

Electron Microscopy

Credits: 4

Unit-1: Introduction

Microscopy with light and electrons, methods of image formation, the light optical microscope, magnification, resolution, depth of field, depth of focus, aberrations of optical systems, electrons versus light

Unit-2: Electron interaction with the specimen

Electrons, Generation of electron beam, deflection of electrons, magnetic lenses, scattering of electrons by atoms, elastic scattering, inelastic scattering, secondary effects, the family of electron microscopes.

Unit-3: Electron diffraction

The geometry of electron diffraction, diffraction spot patterns, use of reciprocal lattice in diffraction analysis, other types of diffraction patterns.

Unit-4: The transmission electron microscope

The instrument, contrast mechanisms, high voltage electron microscopy, scanning transmission electron microscopy, preparation of specimens for TEM.

Unit-5: The scanning electron microscope

How it works, obtaining signal in the SEM, the optics of the SEM, the performance of the SEM, ultimate resolution of the SEM, topographic images, compositional images, crystallographic images from SEM, uses of other signals in the SEM, preparation of specimen for examination in the SEM .

Unit-6: Chemical analysis in the Electron Microscope

The generation of X-rays within a specimen, detection and counting of X-rays, X-rays analysis of bulk specimens, X-ray analysis of thin specimens in the TEM, quantitative analysis in an electron microscope, electron energy loss spectroscopy (EELS), A brief comparison of techniques.

Text Books:

(1) Electron Microscopy and Analysis by Peter. J. Goodhew, John Humphreys, Richard Beanland, 3rd edition, 2001

(2) Transmission Electron Microscopy by David B. Williams, C, Barry carter, 1st edition, 2009
Reference Test Books

(1) Material Characterization, ASM hand book, volume 10