Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER–IV • EXAMINATION – SUMMER • 2014

Subject Code: 741001 Date: 04-06-2014

Subject Name: Advanced Cryogenics and Applied Super Conductivity

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.**

Q.1	(a)	Discuss about the Gibbs free energy difference between the normal and the superconducting phases per unit volume using necessary diagram.	**07**
	(b)	Explain oxygen stoichiometry for the cuprate Y-Ba-Cu-O. Also describe its effect on superconductivity transition temperature of the cuprate.	**07**
Q.2	(a)	List the different cuprates of thallium. Discuss the effect of calcium, copper and oxygen stoichiometry on resistivity of thallium cuprates with respect to the temperatures.	**07**
	(b)	Draw the detailed schematic structure of the following cuprates. i). $Ca_{0.85}Sr_{0.15}CuO_2$ ii). $LaSrCaCu_2O_6$	**07**
		OR	
	(b)	Describe the properties of Oxyhalides and Oxycarbonates cuprates along with their stoichiometry.	**07**
Q.3	(a)	Explain rigidity of the wave function in context to flux quantization with necessary figures.	**07**
	(b)	State London hypothesis. Derive the unique relation between current density and magnetic vector potential from it.	**07**
		OR	
Q.3	(a)	State the equation for classical Lorentz force . From it derive the condition for correct flux quantization.	**07**
	(b)	Differentiate between DC Josephson effect and AC Josephson effect using relevant theories.	**07**
Q.4	(a)	Explain following terms with relevant theories. i). BCS gap ii). BCS ground state	**07**
	(b)	Describe the important issues to design a good superconducting magnet.	**07**
		OR	
Q. 4	(a)	Write the Hamiltonian with usual notations to describe the electronic states of CuO_2 lattice of the cuprates. Also explain one-band and two-band electronic model from it.	**07**
	(b)	Describe the construction and working of a typical SQUID system for sensing external magnetic fields.	**07**
Q.5	(a)	Write the function of a bolometer. Describe basic principle and operation of the bolometer.	**07**
	(b)	Explain construction of Optoisolator with neat figure. Also discuss about its applications,	**07**
		OR	
Q.5	(a)	Explain the principle and operation of a typical magnetic fusion system with figure.	**07**
	(b)	Write short note on (i) Meissner effect and Zero electrical resistance (ii) Type-I Superconductors	**07**

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