

PMT6I101 X-RAY AND ELECTRON MICROSCOPY

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 (14 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 (12 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.

(b) 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 for reference:

1. *Elements of X-Ray Diffraction* by B. D. Cullity, Addison-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. *Physical Metallurgy Principles* by R. E. Reed-Hill.
6. *Transmission Electron Microscopy* by Williams, D.B. and Barry Carter C., Plenum Press.
7. *Materials Characterization, Metals Handbook, Vol. 10, ASM*
8. *Characterization of Materials*, by E N Kaufman, Wiley Publishers