

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**M. E. - SEMESTER – II • EXAMINATION – WINTER 2012**

**Subject code: 1721001****Date: 29-12-2012****Subject Name: Cryogenic Systems****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.
4. Use of properties Charts and Tables is permissible

- Q.1** (a) Explain Joule-Thomson refrigerator with neat sketch. **07**  
 (b) Discuss the importance of regenerator effectiveness for Philips refrigerator **07**
- Q.2** (a) A refrigerator working on Gifford-McMahon cycle operates between the pressure limits of 1 atm and 10 atm using helium as the working fluid. The maximum temperature of the space to be cooled is 70 K, and the temperature of gas leaving the compressor is 300 K. Assume that the regenerator is 100 percent effective, and compressor overall efficiency is 60 percent. The expansion efficiency is 90 percent. Determine the COP for the system. **07**  
 (b) Derive the equation for COP in thermodynamically ideal isobaric refrigeration system. **07**  
**OR**  
 (b) Explain pulse tube refrigerator. **07**
- Q.3** (a) A Claude system using nitrogen as working fluid operates between 1 atm and 300 K, and 50 atm. The expander flow rate ratio is 0.6, and the expander work is utilized to aid in compression of the gas. The condition of the gas at the inlet of the expander is 270 K and 50 atm. Determine the liquid yield, the total work per unit mass of gas compressed and work to liquefy a unit mass of gas. **07**  
 (b) With neat sketch explain Linde dual pressure system. **07**  
**OR**
- Q.3** (a) A Linde dual-pressure system operates with nitrogen as working fluid between 1 atm and 300 K, and 200 atm. The intermediate pressure is 50atm, and the intermediate pressure flow rate ratio is 0.80. Determine the liquid yield, work requirement per unit mass compressed in the high-pressure compressor and work requirement per unit mass liquefied **07**  
 (b) Explain Claude system for gas liquefaction system. **07**
- Q.4** (a) Explain thermodynamically ideal isothermal source refrigeration cycle and derive the equation for COP. **07**  
 (b) Explain the Magnetic refrigeration cycle with neat sketch. **07**  
**OR**
- Q.4** (a) Explain adiabatic expansion process to produce low temperature. **07**  
**Q.4** (b) Explain cascade system for gas liquefaction **07**
- Q.5** (a) Derive an equation for work requirement for thermodynamically ideal gas liquefaction system. **07**  
 (b) Explain Joule-Thomson effect to produce of low temperature. **07**  
**OR**
- Q.5** (a) Write about various types of adsorbents with their properties. **07**  
 (b) Explain BET equation for physical adsorption. **07**

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