Plasma Simulation and Applications

Course Outline

This course gives the students the fundamental knowledge of representative applications of plasmas: dry etching, thin film deposition, and laser-based material processing. In addition, students can obtain the basic skills for numerical computation, analysis of electrostatic field, and magnetohydrodynamics. The course consists of lectures and an exercise. In the exercise, students are asked to write computer programs for analyzing an electrostatic field and/or for solving a problem of electrohydrodynamics.

Note: Students are highly recommended to take "Fundamental Plasma Science" together with this course.

Instructor

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Type of Class and Class Hours [One class hour = Two hours (90 minutes of actual instruction)]	Credit
Lecture (6) Seminar ( ) Experiment (4) Practical Training ( )	1

Duration	Organizing Institution
22/Aug/2017 - 25/Aug/2017	Graduate School of Engineering

Level	Place
Graduate Level	Sapporo

Tuition (No additional fee for HU students)	Language	Capacity
¥14,800	English	10

Target Group (Prerequisites)

This course is designed for graduate students. A basic understanding of electromagnetism is a prerequisite for a successful course completion. In addition, an experience with computer programming is recommended.

Key Words

computational techniques, analysis of electrostatic field, magnetohydrodynamics, plasma etching, plasma deposition, laser processing

Course Objectives

Recently, plasma technologies are applied to various industrial fields such as electronics, mechanical engineering, environmental problems, medicine, agriculture, etc. The developments of plasma-based technologies in these industrial fields require a fundamental understanding on the nature of plasmas; however, there are few opportunities for students to learn the plasma fundamentals efficiently. This course aims to study representative applications of plasmas and basic skills for numerical analysis of plasmas. The special feature of this course is the combination of lectures and an exercise. By completing this course, the students will obtain the basic knowledge on plasma applications and the skill to carry out numerical analysis of plasmas.

Course Goals

By the end of this course, you will be able to
1. present representative applications of plasmas.
2. design the method for numerical analysis regarding electrostatic field and magnetohydrodynamics.
3. compose a computer program for numerical analysis of electrostatic field and magnetohydrodynamics.

Course Schedule

The first aim is to learn the fundamentals of plasma applications. The second aim is to learn the fundamentals of numerical computation and its application to the analysis of electrostatic field and magnetohydrodynamics. The third aim is to obtain practical skills to carry out numerical analyses of electrostatic field and magnetohydrodynamics.

1. Fundamentals of dry etching using plasmas
2. Fundamentals of thin film deposition using plasmas
3. Fundamentals of laser-based material processing
4. Basic numerical computation
5. Analysis of electrostatic field
6. Analysis of magnetohydrodynamics
7. Exercise for numerical analysis of electrostatic field and/or magnetohydrodynamics (4 classes)

Preparation and Assignments

1. You will be asked to write the report that summarizes the applications of plasmas.
2. You will be asked to write the report that describes the results and the discussion on the numerical analysis of electrostatic field and/or magnetohydrodynamics.

Grading System

Your grade will be determined by how well you demonstrate your achievement of the course goals through
1. the report that summarizes the applications of plasmas (40%).
2. the report that describes the results and the discussion on the numerical analysis of electrostatic field and/or magnetohydrodynamics (60%).

Related Course(HSI)

Fundamental plasma science

Textbooks

Textbook and handouts will be distributed.

Reading List

Principles of Plasma Discharges and Materials Processing, 2nd ed. (Wiley, New York, 2005)

Equipment

A laptop is lent to every student.

Additional Information

Update

14/Mar/2017