

University of Wisconsin – Madison
ECE/EP/Phys 525 Introduction to Plasmas
Spring Semester 2007

<http://ecow.engr.wisc.edu/cgi-bin/get/neep/525/wendt/>

Lectures: Tues./Thurs. 9:30-10:45, Rm 1213 Engineering Hall

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Office hours: W 11am-noon, Th 3-4pm, or by appointment

Grading: Homework-30%, 2 mid-term exams-20% each, final -30% (7:45am, Fri. 5/18)

Goals: This course focuses on the fundamentals of the physical behavior of plasmas to provide an introduction to a variety of applications and a foundation for more in depth study. It surveys a broad range of topics using a simplified description of the plasma in order to develop an intuitive understanding of plasma behavior. Applications are made to space plasmas, controlled fusion and industrial processes.

Prerequisites: Intermediate level Electromagnetic Fields course (e.g., Physics 322 or ECE 220/320); Intermediate level Mechanics course (e.g. Physics 311)

Topics:

1. Introduction: Plasmas in nature and industrial applications, examples
2. Basic description of plasmas: what is a plasma, general parameters, distribution functions
3. Single particle motion: magnetic fields, drifts
4. Fluid description of plasma
5. Waves in plasmas
6. Collisions, diffusion and resistivity
7. Equilibrium and stability
8. Introduction to kinetic theory
9. Sheaths and other nonlinear effects

Textbook: Introduction to Plasmas and Controlled Fusion, 2nd Ed., F. F. Chen, Springer, 2006. (1984 Plenum edition okay too.)

Recommended (On reserve in Wendt Library):

Fundamentals of Plasma Physics, J. A. Bittencourt, Pergamon, 1986.

Physics of High Temperature Plasmas, G. Schmidt, Academic, 1979.

Principles of Plasma Physics, N. Krall and A. Trivelpiece, McGraw-Hill, 1973.

Introduction to Plasma Physics, R. Goldston and P. Rutherford, IOP, 1995.

Introduction to Plasma Theory, D. Nicholson, Wiley, 1983.

The Physics of Plasmas, T. J. M. Boyd and J. J. Sanderson, Cambridge, 2003

Fundamentals of Plasma Physics, P. Bellan, Cambridge, 2006