Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER- VII EXAMINATION-SUMMER 2023

Subject Code: 3171919 Date: 26/06/2023

Subject Name: Cryogenics Engineering

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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Write a short note on properties of liquid Hydrogen.	**03**
	(b)	Explain how the ultimate and yield strengths of engineering materials change with cryogenic temperature?	**04**
	(c)	Derive an expression for the work requirement per unit mass of gas liquefied for an ideal system.	**07**
Q.2	**(a)**	Write a note on cryogenic fluid transfer systems.	**03**
	(b)	Write a note on thermal insulation and their performance at cryogenic temperatures.	**04**
	(c)	Explain the Joule Thomson effect. Show the inversion curve of a real gas on a T-p diagram. Prove that an ideal gas will not experience a temperature change upon isenthalpic expansion.	**07**
		OR	
	(c)	Explain Simon Helium liquefier and show the process path on a T-s diagram.	**07**
Q.3	**(a)**	What is Precooled Linde Hampson system?	**03**
	(b)	Explain (i) Meissner effect (ii) Fountain effect.	**04**
	(c)	How the cryo coolers are classified? Explain Strilling cycle cryo refrigerator with neat sketch and write the C.O.P. for same.	**07**
		OR	
Q.3	**(a)**	Sketch and explain the variation of specific heat of liquid helium 4 at near absolute zero temperature.	**03**
	(b)	Explain the terms (i) Transition temperature and (ii) Critical current of superconductors.	**04**
	(c)	With a neat sketch, explain Linde single column gas separation system.	**07**
Q.4	**(a)**	What is FOM?	**03**
	(b)	Explain the significance of heat exchanger effectiveness on the performance of a cryogenic liquefier	**04**
	(c)	Describe the mechanism of insulation in case of each of the following and state the modes of heat transfer against which they are not effectives (i) Opacified powder (ii) evacuated powder and fibrous insulation. (iii) expanded foam insulations. Give their specifications	**07**
		OR	
Q.4	**(a)**	Write note on Application of cryogenics in biology	**03**
	(b)	Discuss the effect of compressor and expander efficiencies on the performance of Claude cycle.	**04**

	(c)	Enlist Air separation and purification systems. Explain any one system with diagram	**07**
Q.5	**(a)**	Explain Metallic resistance thermometer used for cryogenic temperature measurement.	**03**
	(b)	Briefly explain (1) Design of transfer line (2) Cryogenic valves.	**04**
	(c)	With the help of a neat sketch explain a typical cryogenic liquid storage vessel.	**07**

OR

Q.5	**(a)**	Enlist various measurement systems used in cryogenic engineering.	**03**
	(b)	Explain construction and working of Turbine flow meter with figure.	**04**
	(c)	Discuss in brief hazards on account of (i) flammability(ii) high pressure gas (iii) Material of construction (iv) personal exposure hazards.	**07**

****