*Seat No.: _____* *Enrolment No._____*

# GUJARAT TECHNOLOGICAL UNIVERSITY

**M.E Sem-I Regular Examination January / February 2011**

**Subject code: 711001N Subject Name: Cryogenic Fundamentals**

**Date: 31 /01 /2011** **Time: 02.30 pm – 05.00 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 properties Chart and tables permissible**
5. **Draw neat sketches, wherever necessary.**

**Q.1** **(a)** Write important properties to be considered for selection of insulation. Explain merits and demerits of following cryogenic insulations, along with their applications. **07**

1. Gas filled powder insulation 2. Vacuum insulation.

**(b)** Determine the mean thermal conductivity of multilayer insulation. **07**

(i) between 312 K and 20.5 K and

(ii) between 20.5 and 4.2 K

If, insulation is made up of 50 layers per cm of aluminum foil having emissivity of 0.05 on both the sides. The value of $h_i$=85W/$m^2$.

**Q.2** **(a)** Discuss the importance of critical temperature and critical magnetic field in super conductivity. **07**

Write short note on applications of super conductivity.

**(b)** Explain the construction and working of super conducting gyroscope and bearing. **07**

**OR**

**(b)** Explain the use of cryogenics in eye surgery. **07**

**Q.3** **(a)** Briefly explain how the resistance property of a substance can be used for measurement of cryogenic temperatures. Compare the metallic resistance thermometer with non-metallic thermometer. **07**

**(b)** Why hydrogen finds its place in nuclear rockets also? With a neat sketch explain the construction and working of chemical propulsion space engines. **07**

**OR**

**Q.3** **(a)** Compare the constant volume gas thermometer and vapour pressure hermometer. State different corrections made for high precision of the thermometers. What are precautions that must considered for use of such thermometers. **07**

**(b)** Explain the construction and working of general surgery probe used for surgery of tumors. **07**

**Q.4** **(a)** Explain the variation in specific heat of Helium with temperature cryogenic range and Lambda Point. **07**

**(b)** Discuss briefly about thermal properties of liquid and gaseous hydrogen. **07**

**OR**

**Q.4** **(a)** Explain use of cryogenics in blood preservation.

**(b)** With a neat sketch explain the construction and working of a cryotron. **07**

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| **Q.5** | **(a)** | Briefly describe any one cryogenic liquid quality measuring device. | **07** |
| | **(b)** | Prove that the calibration curve of a capacitance type cryogenic liquid-level indicator is a straight line of the type Y= m*x +C | **07** |

**OR**

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| **Q.5** | **(a)** | With a neat sketch explain the method of cryogenic fluid flow measurement. | **07** |
| | **(b)** | Explain various phenomenons taking place with Helium super fluid. | **07** |

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