**COURSE SYLLABUS**

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| **Course Title**：Introduction to Electron Microscopy | | | | |
| **Credits / Hours** | 3/3 | **Course Number** |  | **□Required ■Elective** |
| **Course Description**  This course is designed for PhD program students introducing electron microscopy. Contents of this course are limited on the transmission electron microscopy (TEM). This course includes the whole subject of TEM. Although this course stresses on the theory of electron microscopy, basic application of electron microscope on materials microstructure analysis is also introduced. | | | | |
| **Course Topics** | | | | |
| **Topic** | | **Content** | | |
| 1. Introduction to The Transmission Electron Microscopy | | Why to use TEM, limitations of TEM, different kinds of TEM, properties of electron | | |
| 1. Scattering and Diffraction | | Characteristics of scattering, factors affecting scattering, coherent interference, electron diffraction patterns | | |
| 1. Elastic and Inelastic Scattering | | X-ray emission, secondary electron emission, electron-hole cathodoluminescene, beam damage. | | |
| 1. Electron Sources & How to see Electrons | | Electron detection and display, viewing screen, electron detector, image recording | | |
| 1. Lenses, Apertures, and Resolution | | Light optics and lenses, electron lenses, apertures, real lenses and their problems, resolution of electron lenses, depth of focus and depth of field | | |
| 1. Instruments | | Illumination system, objective lenses and stage, forming diffraction pattern and image | | |
| 1. Diffraction from Crystals | | Scattering from crystals, Bragg’s law, structure factors, selected area diffraction, indexing diffraction patterns, Kikuchi diffraction, convergent-beam diffraction | | |
| 1. Imaging in TEM | | Principle of TEM imaging, mass-thickness contrast, z-contrast, TEM diffraction contrast | | |
| 1. High Resolution TEM | | Origin of lattices fringes, Fresnel contrast, simulation of HRTEM | | |
| 1. X-Ray Energy-Dispersive Spectrometer | | Principles of EDS, detectors and resolution of detectors, quantitative X-ray analysis | | |
| 1. Electro Energy-loss spectrometry | | Basic principles, zero-loss peak, low-loss spectrum, acquiring a spectrum, quantitative analysis | | |