

Advanced Characterization Techniques - Video course

COURSE OUTLINE

1. Advanced Diffraction Techniques: SAXS, SANS, LEED, RHEED, EXAFS.
2. Advanced Surface Characterization Techniques: XPS, AES, SIMS
3. Advanced Microscopic Techniques: TEM: HR, HAADF, STEM, In-situ; EBSD, AFM, STM, Laser Confocal Microscopy
4. Advanced Spectroscopic Techniques: Vis, UV, FTIR, Raman, STEM-EELS

COURSE DETAIL

Sl. No	Topic	Hours
1.	Introduction to the course: Relevance of advanced characterization to materials development, scientific understanding of phenomena in materials technology	1
2.	Advanced Diffraction Techniques: Introduction; X-Ray, their production & properties Review of basic diffraction theory;	3
3.	<ul style="list-style-type: none"> • Various SAXS techniques and its applications in characterizing material • SAXS • GISAXS • LEED and RHEED 	4



NP-TEL

NPTEL

<http://nptel.ac.in>

Metallurgy and Material Science

Pre-requisites:

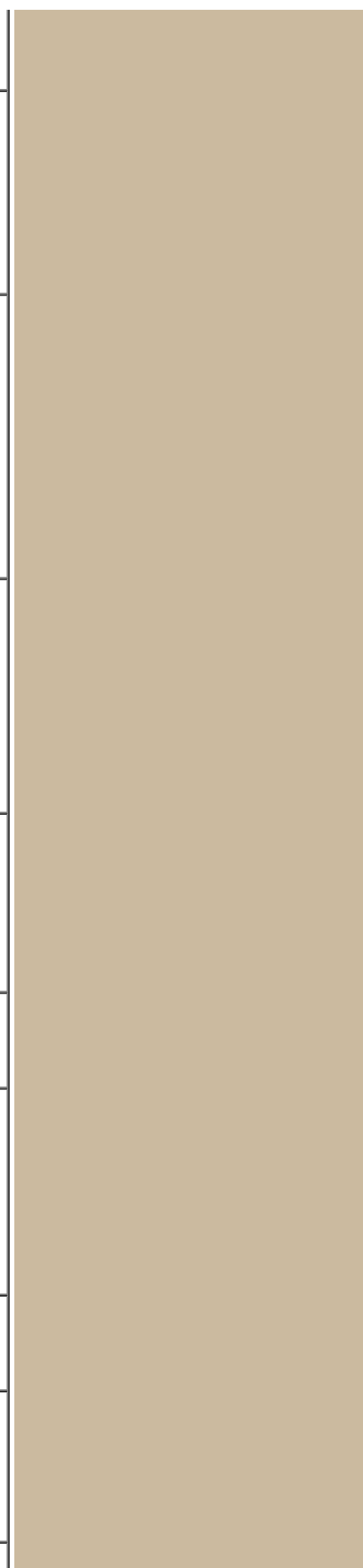
Basic knowledge on basic materials characterization techniques is the primary requirement for this course

Coordinators:

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	<ul style="list-style-type: none"> EXAFS, SEXAFS/NEXAFS 	
4.	<ul style="list-style-type: none"> Properties of neutron radiation; neutron sources; Small angle neutron scattering; Examples 	2
5.	<ul style="list-style-type: none"> Advanced Surface Characterization Techniques: XPS, AES & SIMS; Importance of surface characterization techniques; Physical principles of XPS, Photoelectric effects; 	3
6.	Instrumentation, XPS patterns; Spin orbital Splitting; Quantitative analysis, Chemical effect, Chemical shift, XPS imaging Auger electron generation; Principle, Chemical effect, Quantitative analysis, Depth profiling, Applications	3
7.	Static and Dynamic Secondary Ion Mass, Common modes of analysis, Depth Profiling, quantitative and Qualitative analysis	3
8.	Comparison surface analysis techniques	1
9.	Advanced Spectroscopic Techniques: Introduction; Electromagnetic spectroscopy; UV-Visible Spectroscopy; Photo-luminescence spectroscopy; Infra-red spectroscopy;	7
10.	Raman; STEM; EELS	3
11.	Advanced Microscopic Techniques: Introduction; Electron-materials interactions;	1



12.	TEM: HR, HAADF, STEM, In-situ TEM;	4
13.	SEM, EBSD, In-situ SEM	2
14.	AFM, STM	2
15.	Laser Confocal Microscopy	1

References:

1. Materials Characterization Techniques Sam Zhang, Lin Li, Ashok Kumar;CRC press, (2008)
2. Transmission Electron Microscopy; D.B. Williams and C.B. Carter, Plenum Press (2004)
3. Modern ESCA The Principles and Practice of X-Ray Photoelectron Spectroscopy, Terry L.Barr, CRC press, (1994)
4. Scanning Electron Microscopy and X-ray Microanalysis by Joseph Goldstein, Dale E. Newbury, David C. Joy, and Charles E.; Springer Science (2003)
5. Advanced Techniques for Materials Characterization, Materials Science Foundations (monograph series) A. K. Tyagi, Mainak Roy, S. K. Kulshreshtha and S. Banerjee;; Volumes 49 – 51 (2009)
6. Encyclopedia of Materials Characterisation Editors: c.r. Brundle, C.A. Evens, Jr, S. Wilson, Butterworth-Heinmann, Boston (1992)