Fundamental Plasma Science

Course Outline

This course gives the students the fundamental knowledge of plasma science which is necessary to apply plasmas to various industrial problems. In addition, students can obtain an experience of spectroscopic diagnostics of plasmas. This course consists of lectures and an exercise. In the exercise, students are asked to carry out the analyses of an optical emission spectrum from an atmospheric-pressure helium plasma and an optical absorption spectrum of an inductively coupled argon plasma.

Note: Students are highly recommended to take "Plasma simulation and applications" 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
21/Aug/2017 - 24/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.

Key Words

elementary processes, particle motion in electromagnetic field, collective phenomena, transport phenomena, plasma production, plasma diagnostics

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 the plasma fundamentals which are the vital knowledge for developing various plasma-based technologies. 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 science and the skill for analyzing optical emission/absorption spectra of plasmas.

Course Goals

By the end of this course, you will be able to
1. present how to describe the fundamental characteristics of plasmas
2. analyze the optical emission spectra from plasmas
3. analyze the optical absorption spectra of plasmas

Course Schedule

The first aim is to learn the fundamental plasma science. The second aim is to obtain practical skills to carry out the analyses of optical emission and optical absorption spectra of plasmas.

1. Elementary processes in plasmas
2. Particle motion in electromagnetic field
3. Collective phenomena in plasmas
4. Transport phenomena in plasmas
5. Methods for plasma production
6. Methods for plasma diagnostics
7. Exercise for the analyses of an optical emission spectrum from a plasma and an optical absorption spectrum of a plasma (4 classes)

Preparation and Assignments

1. You will be asked to write the report that shows the solutions of exercise problems.
2. You will be asked to write the report that describes the results and the discussion on the analyses of an optical emission spectrum from a plasma and an optical absorption spectrum of a plasma.

Grading System

Your grade will be determined by how well you demonstrate your achievement of the course goals through
1. the report that describes summarizes the solutions of exercise problems (50%).
2. the report that describes the results and the discussion on the analyses of an optical emission spectrum from a plasma and an optical absorption spectrum of a plasma (50%).

Related Course(HSI)

Plasma simulation and applications

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