cryogenic storage vessels with all essential components.	**07**
	(b)	Explain the thermodynamically ideal gas separation system.	**07**
Q.2	**(a)**	Write note on Heylandt system of gas separation.	**07**
	(b)	Write note on enthalpy composition diagram.	**07**
		OR	
	(b)	Write note on Argon separation system.	**07**
Q.3	**(a)**	A cylindrical liquid nitrogen vessel with evacuated perlite having an apparent thermal conductivity of 1.7 mW/mK. The inner vessel is 1.5 m diameter and outer vessel diameter is 2.1 m. The vessels have 2:1 elliptical heads. The lengths of the cylindrical portions are inner vessel 2.2 m and outer vessel 2.8 m. calculate the boil-off rate considering latent heat of LN_2 equal to 199.6 kJ/kg.s	**12**
	(b)	Give classification of cryogenic fluid storage vessels.	**02**
		OR	
Q.3	**(a)**	Design the inner vessel shell and heads for 110 m^3 liquid nitrogen vessel. The inside diameter of the shell and heads is 3.05m. Hemispherical heads are to be used. The design internal pressure is 800 kPa and 10% ullage volume is to be considered. Also design the stiffening rings which are placed at $\theta = 80^o$. Take material for inner vessel is 304 SS.	**12**
	(b)	Explain cryostat.	**02**
Q.4	**(a)**	Derive the formula for theoretical plate calculation according to McCabe-Thiele method.	**10**
	(b)	Describe the methods of reducing the boil-off rate in cryogenic piping.	**04**
		OR	
Q.4	**(a)**	Describe different types of rectification columns in brief.	**10**
	(b)	Differentiate perforated plate and bubble cap plate used in rectification column.	**04**
Q.5	**(a)**	When vacuum insulated line is used in cryogenic fluid transfer line systems? Also discuss its limitations.	**07**
	(b)	Write note on cryogenic valves.	**07**
		OR	
Q.5	**(a)**	Explain fabrication and joining techniques used in cryogenic field.	**07**
	(b)	Compare Linde double column system and Linde-Frankl system of gas separations	**07**

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