

6th Semester	X – Ray and Electron Microscopy	L-T-P 3-0-0	3 CREDITS
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Module I:**(12 Hours)**

Introduction to x-ray and properties of x-ray: Continuous characteristics x-ray, absorption, filter, production and detection of x-rays. Diffraction of x-rays; special topics on crystallography, directions and intensities of diffracted beams.

Module II:**(12 Hours)**

Experimental methods in x-ray analysis; Laue methods, powder photographs diffractometer and spectrometer measurements. Applications: orientation of single crystal, crystal structures of polycrystalline materials, precise lattice parameter measurements. Calculation of integrated intensity, structure factor calculation. Application: Phase diagram, order-disorder transformation, chemical analysis, residual stress, texture.

Module III:**(8 Hours)**

Electron optical methods: (a) Scanning electron microscopy and X-ray microanalysis including electron probe microanalysis, electron optics, electron beam specimen interaction, image formation in the SEM. X-ray spectral measurements: WDS and EDS, quantitative X-ray analysis.

Module IV:**(6 Hours)**

Analytical transmission electron microscopy: Electron diffraction, reciprocal lattice, analysis of SAD patterns; different electron diffraction techniques, atomic resolution microscopy, analytical devices with TEM, field ion microscopy, scanning tunneling microscopy, advanced techniques.

Books:

- [1] Elements of X-Ray Diffraction by B. D. Cullity, Adison-Wesley.
- [2] Scanning Electron Microscopy and X-Ray Microanalysis, by J.I. Goldstein, C. E. Lyman
- [3] Structure of Metals by C. Barret and T. B. Massalski, Pergamon.
- [4] X-ray Diffraction – its Theory and Applications by S. K. Chatterjee, Prentice Hall of India.
- [5] Transmission Electron Microscopy by Williams, D.B. and Barry Carter C., Plenum Press.
- [6] Characterization of Materials, by E N Kaufman, Wiley Publishers.

Digital Learning Resources:

Course Name: X – Ray and Electron Microscopy
 Course Link: <https://nptel.ac.in/courses/113/106/113106069/>
<https://nptel.ac.in/courses/113/106/113106064/>

Course Instructor: