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## Course Syllabus for Physics 348 – Plasma Physics, Spring 2016

Instructor: Yong W. Kim, Professor of Physics ([ywk0@lehigh.edu](mailto:ywk0@lehigh.edu); 610-758-3922; Lewis Lab, Rm 403)

Textbook: Introduction to Plasma Physics, Second Edition, Francis Chen, Plenum Press (1984)

Supplementary References: Controlled Thermonuclear Reactions, S. Glasstone and R. Lovberg, Van Nostrand Reinhold (1960)

Energy Conversion and Utilization, J. Krenz, Ally and Bacon (1976)

Laser-Induced Plasmas and Applications, L. Radziemski and D. Cremers, eds., Marcel Dekker (1989)

### Course Content

#### Introduction

Definition of Plasma

Concept of Equilibrium – temperatures, collision times, collisional energy transfer

Distribution Function

Debye Length – Poisson's equation, prominent role of electrons in Debye length

#### Single Particle Motions in Electric and Magnetic Fields

Uniform Steady  $\vec{E} \perp \vec{B}$ , and its Generalization

Curved  $\vec{B}$ -Field

*gradient*  $|\vec{B}| \uparrow \vec{B}$  (mirror field)

Non-steady  $\vec{B}$ -Field

Methods of Plasma Heating, based on above examples

#### Plasmas as a Fluid

Governing Equations – ex. Bernouille's relation

Fluid Drifts perpendicular to  $\vec{B}$ -field

#### Waves in Plasmas

Phase Velocity Versus Group Velocity

Dispersion Relations

Plasma Oscillation

Langmuir Waves

Ion Acoustic Waves

Electromagnetic Waves

Alfvén Waves

#### Landau Damping in Electron Plasma Wave

#### Transport Processes in Plasmas

#### Thermonuclear Fusion

Fusion Reactions

Reaction Rates

Radiation Losses

Lawson Criterion

Basics of Magnetic Fusion Devices

#### Plasma Diagnostics

Plasma Spectroscopy

Spectral Line Broadening

Thomson Scattering

#### Magnetohydrodynamic Power Generation

Inertial Confinement Fusion – lasers and particle beams

### Tests and Assignment

One Hour Exam and Final

Weekly Homework Assignments

Special Topics Term Papers (to count as 1-1/2 Hour Exams)

**Accommodations for Students with Disabilities:** *If you have a disability for which you are or may be requesting accommodations, please contact both your instructor and the Office of Academic Support Services, University Center C212 (610-758-4152) as early as possible in the semester. You must have documentation from the Academic Support Services office before accommodations can be granted.*

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