

## Course Outline Accelerator Physics

**Meeting Times:** 9:00-12:00, 14:00-17:00

**Text:** H. Wiedemann, *Particle Accelerator Physics*, 3<sup>rd</sup> Edition, Springer

**Supplementary Texts:** K. Wille, *The Physics of Particle Accelerators*, A. W. Chao and M. Tigner, *Handbook of Accelerator Physics and Engineering*, J. D. Jackson, *Classical Electrodynamics*

**Grading:** Homework Problems 35%; Mid-term Examination 25%; Final Examination 40%

### Course Content

- Introduction to Accelerators and Short Historical Overview
  - Basic Units and Definitions
  - Lorentz Force
  - Linear Accelerators
  - Circular Accelerators
- Particle Motion in EM Fields
  - Linear Beam Dynamics
  - Periodic Systems
  - Longitudinal Stability
  - Magnetic Multipoles
  - Coupled Betatron Motion
- Synchrotron Radiation
  - Radiation Power and Distribution
  - X-ray Sources
  - Free Electron Lasers
  - Low Emittance Lattices
- Technical Components
  - Particle Acceleration Cavities and RF Systems
  - Multipole Magnets
  - Insertion Devices
- Non-linear Dynamics
  - Non-linear Resonances
  - Perturbation Theory
  - Lyapunov Exponents
  - Chaotic Dynamics
- Relaxation Phenomena
  - Radiation Damping
  - Feedback Systems
  - Stochastic Cooling
  - Dampers