Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**M. E. - SEMESTER – I • EXAMINATION – SUMMER • 2013**

**Subject code: 711004N** **Date: 06-06-2013**

**Subject Name: Elements of Cryogenic Engineering**

**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.**
4. **Use of chart for Nitrogen is permissible.**

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|---|---|---|---|
| **Q.1** | **(a)** | Discuss the use of Multilayer insulation for cryogenic application. Explain the variation of apparent mean thermal conductivity of MLI with residual gas pressure. | **07** |
| | **(b)** | Differentiate between evacuated powders and opacified powder insulation. Discuss the effect of variation of thermal conductivity with percentage of opacifier for an opacified powder insulation. | **07** |
| **Q.2** | **(a)** | Write note on Space simulation chamber. | **07** |
| | **(b)** | Explain following phenomenon of superconductivity<br>1. Meissner effect 2.Critical current 3. Critical flux density | **07** |
| | | **OR** | |
| | **(b)** | Write a short note on microsphere insulation | **07** |
| **Q.3** | **(a)** | What are the different types of thermometer used for low temperature? Describe working of any one thermometer with neat sketch. | **07** |
| | **(b)** | Explain capacitance level probe. Derive an expression for liquid level $L_f$ and its sensitivity. Discuss about the parameters affecting the sensitivity. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | List the Pressure measurement devices and explain thermal conductivity gauge with neat sketch | **07** |
| | **(b)** | What are the different flow measuring instruments? Describe working of any with neat sketch. | **07** |
| **Q.4** | **(a)** | Why is it necessary to study the physical properties of some engineering materials commonly used in cryogenic engineering? | **07** |
| | **(b)** | Explain the fountain effect, rolling effect and second sound phenomenon for helium II. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | Define thermal conductivity of materials. Explain the effect of low temperature on thermal conductivity of following materials.<br>(i) Pure Copper (ii) Titanium (iii) SS-304 (iv) Beryllium Copper | **07** |
| | **(b)** | Discuss the thermal properties of liquid and gaseous hydrogen. | **07** |
| **Q.5** | **(a)** | Write a short note on the cryo-freezing and food preservation. | **07** |
| | **(b)** | Discuss the safety criteria to be considered while handling the cryogens. | |
| | | OR | |
| **Q.5** | **(a)** | Write note on Application of cryogenics in biology and medicine. | **07** |
| | **(b)** | Discuss in brief hazards on account of (i) flammability (ii) high pressure gas (iii) materials of construction (iv) personal exposure hazards. | |

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