

Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

## GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER II (NEW) – • EXAMINATION – SUMMER 2016

Subject Code: 2721001

Date: 24/05/2016

Subject Name: Cryogenic System

Time: 10:30 am to 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.

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|-----|-----|---|----|
| Q.1 | (a) | Explain "Cascade system for gas liquefaction".  | 07 |
|     | (b) | Explain BET equation for physical adsorption  | 07 |
| Q.2 | (a) | Explain pulse tube refrigerator.  | 07 |
|     | (b) | 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.<br>Determine the liquid yield, the total work per unit mass of gas compressed and work to liquefy a unit mass of gas. | 07 |
|     |     | <b>OR</b>   |    |
|     | (b) | List a few applications of low temperature refrigeration. Write the basic criteria for cryogenic fluid selection  | 07 |
| Q.3 | (a) | Explain briefly Langmuir Monolayer theory of adsorption process.  | 07 |
|     | (b) | Write note on (1) Thermal valves<br>(2) Adiabatic expansion process to produce low temperature  | 07 |
|     |     | <b>OR</b>   |    |
| Q.3 | (a) | Explain thermodynamically ideal isothermal source refrigeration cycle and derive the equation for COP.  | 07 |
|     | (b) | Explain in brief PSA and VSA adsorption systems.  | 07 |
| Q.4 | (a) | What modification in Claude system was carried out by Heylandt? Explain the Modified system with neat diagram.  | 07 |
|     | (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 %. Estimate the COP of the refrigerator.   | 07 |
|     |     | <b>OR</b>   |    |
| Q.4 | (a) | With neat sketch explain Linde dual pressure system.  | 07 |
|     | (b) | Discuss the importance of regenerator effectiveness for Philips refrigerator  | 07 |
| Q.5 | (a) | Write difference between Refrigeration and Liquefaction. Explain Kapitza Gas liquefaction system.   | 07 |
|     | (b) | Derive the equation for COP in thermodynamically ideal isobaric refrigeration system.   | 07 |
|     |     | <b>OR</b>   |    |
| Q.5 | (a) | Write short note on :<br>(1) Importance of inversion curves in Cryogenic liquefaction systems<br>(2) Thermal valves   | 07 |
|     | (b) | What do you mean by Magnetic refrigeration? With a neat sketch explain Magnetic refrigeration cycle.  | 07 |