GUJARAT TECHNOLOGICAL UNIVERSITY

MECHANICAL (CRYOGENIC ENGINEERING) (10)
APPLIED SUPER CONDUCTIVITY
SUBJECT CODE: 2741001
SEMESTER: IV

Type of course: Major Elective V

Prerequisite: Physics, Thermodynamics and Cryogenic fundamentals

Rationale: The contents of this subject will give the knowledge of superconductivity and applications of superconductivity in different fields

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks		Practical Marks				
				ESE (E)	PA (M)	PA (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2#	0	4	70	30	30	0	10	10	150

Content:

Sr. No	Course Content	Hours	% Weightage
1	**Superconductivity:** Transition Temperature, Meissner– Ochsenfeld Effect, Type I Superconductors, Type II Superconductors, Thermodynamics of Superconductors ,London Equations, Pipard's Equation, Free energy function for super conductor, Super conducting phase transition, Coherence length and Zero electrical resistance, Flux Quantization Josephson Effect, BCS Theory, Superconducting Magnetometer – Squid ,Superconductors With Unusual Properties – Organic Superconductors, Magnetism and Superconductivity, Heavy – Fermion Superconductors, High –Tc Superconductors (HTS), HTS family, Structural and electrical properties, Applications of HTS.	**14**	35
2	**Super conducting Materials :** Material superconducting at LHe temperature, Structure of material and composition, High Tc cuparates, Composition, structures properties and general future of various types of cuparates. Electron super conductors , Oxyhalides , oxycarbonates, ladder cuprates copper free oxide superconductors ,boro carbides ,super conducting fullerides and related materials preparation of cuparates materials making of films of superconductor by electron beam evaporation, high pressure oxygen sputtering system ,lesser ablation method.	**12**	30
3	**Applications of Superconductivity :** 1) Magnets : High field magnet application ,Nuclear magnetic resonance, medical diagnostics and spectroscopy ,Ore refining (Magnetic separators),Magnetic levitation, Magnetic shielding, Large physics machines	**16**	35

	2) Energy related : Production by magnetic fusion and magneto hydrodynamics, energy storage, Electrical power transmission 3) Transportation: High speed trains ,Ship –drive system 4) Electronics and small devices: SQUIDS, Josephson devices, Bolometer ,Electromagnetic shielding 5) Computers and information processing: Semiconductor-superconductor hybrids, Active superconducting elements, Voltage standard Optoelectronics, Matched filters. 6) Applications in advance research		

References Books:

1. Low Temperature Superconductivity & Superconductivity By Christian Enss & Siegfried Hunklinger
2. Matter & Methods At Low Temperature By F.Pobell.
3. Experimental low temperature physics by Anthony Kent
4. D. Schoneberg , Superconductivity, Cambridge University Press,1954.
5. M. Tinkham, Introduction to superconductivity, McGraw-Hill, New York, 1975

Course Outcome:

After learning the course the students should have idea about superconductivity phenomena, superconducting material and applications of superconductivity

List of tutorials: Students will submit the assignment or visit report or case study as per the instruction of faculty

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.