Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. IST Semester–Remedial Examination – July- 2011

Subject code: 711004

Subject Name: Elements of Cryogenic Engineering

Date:13/07/2011 **Time: 10:30 am – 01:00 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)** Define thermal conductivity of materials. Explain the effect of low temperature on thermal conductivity of following materials. **06**
(i) Pure Copper (ii) Titanium (iii) SS-304 (iv) Beryllium Copper

(b) Explain heat transfer phenomenon for vacuum insulation for cryogenic applications. **06**

Q.2 **(a)** A neon vapour pressure thermometer has a pressure indication of 300 kPa. Determine the temperature indication and the sensitivity of the thermometer at this point. **06**

(b) Describe the selection criteria for insulations for low temperature applications. **06**

OR

(b) Explain construction and working of capacitance type liquid level gauge with figure. **06**

Q.3 **(a)** Determine the specific heat of chromium at 20 K if the specific heat is given by the Debay function. Take Debay characteristic temperature for chromium is 440 K. **06**

(b) Discuss briefly about the properties of Helium-3. **06**

OR

Q.3 **(a)** Write short note on Superconducting Bearings stating its applications. **06**

(b) Explain working principle of Thermodynamic liquid level gauge with figure. **06**

Q.4 **(a)** Write various categories of Hazards. Explain any one in brief. **06**

(b) Write short note on CRYOBIOLOGY. **06**

OR

Q.4 **(a)** Explain construction and working of Turbine flow meter for cryogenic flow measurement. **06**

(b) Liquid hydrogen at 22 K flows through a pipe having an inside diameter of 42.8 mm. A venturimeter having a throat diameter of 21.4 mm is placed in the line to measure the flow rate of the fluid. Determine the volumetric flow rate of liquid hydrogen if the pressure difference measured is 1.35 kPa. **06**

Q.5 **(a)** Explain working of Fixed Electric Resistance liquid level gauge for cryogenic storage tank with neat figure. **06**

(b) Determine the critical current using Silsbee's rule for a tantalum wire of 1.3 mm diameter at 3.3 K. Assume the parabolic rule is valid for the transition curve. **06**
Take H_0 = 0.0805 tesla at T_0 = 4.48 K.

OR

Q.5 **(a)** Explain the heat transfer mechanism of Opacified powder insulation of cryogen storage vessels. **06**

(b) Determine the mean apparent thermal conductivity of a multilayer insulation between 300 K and 77 K. The layer density of insulation is 25 layers per centimeter. If the emissivity of aluminium foil is 0.05 and the spacer of fiberglass has solid conductance of 85 mW/m^{2}K. **06**

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