

3. ADVANCED MICROSCOPIC AND SPECTROSCOPIC TECHNIQUES

Module I (6 Hours)

Free electron theory of metals, Photo electric effect , molecular orbital theory, types of electro-optical instruments and their resolution. Electron diffraction kinematical theory – Superstructure and modulated structures.

Module II (15 Hours)

Scanning electron microscope (SEM); electron guns, lens system, electron sample interaction, imaging system. Field emission SEM, Energy dispersive X-ray spectroscopy (EDX), Wavelength dispersive X-ray spectroscopy (WDS). Transmission Electron Microscope (TEM); imaging, bright field image, dark field image, High Resolution TEM. Scanning tunneling microscope (STM); Working principle of STM, Atomic force microscope (AFM); contact mode, non-contact mode, tapping mode.

Module III (15 Hours)

UV-visible spectroscopy; Beer Lambert law, Fourier transform infrared spectroscopy, RAMAN spectroscopy; Stokes and anti-Stokes scattering, X-ray photoelectron spectroscopy (XPS) and Ultra violet Photoelectron Spectroscopy (UPS); Principle, construction and analysis

FESEM, TEM, XPS, RAMAN, UPS, UV-Vis, EDX and WDS Analysis of several recent hetero structures, metals, metal oxide, carbon materials.

Text and Reference Books:

1. Lawrence E Murr, Electron and ion microscopy and microanalysis principal and applications”, Marcel Dekker Inc. New York 1991
2. Cullity, B.D., “Element of X-ray diffraction”, Addison-Wesley Company Inc. New York 3rd Edition.
3. Solid state physics by A.J Dekkar
4. Solid state physics by Puri and Babar
5. Introduction to nanoscience and nanotechnology by K.K.A.N. Banerjee Chattopadhyay