Fundamentals of Plasma Physics: SYLLABUS

1. General Information:
   Course: Fundamentals of Plasma Physics (PHYS F626),
   Room: NSCI 136,
   Time: MWF 9.15a - 10.15a,
   Credits: 3.0 CR,
   Prerequisites: Graduate standing or permission of instructor,
   Electrodynamics, Calculus (including vector and tensor).
   Instructor: Heinz Wiechen, Geophysical Institute 708D, phone: 4745914, email: hew@gi.alaska.edu,
   Office Hours: anytime.

2a. Course Textbook:
   Nicholson, Introduction to Plasma Theory, Wiley 1983, Krieger Publ. 1992, copy for sell.

2b.Supplementary Readings
   Baumjohann and Treumann, Basic Space Plasma Physics, College Press 1997
   Chen, F. Introduction to Plasma Physics and Controlled Fusion, Plenum 2nd ed. 1984.
   – Both books are very suitable as supplementary readings for this course–
   Krall and Trivelpiece, Principles of Plasma Physics. San Francisco Press, 1986 (library)
   – detailed, general coverage of traditional plasma physics, but partially confusing–
   Sitenko and Malnev, Plasma Physics Theory, Chapman and Hall, 1994
   – suitable alternative to Nicholson (?), but I have no experience with this book as a textbook–
   Goldstein and Rutherford, Introduction to Plasma physics, Inst. of Physics Publ, 1995
   – very good book, but more suitable regarding technical plasmas.

3. Instructional Methods
   Lectures, blackboard

4. Course Description

The course offers an introduction into one of the most exciting fields in physics. Plasma Physics deals with properties and dynamics of partially or fully ionized systems which are dominated by long range, collective interactions. The collective interaction of particles with electromagnetic fields is one of the most challenging areas in modern physics. Plasma Physics is important with respect to space and astrophysical systems as well as with respect to technical applications. Since its origins, plasma physics is explosively growing. It is a fundamental prerequisite for Space Physics Research.

This plasma physics course will provide a systematic introduction and coverage of the fundamentals of Plasma Physics. This includes basic elements of Plasma Physics, the motion of charged particles in electrodynamic field, the description of plasmas in the framework of a one and two-fluid approach and the description in the framework of kinetic theory. Of particular interest are plasma equilibria, waves and instabilities.

5. Course Goals

The general goal of this course is to provide an introduction into a explosively growing field in modern physics, which is of fundamental importance with respect to Space Physics, Solar Physics, Astrophysics, Plasma technology, Laser Physics and Nuclear Fusion.

6. Course Calendar

To formulate a detailed (daily or weekly) schedule is not appropriate in the very beginning. It will depend on questions and suggestions of the students, which are very welcome. A rough schedule will be as follows:

a) Definition and basic properties of a plasma.
b) Single particle motions in given electric and magnetic fields.
c) Derivation of basic plasma-fluid equations.
d) Description of a plasma in the framework of Magneto-Hydrodynamics.
e) Description of a plasma in the framework of a two-fluid approach.
f) Kinetic description of a plasma.

7. Course policies

Please, show up in time. This helps to avoid disturbances. Please, attend the classes regularly. Not doing this will result in serious problems with homework and exam. Do the homework ! (It is in YOUR interest). There are no problems, if students discuss problems and homework in groups. BUT: (i) Plagiarism is forbidden and (ii) it will end in a disaster in the final exam. Thus: NO PLAGIARISM !

8. Evaluation

The grading is based to 65 % on the homework and to 35 % on the final exame.

9. Support Services

Questions to the instructor (anytime), Library.

10. Disability Services

Contact Office of Disabilities Services.