

GUJARAT TECHNOLOGICAL UNIVERSITY

NANO TECHNOLOGY (39)

CHARACTERIZATION OF NANOMATERIALS-I

SUBJECT CODE: 2130403

B.E. 3RD SEMESTER

Type of course: Instrumentation in Nanoscience and Nanotechnology

Prerequisite: Require basic knowledge of computer operation and computer language which helps student to understand characterisation of Nanomaterials using different instrumental software, Solid State Physics and basic knowledge of Nanomaterials are also require to understand basic properties of Nanomaterials.

Rationale: The objective of this course is to make students familiar with different characterization techniques which are useful indentifying physical, optical and biological properties of Nanomaterials

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)		
PA	ALA	ESE		OEP						
2	0	4	6	70	20	10	20	10	20	150

Contents:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	INTRODUCTION: Optical microscopes, Electron microscopes and Scanning probe microscopes, The general application of SEM, TEM & Spectroscopy.	4	10
2	Scanning Electron Microscopy (Sem),	4	15
3	Transmission Electron Microscopy (Tem)	4	15
4	Advanced Optical Microscopy (Aom),	4	15
5	X-Ray Diffraction	5	15
6	Optical Thin Film Measurements, Ellipsometry, Profilometry, Resistively/Conductivity Measurements.	6	15
7	Breakdown Measurements, Junction Testing, Capacitance-Voltage & Current Voltage Measurements.	6	15

Reference Books:

1. Encyclopedia of Materials Characterization Tools/Equipment, Brundle, Evans, Jr. Watson, Manning Publishing, 1992.
2. Willard, Merritt, Dean, Settle, " Instrumental Methods of Analysis ", CBS publishers & Distributors, Delhi, Sixth Edition, 1986.
3. Colin N. Banwell and Elaine M. McCash, Molecular Spectroscopy, Mcgraw-Hill College; 4 Sub edition (June 1, 1994), ISBN-10: 0077079760

5. Rainer Waser (Ed.) , “Nano electronics and information technology”, Wiley- VCH., Edition II, 2005.
6. Willard, Merritt, Dean & Settle, Instrumental Methods of Analysis, Wadsworth Publishing Company; 7 Sub edition (February 1988), ISBN-10: 0534081428.
7. P. J. Goodhew and F. J. Humphreys. Electron Microscopy and Analysis, 2rd Ed. Taylor and Francis, 1988.

Course Outcome:

- Get introduction of different and complicate techniques to characterized properties of Nanomaterials.

List of Experiments:

Sr. No.	Topics
1.	Introduction of Analysis and characterization of nanostructured Materials ,Coating and Thin Film Sensors
2.	Powder X-Ray Diffraction - XRD : Structure Identification
3.	Powder X-Ray Diffraction - XRD: Composition and Phase Identification, Particle size calculation,
4.	Atomic Force Microscopy - AFM Light Microscopy Fluorescence: Surface analysis
5.	AFM Microscopy: 2D and 3D View, Roughness and Porosity analysis
6.	Surface Tension Measurements of Nanofluids
7.	Transmission Electron Microscopy – TEM (Data analysis)
8	To observe the size and shape of the nanosized sample using SEM

Open ended/design based Projects on Science and technology :-

Open Ended /design based project: Apart from above experiments a group of students (Maximum Three) has to undertake one open ended problem/design problem. **(Students are free to select any area of science and technology may be based on their branch to define the project)**

Aims:

1. To provide experience in laboratory based experimentation, data recording and analysis and drawing of conclusions.
2. To develop report writing skills for scientific material
3. To develop the ability to undertake investigations where, as part of the exercise, the goals and methods have to be defined by the investigator.
4. To develop skills in literature searches and reviews.

Evaluation of Open ended / design based small project

1. Open ended / design based small project will be evaluated by external examiner with appropriate marks allotment given by GTU time to time.
2. Faculties should cultivate problem based project to enhance the basic mental and technical level of students.
3. Evaluation should be done on **approach of the student on his/her efforts** (not on completion) to study the design module of given task.

Examples

1. Chaterization of any one material from local Industries.
2. A survey of Materials used in local industries and focus on the nature of microstructure and its manipulation and control to determine engineering properties.

3. Report on learning of Simulation software any characterization technique.

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.