

Course Outline Graduate Accelerator Physics

Meeting Times: Tuesdays and Thursdays, 13:30-14:45, OCEAN/PHYSICS 303

Text: H. Wiedemann, *Particle Accelerator Physics*, 3rd Edition or 4th Edition, Springer

Supplementary Texts: K. Wille, *The Physics of Particle Accelerators*, Cambridge University Press, 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%

Office Hours: 15:00-16:00 Tuesdays and Thursdays, CAS 107

Course Content

- Introduction to Accelerator Physics and Linear Dynamics
 - Relativity and E&M
 - Transverse Stability and Betatron Motion
 - Linear Optics
 - Synchrotron Motion
- Advanced Linear Dynamics
 - Solenoids
 - Coupled Motion
 - Flat Beam Transformations
 - 4 by 4 Matrix Descriptions
- Linear and Non-linear Perturbations
 - Multipoles
 - Closed Orbit Distortion and Correction
 - Resonances and Resonance Theory
 - Chromaticity and Its Correction
 - Lyapunov Exponents
 - Chaotic Dynamics
- Charged Particle Acceleration
 - RF Acceleration Systems
 - Acceleration System Parameters
 - Beam Loading
 - Robinson Damping
- Statistical and Collective Effects

- Vlasov Theory
 - Landau Damping
 - Envelope Theory
 - Beam-beam Effect
 - Basic Instabilities
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- Relaxation Phenomena
 - Intrabeam Scattering and Toushek Effect
 - Beam Cooling Methods and Theory
 - Radiation Damping and Low Emittance Rings