UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Laboratory of Plasma Physics II

2627-1-F1703Q021

Aims

Knowledge and understanding: Students will acquire advanced knowledge of experimental techniques and methods in plasma physics, including the use of power supplies, vacuum systems, and plasma diagnostic tools for parameter measurement.
Applying knowledge and understanding: Students will be able to apply experimental methodologies to plasma studies, perform spectral analysis of signals, and implement numerical tools for data analysis.
Making judgements: Students will develop critical skills in analyzing complex experimental data, evaluating measurement uncertainties, and interpreting plasma physics phenomena within broader physical contexts.
Communication skills: Students will be able to write comprehensive scientific reports and present experimental results effectively using proper scientific English and appropriate technical terminology.
Learning skills: Students will acquire collaborative research skills for addressing complex physical problems within working groups, applying rigorous scientific methodology and developing autonomous learning capabilities for advanced plasma physics topics.

Contents

Plasmas produced in electrical discharges in gases.

Low pressure cold plasmas.

Radiofrequency plasmas.

Cold plasmas at atmospheric pressure.

Plasma diagnostics.

Plasma processing for material treatments.

Neutron detectors

Gamma detectors

Detailed program

The laboratory starts with an introduction on electrical discharges in gases,
on elementary processes in plasmas and on plasma processing of materials.
We also discuss nuclear fusion and the diagnostics aimed to the fusion products.

Experiments will be realized in small groups concerning, partially at student will, according to the available instrumentations and the number of students:

a) Characterization of a glow discharge
b) Characterization of a plasma produced by a radiofrequency antenna
c) Characterization of a DBD, Dielectric Barrier Discharge
d) Characterization of plasma-material interactions also with atomic physics methods.
e) Characterization of neutron and gamma detectors

Prerequisites

It is required to have attended to the Plasma Physics Laboratory I.

It is useful but not needed to have attended to general courses of Plasma Physics.

Maths and physics concepts given in the first-level degree.

Teaching form

Activities will be held in laboratory in U9 building.
Introductory delivered in face-to-face delivery mode (12 hr);
Laboratory activities delivered in face-to-face interactive mode (60 hr).
Introductory lectures will be delivered in Italian.

Laboratory: 72 hours (6 cfu)

Textbook and teaching resource

References:

Y.P.Raizer, Gas Discharge Physics, Springer-Verlag, 1991.
M.A. Lieberman and A.J. Lichtenberg, Principles of Plasma Discharges and Materials Processing, Wiley, 1994.
I.H. Hutchinson, Principles of Plasma Diagnostics, Cambridge University Press, 1990.

website: http://virgilio.mib.infn.it/labdida/doku.php?id=laboratorio_di_plasmi

Semester

First year, second semester

Assessment method

Oral (after the presentation of a written report of the experiments performed).

There are no in-progress tests, only a final exam.
To be admitted to the examination, a report must be drawn up on all the experiments carried out in the laboratory.

The report, written in English, must contain a brief description of the apparatus used, the results obtained and a brief discussion of them.
The examination, which will be held orally, will focus mainly on the discussion of the report itself, with possible mentions of the concepts
explained during the introductory lectures and to connect experimental results with basic plasma properties.

During the examination, the quality of the report, the care taken in performing the measurements and related data analysis and the understanding of the physics concepts on which the experiments are based will be evaluated.

Mark range:

18-30/30

Office hours

During the year:

Book a meeting by email (ruggero.barni@unimib.it), at the teacher office (U2-3029, III floor) and/or
the other teacher office (gabriele.croci@unimib.it, U2-3013, III piano).

Sustainable Development Goals

CLEAN WATER AND SANITATION | AFFORDABLE AND CLEAN ENERGY | INDUSTRY, INNOVATION AND INFRASTRUCTURE