

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
ME - SEMESTER- 3 (NEW) • EXAMINATION – WINTER - 2023

Subject Code:3731002

Date: 02 Dec 2023

Subject Name:Advanced Cryocoolers

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.

Q-1 (a) Explain the importance of Cryocooler in present era. Enlist the design parameters of cryocoolers and ideal working cycle. **07**

(b) Explain Thermoacoustic compressor & Sorption compressor for driving Pulse tube cryocooler. **07**

Q-2 (a) Explain linear compressor drive with reference to miniature Stirling cooler **07**

(b) How are cryocoolers classified? **07**

OR

(b) Discuss the desirable characteristics of cryocoolers used in Space & Defense. **07**

Q-3 (a) Explain the effect of orientation in case of working of G-M Cooler with reference to its medical applications. **07**

(b) Write a short note on loss analysis as applied to Stirling cryocooler. **07**

OR

Q-3 (a) Explain working principle of Magnetic refrigerator. Describe its working with example of suitable application. **07**

(b) Describe the design methodology of two stage G-M Cryocooler. Also give its applications. **07**

Q-4 (a) Explain with flow diagram the mixed gas J-T Cryocooler with precooling. **07**

(b) Manufacturing considerations of rare earth powder used in Cryocoolers for regenerative heat exchangers. **07**

OR

Q-4 (a) Describe Cool-down characteristics of the J–T Cryocooler with different (a) supply pressure, (b) temperature and (c) mass flow rate and pressure. **07**

(b) Explain working of He3 -He4 dilution Cryocooler to attain the temperature of 0.040 K in mixing chamber with schematic diagram. **07**

Q-5 (a) Explain approximate design method for single stage pulse tube Cryocooler considering the losses. **07**

(b) Describe the advantages and disadvantages of Pulse Tube Cryocoolers. **07**

OR

Q-5 (a) Explain valve timing effect on Performance of 4K pulse tube Cryocooler with necessary figure. **07**

(b) Write briefly about present developments in Space pulse tube Cryocoolers. **07**
