



FORMAT FOR COURSE CURRICULUM

Course Title: INSTRUMENTATION TECHNIQUES AND CHARACTERIZATION OF NANOMATERIALS

L	T	P/S	SW/F W	TOTAL CREDIT UNITS
4	0	-	-	4

Course Code: Credit Units: 04

Course Objectives: Understanding of various sophisticated analytical techniques and their applications to characterize nanomaterials

Pre-requisites: Basic fundamental knowledge about physics and materials.

Student Learning Outcomes:

Course Contents/Syllabus:

	Weightage
Module I Microscopy Technique	
Descriptors/Topics Scanning Probe, Optical microscope, SEM/FESEM, TEM/HRTEM, STM, AFM, MFM: Description, operational principle and application for analysis of nanomaterials. Sample preparation for each technique	20
Module II Spectroscopic Characterization Technique	
Descriptors/Topics Basics of spectroscopy, Spectrophotometer, UV-VIS spectroscopy, IR Spectroscopy, Principle of operation and application for band gap measurements	20
Module III Structural Analysis Techniques	
XRD, XRF, XAS, Raman - principle, operation and applications	20
Module IV Spectroscopy for Chemical Analysis	
XPS/ESCA, Auger electron spectroscopy (AES), Secondary-ion mass spectroscopy (SIMS), Ion scattering spectroscopy (ISS), Energy dispersive spectroscopy (EDS), Wavelength dispersive spectroscopy (WDS) : Principle, operation and application for various	20

nanomaterials	
Module: V Particle size & thermal analysis	
Measurements of size of nanoparticles, DTA, TGA, and DSC measurements in characterization of nanostructured materials	20

Pedagogy for Course Delivery:

Lab/ Practical's details, if applicable:

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
30		70

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment					End Term Examination
Components (Drop down)	A	CT/lab expt	S/V/Q	HA	EE
Weightage (%)	5	15	5	5	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; A: Attendance

Lab/ Practical/ Studio Assessment:

Continuous Assessment/Internal Assessment				End Term Examination		
Components (Drop down)	Preparation	Analysis	Output/test			
Weightage (%)						

Text & References:

Text Books/Reference Books:

- **Encyclopedia of Nanotechnology - Hari Singh Nalwa.**
- **Introduction to Nanotechnology -Charles P. Poole Jr and Frank J. Owens.**
- **X-ray diffraction procedures -H.P. Klug and L.E. Alexander.**
- **The Powder Method - I.V. Azaroff and M.J. Buerger.**
- **Introduction to Solids - I.V. Azaroff**
- **Elements of X-ray diffraction - A.D Cullity**
- **Differential Thermal Analysis - R.C. Mackenzie**
- **Thermal Methods of Analysis - W.W. Wendlandt**

Any other Study Material:

- **Related Research papers for analysis of different nanomaterials by above technique**
 - **Review papers related to above technique.**
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