

GUJARAT TECHNOLOGICAL UNIVERSITY

MECHANICAL (CRYOGENIC ENGINEERING) (10)

CRYOGENIC FUNDAMENTALS

SUBJECT CODE: 2711001

SEMESTER: I

Type of course: Core subject

Prerequisite: - Basic knowledge of thermodynamics and physics.

Rationale:

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	PA (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2#	2	5	70	30	20	10	10	10	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1.	Properties of engineering materials at cryogenic temperatures, mechanical properties ,thermal properties, electric & magnetic properties, super conducting materials ,thermo electric materials, composite materials, properties of cryogenic fluids, super fluidity of He3 & He4.	9	20
2.	Measurement systems for low temperatures:-Temperature measurements, pressure measurements, flow measurements, liquid level measurements, fluid quality measurements.	11	25
3.	Cryogenic insulation:- various types such as expanded foams, gas filled& fibrous insulation, vacuum insulation, evacuated powder& fibrous insulation, opacified powder insulation, multi-layer insulation, comparison of performance of various insulations.	12	25
4	Applications of cryogenic systems Super conductive devices such as bearings, motors, cryotrons, magnets, D.C. transformers, tunnel diodes, space technology, space simulation, cryogenics in biology and medicine, food preservation and industrial applications, nuclear propulsions ,chemical propulsions.	6	15
5	Hazards:-Physical hazards, Chemical hazards, Physiological hazards, combustion hazards, oxygen hazards, , accidents in cryogenic plants & prevention	6	15

Reference Books:

1. Cryogenic systems-Baron, McGraw-Hill book

2. Cryogenic fundamentals-Haselden, Academic press New York
3. Cryogenic technology –Vance
4. Advance cryogenic –bailey, plenum press
5. Cryogenic engineering –Scott

Course Outcome:

After learning the course the students should be able to: Properties of material at low temperature. Pressure, temperature, flow, fluid quality and liquid level measurement at low temperature. Different types of cryogenic insulations. Different cryogenic applications. Low temperature hazards

List of Experiments:

1. Study of cryogenic properties of hydrogen and helium.
2. Study of low temperature measurement instrument.
3. Study of flow measurement and quality measurement instrument.
4. Study of liquid level measurement.
5. Study of insulation used in cryogenic equipment.
6. Study of cryogenic application (superconductivity)
7. Study of cryogenic application in space technology.
8. Study of cryogenic application in bio medical and food preservation.
9. Study of safety while handling fluid.
10. To find the thermal conductivity of powder insulation by boil off calorimeter method.

Design based Problems (DP)/Open Ended Problem:

In depth study of any application of cryogenics and recent development in that area.