Intro to Electron Optics
(PH410/510)

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Textbooks: M. Sedlacek, Electron Physics of Vacuum and Gaseous Devices
Wiley, 1996
A simulation program SIMION will be ordered and used in class

Prerequisites:
Ph200 level. Familiarity with E&M and light optics
Math**:** Geometry, Trig and Algebra, Calculus.

Course content:

Review of light optics, wave and particle picture
Fermat's principle
optics of charged particles
the least action principle
charged particles in electric and magnetic fields
deflection, rotation, reflection
relativistic effects
Maxwell's equations
electric and magnetic potentials
cylindrical coordinates
equation of motion
non-relativistic trajectory equations
the finite difference technique
Intro to SIMION
simulation of trajectories
multi-aperture electrostatic lenses
first order focusing properties
trajectories through electrostatic and magnetstatic lenses
lens and image aberrations
derivation, classification
aberration correction
quadrupoles
electron sources
thermionic emission
field emission
image converters
Electron microscopes
magnification, diffraction, resolution
imaging modes
TEM, SEM, PEEM, field emission microscopes
Interference and interferometry
the Aharonov-Bohm effect
Electron holography
aberration correction and holography

practical sessions:
projection microscope
shadowgraph technique
experimental characterization of electron lenses
Photoemission microscope
Focused Ion Beam