

Accelerator Physics

January-February 2021 USPAS (Online via Zoom through Texas A&M)

<http://www.toddsatogata.net/2021-USPAS/>

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Day	Topic	Chapter
Mon 25	Introduction, Relativity Refresher; Linear Motion	1,2
Tue 26	Linear Motion and Stability	2
Wed 27	Strong Focusing Transverse Optics	3
Thu 28	Longitudinal and Off Momentum Motion	4
Fri 29	Emittances and Phase Space	5
Mon 1	Magnets and Magnet Design	6
Tue 2	RF Cavities and Synchrotron Motion	7
Wed 3	Introduction to SRF	–
Thu 4	Linear Errors and Their Correction	8
Fri 5	Lattice Exercises and Insertions I	–
Mon 8	Lattice Exercises and Insertions II	–
Tue 9	Sextupoles and Chromaticity	9
Wed 10	Octupoles, Detuning, Slow Extraction	10
Thu 11	Synchrotron Radiation and Damping	11
Fri 12	Synchrotron Light Facility Lattices	–
Mon 15	Linacs — Protons and Ions	13
Tue 16	Beam-Beam Interaction: 1-D Resonances	15
Wed 17	Chaos and Nonlinear Dynamics	16
Thu 18	Linacs — Electrons and ERLs	14+
Fri 19	By request (hadron therapy?)	–

Table 1: Class Schedule for the January 2021 USPAS “Accelerator Physics” course.

Time Zone and Lectures: All times listed in class materials are EST, consistent with the class instructors and TAs all being in the EST time zone. **Lectures** are according to the above schedule in the class Zoom room from **11:00-13:00 EST**. Additional class time for homework help, labs, and possible lecture make-up time is **15:00-16:00 EST** daily. **Attendance will be taken at 11:00-13:00 EST sessions** per request of the USPAS director.

Text: “An Introduction to Linear and Nonlinear Accelerator Dynamics”, S. Peggs and T. Satogata (Cambridge University Press, 2017), plus handouts and posted references on the class website.

Grading: 60% homework and labs, 20% final exam, 20% class participation.

Homework: We will endeavor to assign a few homework questions after every class. Homework is due at the start of class on the day after it is assigned, **emailed to both instructors and both TAs in PDF format**. Collaboration is encouraged, but everyone must turn in their own individual version of the homework solutions. Like any good scientist, you should **cite** the contributions of your teammates: referencing sources is an important part of ethical publication. Solutions will be distributed at the start of class, so late homework will not contribute to your grade. The use of Mathematica, spreadsheets, and other computer tools is encouraged.

Final Exam: The overnight “take-home” final exam, handed out Thursday February 18, is due at the start of Friday Feb 19. You may use books and other references (with citations!!) but may not collaborate with other class members or people.

Labs: Computer labs for the course will replace some afternoon lectures. These labs are meant to give you (perhaps more) experience with `madx`, and to illustrate material presented in class. Like homework, these labs can be worked on individually or in small teams, and they should be turned in like homework, **emailed to both instructors and both TAs in PDF format**. Their due dates will be announced when they are assigned. They will be graded similar to homework. `madx` is available for download for most platforms at <http://madx.web.cern.ch/madx/>.

Study time: At least one of us will usually be monitoring the class Slack channel for consultation in the early evenings in the US, approximately 19:00-21:00 EST. We can open up Zoom rooms as needed for discussion. We are also available for questions via email and Slack inquiries, and will reply as soon as feasible.