

JML 302 (310) Transmission Electron Microscopy and Spectroscopy (Jan-Apr)

Instructor: Ranjan Datta

Syllabus:

1. Basics of TEM: a brief history, various imaging and DP features, electron as probe, electron matter interaction, general features of elastic and inelastic scattering, instrument, electron source, aperture, recording system, spectrometer etc. (3 hrs)
2. Image formation in a TEM: resolution, various contrast in TEM such as diffraction contrast, phase contrast, Z-contrast, magnetic contrast, energy filtered TEM etc (6 hrs)
3. Concept of phase contrast microscopy in a TEM, aberration corrected TEM, imaging with negative Cs, imaging of light elements and quantification. (12 hrs)
4. STEM-HAADF imaging in TEM, aberration corrected STEM and atom by atom imaging. Phase contrast in STEM, ptychography. (8 hrs)
5. Principle of Gun monochromator, high resolution electron energy loss spectroscopy, application of HREELS e.g., band gap measurement, plasmon mode determination, probing electronic structure by ELNES, bonding environment, momentum resolved EELS and atom by atom imaging and spectroscopy (8 hrs)
6. Newer developments in ultra high-resolution TEM (2 hrs)
7. Some demonstrations of technique (3 hrs)

References:

- A. Transmission electron microscopy by David B. Williams and C. Barry Carter
- B. High resolution electron microscopy by J.C.H. Spence
- C. Transmission electron microscopy and diffractometry by Brent Fultz and James M. Howe