Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-I Examination January 2010

Subject code: 711004 Subject Name: Elements of Cryogenic Engineering

Date:29 / 01 / 2010 Time: 12.00 – 2.30 pm

Total Marks: 60

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	What is cryogenics? Describe the scope of cryogenics.	**06**
	(b)	Discuss the variation of fatigue strength of material at cryogenic temperature.	**06**
Q.2	**(a)**	Determine the total heat transfer rate from the outer shell to the inner shell of a spherical dewar with a 1.5m OD inner shell and 2.1m ID outer shell. The outer shell is at 300 K; it has an emissivity of 0.10 and an accommodation coefficient of 0.90. The inner shell is at 78 K; it has an emissivity of 0.05 and an accommodation coefficient of 1.00. The gas within the annular space is air at a pressure of 2 mPa. The dewar is insulated by vacuum only and viscosity of air is 18.47×10^{-6} Pa-s at 300 K	**06**
	(b)	Explain the variation of specific heat of solids.	**06**
		OR	
	(b)	Write a note on superconductivity.	**06**
Q.3	**(a)**	Write in detail about multilayer insulation.	**06**
	(b)	Discuss the properties of Helium as cryogenic fluid.	**06**
		OR	
Q.3	**(a)**	Explain opacified-powder insulations	**06**
	(b)	Discuss about the measurement and calibration of thermometer based on thermocouple.	**06**
Q.4	**(a)**	Write the calibration process for thermometer based on the principal of Curie law.	**06**
	(b)	An orifice meter is used to measure the flow of liquid nitrogen through a tube having an ID of 102mm. The diameter of the orifice is 51mm, and the measured pressure drop is 0.150 kPa. The temperature of the liquid nitrogen is 85 K. Determine the mass flow rate of the liquid nitrogen. At 85 K, density and viscosity for nitrogen are $771 kg/m^3$ and 119×10^{-6} Pa-s. assume initial value of $C_d = 0.62$.	**06**
		OR	
Q.4	**(a)**	Discuss in detail about turbine flow meters.	**06**
	(b)	A platinum resistance thermometer yields a resistance reading of 38.6 ohms at a certain temperature. If the electric resistance at 0^oC is 100 ohms. Determine the corresponding temperature indication of the thermometer. Take the values of constants as $A = 3.946 \times 10^{-3} {}^oC^{-1}$ $B = -1.108 \times 10^{-6} {}^oC^{-2}$ and $A = 3.33 \times 10^{-12} {}^oC^{-4}$	**06**
Q.5	**(a)**	Write a note on space simulation chamber.	**06**
	(b)	Write on safety and precautions to be taken for the storage of gaseous cylinders.	**06**
		OR	
Q.5	**(a)**	Discuss the applications of cryogenics in food and organ preservation.	**06**
	(b)	Discuss about the chemical hazards in cryogenic systems	**06**

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