

SARDAR PATEL UNIVERSITY

Master of Science – Materials Science (M.Sc.) Semester –II

(Effect from June, 2024)

Course Code	PS02CMTS57	Title of the Course	PRACTICAL – I
Total Credits of the Course	4	Hours per Week	12 hr

Course Objectives:	To explore and understand various aspects of materials science and semiconductor physics through a series of experiments and studies, encompassing lattice parameter calculations, crystal growth methods, electronic properties of P-N junction diodes, chemical structure visualization, resistivity determination, energy band gap estimation, depletion capacitance study, Hall effect analysis, thermistor characteristics determination, and heat treatment effects on different metals.
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Course Content Unit	Description	Weightage* (%)
1	Calculate the Lattice parameters (a Å), volume of unit cell, density of unit cell, atomic radius(r) and average crystallite size(D), dislocation density(ρ) and microstrain(ϵ) using diffractogram of NaCl crystal.	
2	Lattice parameters calculation using Debye Scherrer method.	
3	Growth of single crystal using the slow evaporation (using seed crystal and without seed crystal) method.	
4	Calculation of the materials constant of P-N junction diode.	
5	Calculation of the energy-band gap of P-N junction diode.	
6	Drawing the chemical structure using computer-based software.	
7	Determination of resistivity of Germanium crystal at different temperature and estimation of energy band gap by using Four probe method.	
8	Study of depletion capacitance and its variation with reverse bias of PN junction diode.	
9	Study of Hall effect and estimation of Hall coefficient R_H , carrier density (n) and carrier mobility(μ) of n-type and p-type semiconductor.	
10	Determination of thermistor characteristics.	
11	Heat treatment of different metals: Quenching in different Media.	
Note - Experiments can be added or deleted depending upon current advancements.		

Teaching Learning Methodology	Demonstration/Group discussion/ Panel/Hands on training
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1	Make use of different electronic devices used in the labs/industries.
2	Understand the principles of crystallography and apply them to calculate lattice parameters from a diffractogram
3	Develop skills in representing complex molecular structures and chemical reactions.

Suggested References:	
1	Elements of X-Ray Diffraction" by B.D. Cullity and S.R. Stock
2	Introduction to Crystallography" by Donald E. Sands
3	Solid State Electronic Devices" by Ben G. Streetman and Sanjay Kumar Banerjee
4	Chem-Draw for Beginners" by Alexander D. MacKerell Jr.
5	Introduction to Solid State Physics" by Charles Kittel
6	Semiconductor Physics And Devices: Basic Principles" by Donald A. Neamen
7	Introduction to Thermoelectricity" by Julian Goldsmid
8	Materials Science and Engineering: An Introduction" by William D. Callister Jr., David G. Rethwisch
9	The Science and Engineering of Materials" by Donald R. Askeland and Pradeep P. Fulay

On-line resources to be used if available as reference material	
1	https://nptel.ac.in/