COURSE OUTLINE
Introduction to Plasmas
EE 471/AerSp 490

INSTRUCTOR: J. D. Mathews
323A EE East, 865-2354, JDMathews@psu.edu
Office hours: W 12:30-2:30P, T TH 12:30-1:30P, & by appointment

WEB SITE: Available on Penn State's Course Management System (ANGEL) at http://cms.psu.edu

CATALOG DATA: Plasma oscillations; collisional phenomena; transport properties; orbit theory, typical electrical discharge phenomena.

COURSE OBJECTIVES: This course is designed to give seniors and graduate students a working knowledge of plasma phenomena, models to describe such phenomena, and applications of plasmas. This course stresses a physical understanding of plasma phenomena, backed up with mathematical formulation. This is not a review course and requires substantial math usage.

LECTURES: T TH 11:15A-12:30P 103 EE West

TEXTBOOK: Francis F. Chen, INTRODUCTION TO PLASMA PHYSICS AND CONTROLLED FUSION. Volume 1: Plasma Physics, Plenum Pub Corp; ISBN: 0-306-41332-9; Second edition (February 1984).

REFERENCES: Bellan, P. M., Fundamentals Of Plasma Physics, Cambridge Un Press, 2008.

Sturrock, P. A., Plasma Physics, An Introduction to the Theory of Astrophysical, Geophysical, and Laboratory Plasmas, Cambridge Un Press, 1994.

PREREQUISITE: EE 330 (good understanding of electromagnetics & grad, div, & curl).

HOMEWORK: Assigned every week and must be submitted in class on the indicated due date. The solutions of the homework will be posted on EE 471 web site shortly after the due date. The graded work should normally be returned to you one week after it is collected.

COMPUTER LAB: Computer experiments will be discussed in class and provided as separate project assignments. In some cases well tested plasma simulation codes will be supplied, which run from input files that are mostly experimental parameters, and produce diagnostics similar to those obtained in lab experiments. Sufficient background in numerical methods or programming will be provided, however, proficiency in Matlab is required to solve simple differential equations and to analyze results of computer experiments as well as to solve some of the homework problems.

LATE POLICY: Late assignments will NOT be accepted without prior arrangement.

EXAMS: No exams! Homework, quizzes, and projects.

GRADING: Tentatively set at 25% homework, 25% quizzes, 50% projects.
Note that ALL work must be individual. ALL use of web materials and other sources must be referenced.
NOTE: Grading will be on a class ranking basis. Extra credit will be given for outstanding work.

COURTESY Phones, TM, web browsing, etc. during class may result in a request to leave the classroom.

EE 471 Introduction to Plasmas course CONTENT (subject to change….):

Chapter	Topic	Lectures
1	Introduction	2
2	Single-particle motions in given electric and magnetic fields	4
3	Fluid description of plasmas, the plasma approximation	2
4	Waves in plasmas, the CMA diagram	5
5	Diffusion and resistivity, magnetohydrodynamics	3
6	Plasma instabilities	4
7	Kinetic description of plasmas, Landau damping	4
8	Nonlinear effects	4
(Notes)	Kinetics of electrons in a weakly ionized gas placed in an electric field	2
Total lectures		30