

## MATERIAL CHARACTERIZATION

### Module I (8 hrs)

Introduction: Fundamentals of image formation, pixels, magnification, light-optical microscope, lenses, numerical aperture, limit of resolution, depth of field and depth of focus - lens defects and correction, bright field and dark field illumination, polarised light, phase contrast, interference contrast, hot-stage, in-situ techniques, quantitative metallography

### Module II (16 hrs)

Electrons interaction with specimen, scattering of electrons by atoms, magnetic lenses, electron guns Construction and operation of SEM, signals and detectors, analysis of fractured surfaces, elemental analysis by WDS and EDS systems, stereographic projections, Wulff net, reciprocal lattice, Ewald's sphere

Construction and operation of TEM - diffraction effects and image formation, contrast mechanisms, specimen preparation techniques

Electromagnetic radiation, continuous spectrum, characteristic spectrum, absorption, filters, production of X-rays, detection of X-rays and safety precautions, Bragg law, Powder, rotating crystal and Laue methods, X-ray residual stress measurement

### Module III (8 hrs)

X-ray fluorescence, Auger spectroscopy, DTA, DSC and TGA, working principle, applications

Stress analysis by strain gauging, high temperature strain gauge technique, photo elasticity and holography

### Text and Reference books:

1. Solid state chemistry and its Applications, Antony R. West, Wiley Student Edition
2. Elements of X-ray Diffraction, Cullity B. D., Addison-Wesley Publishing Co., 1979.
3. Electron Microscopy and Analysis, P.J. Goodhew, F.J. Humphreys, Taylor & Francis, Second Edition, 1997
4. Fundamentals of Molecular spectroscopy, Colin N. Banwell and Elaine M. McCash, Tat McGraw- Hill Publishing Co. Ltd., Fourth edition
5. Smallman R. E., 'Modern Physical Metallurgy', 4<sup>th</sup> Edition, Butterworths, 1985
6. Philips V. A., 'Modern Metallographic Techniques and their Applications', Wiley Interscience, 1971
7. Cullity B. D., 'Elements of X-ray Diffraction', 4<sup>th</sup> Edition, Addison Wiley, 1978
8. Loretto M. H., 'Electron Beam Analysis of Materials', Chapman and Hall, 1984
9. Physical Methods for Material Characterisation, Flewitt P.E.J. and Wild R.K., Institute of Physics Publishing, 1994
10. Structure of Metals, Barrett C. S. & Massalski T.B., McGraw Hill, New York, 1996.
11. Physical Characterisation of Metal - Flewilt.
12. Electron Microscopy and Microanalysis of Crystal materials by Belk J.A., Applied Science Publication, 1979.
13. Computer Techniques for Image Processing in Electron Microscopy. Academic Press 1978.