

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

Subject code: 731002**Date: 26/12/2012****Subject Name: Advanced Cryo Coolers****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) Describe the difference between recuperative and regenerative cryocooler with suitable examples. 07
- (b) Describe the methodology of loss analysis of basic pulse tube cryocooler. 07
- Q.2 (a) Describe the working of Ideal Stirling Cycle with necessary diagrams. Also draw the displacement diagrams for displacer and piston. 07
- (b) Explain about Phase Shift Mechanisms and DC flow applicable to a typical pulse tube refrigerator. 07

OR

- (b) Explain pressure-volume variations phenomenon for the Stirling Cryocooler. 07
- Q.3 (a) Explain briefly on working of (a) Sorption compressor, (b) Electrochemical compressor used for cryocoolers. 07
- (b) Describe the advantages and disadvantages of J-T cryocoolers applied for cooling of infrared sensors. 07

OR

- Q.3 (a) Write short note on Mass flow rate and cooling capacity of the J–T cryocooler. 07
- (b) Describe selection procedure of gas mixture components for MR J-T cryocooler. 07
- Q.4 (a) Explain about monolithic regenerator and multilayered regenerators with necessary figures. 07
- (b) Describe about valve timing and its effect on performance of 4 K pulse tube refrigerator. 07

OR

- Q.4 (a) Explain with neat sketch the construction of $\text{He}^3\text{-He}^4$ dilution refrigerator precooled by G-M two stage Cryocooler to achieve temperature of 0.015 K. 07
- (b) Explain significance of miniaturization of pulse tube cryocooler in space applications. 07
- Q.5 (a) Give classification of different regenerative materials with respect to temperature range. 07
- (b) Describe concept of microgravity applicable to dilution refrigerator. What are the merits of it? 07

OR

- Q.5 (a) Write on applications of cryocoolers for military and medical along with suitable examples. 07
- (b) Write short note on followings. 07
- (i). Cryocooler reliability (ii) Linear compressor cryocooler
