Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject code: 1721002 **Date: 09/07/2012**

Subject Name: Cryogenic Plants and Equipments

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)**	A mixture of nitrogen, oxygen and argon as a two phase substance, how many properties must be specified in order to determine the state of the mixture? List some typical combination of properties.	**07**
	(b)	Determine equilibrium liquid and vapour compositions of a mixture of nitrogen and argon at 101.3 kPa and 84 K assuming that the liquid is a perfect solution and vapour is an ideal gas. The saturation pressure for pure nitrogen at 84 K is 245.3 kPa. And saturation pressure of argon at 84 K is 84.2 kPa.	**07**
Q.2	**(a)**	Describe McCabe-Thiele method for theoretical plate calculations.	**07**
	(b)	Explain briefly Linde Double column air separation system with figure.	**07**
		OR	
	(b)	Determine the ideal work required to separate reversible and isothermally 3 kg mixture of 92 % gaseous Hydrogen and 8 % gaseous Methane by volume at 300 K.	**07**
Q.3	**(a)**	Describe about different rectification columns used for gas separation process.	**07**
	(b)	Explain with the help of line diagram Krypton and Xenon purification system.	**07**
		OR	
Q.3	**(a)**	Explain catalytic combustion purification system for argon with neat sketch.	**07**
	(b)	Explain briefly helium separation from natural gas with line diagram.	**07**
Q.4	**(a)**	Describe with neat sketches the suspension systems for inner vessels of cryogenic fluid storage Dewars.	**07**
	(b)	Classify Dewar vessels. Also draw the figure of Dewar vessel indicating its basic elements.	**07**
		OR	
Q.4	**(a)**	Explain construction and working of liquid shielded vessels used for cryogen storage with figures.	**07**

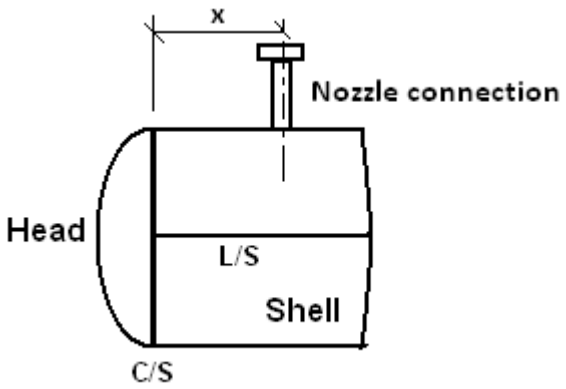
(b) The inner shell of a horizontal cylindrical LN2 Dewar has a cylindrical length of 24 m and inside diameter of 2.0 m. The inner vessel is constructed of SS 304 with full radiographed welds. The working pressure for inner vessel is 650 kPa absolute. Elliptical heads with axis ratio of 2 are used as the end closures. For 10 % ullage space find minimum thickness of inner shell and heads. **07**

Q.5 **(a)** Explain features of Cryostat for testing mechanical properties of metals in a temperature range of 20 K to 300 K. **07**

(b) Describe construction of extended stem valve for cryogen flow control with figure. **07**

OR

Q.5 **(a)** Describe briefly the steps of fabrication procedure for SS-304 cylindrical inner vessel as shown in following figure. **06**



L/S : Long Seam, C/S: Circumferential Seam
x= Distance of nozzle from C/S

(b) Describe the following typical butt weld preparations for 16 mm thick S.S.316L material with neat sketches. **08**

(i) Single 'V' (ii) Double 'V' (iii) Single 'U' (iv) Double 'U'

****