

CHARACTERIZATION OF MATERIALS (4-0)**CREDITS: 04****Module I (12 Hours)**

Introduction, Classification of characterization techniques for materials: macro and micro-characterization structure of solids. Bulk averaging techniques: Thermal characterization techniques: Theory, Instrumentation, methodology, applications. DTA, DTA, DSC, TGA, Dilatometry, resistivity/ conductivity. Diffraction methods: X-ray diffraction, X-ray topography, residual stress measurement techniques, small angle X-ray and neutron scattering.

Module II (12 Hours)

Electron microscopy techniques: Scanning electron microscope, Modes of operation, Study of surface topography and elemental composition analysis, Electron probe analysis (EPMA/ EDX, WDS) and Auger Spectroscopy. Transmission electron microscopy, Imaging and different modes, bright and dark field imaging, selected area diffraction (SAED) pattern, specimen preparation techniques. Advanced microscopic techniques: AFM, FIM, STM etc.

Module III (12 Hours)

Chemical characterization techniques: Principle underlying techniques, Emission spectroscopy, Atomic absorption spectroscopy, X-ray spectrometry, infrared spectroscopy and Ramanspectroscopy. Chromatography techniques: Principles of gas chromatography, mass spectrometry, liquid and ion chromatography. Surface characterization techniques: principles underlying techniques of ELES, Auger Spectroscopy,

Books for reference:

1. Materials Characterization, Metals Handbook, Vol 10, ASM
2. Kaufman E.N., Characterization of Materials, Wiley Publishers
3. Barrett, C.S. and Massalski, T.B., Structure of Metals, Pergamon Press, Oxford.
4. Cullity B.D., Elements of X-ray Diffraction, Addison-Wesley, 1978
5. Williams, D.B. and Barry Carter C., Transmission Electron Microscopy, Plenum Press.
6. Goldstein J.I., Lyman C. E., Scanning Electron Microscopy and X-Ray Microanalysis.
7. Machenzie R.C., Differential Thermal Analysis.
8. Phillips Victor A. Modern Metallographic Techniques and their application.