

Classical Mechanics and Electromagnetism in Accelerators and Beams

Reference Material

The reference items listed below correspond, more or less, to topics to be covered in the course. Unless otherwise noted they are unpublished notes by R. Talman. The purpose of the code letters is to permit easy reference in the course schedule.

MKS/Ga: M.K.S./Gaussian Unit Conversion, 9 pages

NM: Normal Modes, 9 pages

PDM: Particle Deflection by Magnets, 54 pages

AI: Action/Angle Variables and Adiabatic Invariance, 31 pages

L&T: G. Loew and R. Talman, *Lectures on the Elementary Principles of Linacs*, contained in *Physics of High Energy Particle Accelerators*, AIP Conference Proceedings 105, M. Month Editor, 1983, 91 pages

BCM: R. Talman, *Beam Current Monitors*, contained in *Accelerator Instrumentation*, AIP Conference Proceedings 212, E. Beadle and V. Castillo Editors, 1989, 25 pages

SRRS: Storage Ring as Radiation Source, 261 pages

LL: R. Talman, *Specific Luminosity Limit of $e+e-$ Colliding Rings*, submitted to Phys. Rev. AB, April, 2002, 21 pages

Topics to be covered, not necessarily in order. Electromagnetism and Mechanics topics will be interleaved.

Topics Emphasizing Electromagnetism

- E1: Review E&M, MKS/Ga ps. 1-9
- E2: 2D Magnetic Fields, PDM ps. 1-13
- E3: Magnet Design, SRRM Chap. 7
- E4: Guided Waves, L&T, Sects. 4.1-4.6
- E5: Synchrotron Radiation, SRRS, Chap. 2
- E6: (Influence of Synchrotron Radiation, SRRS, Chap. 4)
- E7: Undulator Radiation, SRRS, Chap. 6
- E8: FEL Theory, SRRS, Chap. 10
- E9: Beam Current Monitors, BCM, ps. 6-23

Topics Emphasizing Mechanics

- M1: Review of Mechanics, NM
- M2: Deflection by Magnets, PDM, ps. 1-33
- M3: Transfer Matrices, PDM, ps. 35-55
- M4: Action/Angle Variables, AI, ps. 1-18
- M5: Adiabatic Invariance, AI, ps. 18-31. L&T, Sects. 3.5-3.6
- M6: Photon and Electron Beam Description, SRRS, Chap. 1
- M7: Storage Ring Fundamentals, SRRS, Chap. 3
- M8: Luminosity Limit of Colliding Beams, LUM
- M9: Chaotic Particle Orbits

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Tentative Schedule

Table 1: Week 1

M	T	W	Th	F
M1 Review Mech. NM	E2 2D Mag. flds. PDM, 1-12	E3 Mag. design SRRS Ch. 7	E4 Linacs L&T, 4.1-4.6	E5 Synch. Rad. SRRS, Ch. 2
E1 Review E&M MKS/Ga	M2 Defl. by mag. PDM, 13-34	M3 Transfer maps PDM, 35-55	M6 Beam descr. SRRS, Ch. 1	Undulator rad. SRRS Ch. 6

Table 2: Week 2

M	T	W	Th	F
E7 Und. rad. (cont.) SRRS Ch. 6	E8 FEL's SRRS Ch. 10	E9 Beam pickups BCM, p. 6-23	M8 Luminosity lim. LL	
M4 Action/angle vars. A1, 1-18	M5 Adiabatic inv. A1, 18-31, L&T, 3.5,3.6	M7 Storage rings SRRS Ch. 3	M9 Chaotic orbits	