Classical Electrodynamics

Academic Year: (2019 / 2020) **Review date: 28/03/2019 17:58:47**

Department assigned to the subject:

Coordinating teacher: MARTIN SOLIS, JOSE RAMON

Type: Compulsory ECTS Credits : 6.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Basic knowledge of electromagnetic theory (graduate level) and special theory of relativity

OBJECTIVES

The course provides the basics for an understanding of the electromagnetic field theory and the behaviour of charged particles in electromagnetic fields, mainly from a classical field theoretical point of view. The course includes electrostatics, magnetostatics, and their unification (Maxwell equations), electromagnetic waves and their propagation, covariant formulation of classical electrodynamics, as well as charged particle dynamics and radiation phenomena.

The course will provide the student with an appropiate training in electromagnetic field theory and charged particle dynamics especially suited for its application to plasma physics and nuclear fusion science

DESCRIPTION OF CONTENTS: PROGRAMME

Part I. Introduction:

1. Preliminaries
2. Classical electrodynamics and nuclear fusion

Part II. Basic electromagnetic theory:

3. Electrostatics
4. Magnetostatics
5. Electrodynamics
6. Conservation laws

Part III. Applied electromagnetism:

7. Potentials and fields
8. Electromagnetic radiation and radiating systems
9. Electromagnetic waves

Part IV. Charged particle dynamics:

10. Relativistic electrodynamics
11. The motion of charged particles in electromagnetic fields
12. Charged particle radiation

LEARNING ACTIVITIES AND METHODOLOGY

* Lectures where the theoretical concepts are explained:

The lecturer will provide to the students with a file including the material to be given (1 week in

advance) which constitutes the basis of the theoretical lectures (lecture notes).

* Practical classes:

The exercises proposed by the lecturer are solved by the students during the practical classes, corrected and evaluated by the lecturer.

The main skills to be acquired in these activities are:
- To understand the statement of a problem
- To identify the physical electromagnetic phenomenon involved in the statement and the physical laws involved
- To develop an strategy to reach the objective (for instance breaking the problem in small subproblems)
- To be careful in the use of required mathematics tools
- To be able to make a critical analysis of the results

ASSESSMENT SYSTEM

% end-of-term-examination/test:	70
% of continuous assessment (assigments, laboratory, practicals…):	30

* Continuous evaluation (30% of final mark):

The evaluation will take into account attendance and student attitude, and the solution of proposed exercises in the practical classes.

* Written exams (70% of final mark)

Two written exama will take place (mid and end of the semester) and it will be common for all the students. Contents:

- Problems to be solved covering the main topics of the program.
- Short theoretical questions.

BASIC BIBLIOGRAPHY

- D.J. Griffiths INTRODUCTION TO ELECTRODYNAMICS, Prentice-Hall International, Inc., 1999

- J.R. Reitz, F.J. Milford and R.W. Christy FOUNDATIONS OF ELECTROMAGNETIC, Addison Wesley, 1992

- R. Wangsness ELECTROMAGNETIC FIELDS, John Wiley & Sons, Inc., 1986

ADDITIONAL BIBLIOGRAPHY

- J.D. Jackson CLASSICAL ELECTRODYNAMICS, Wiley & Sons, 1999

- L. D. Landau, E.M. Lifshitz THE CLASSICAL THEORY OF FIELDS, Course of Theoretical Physics, Vol.2, Pergamon Press, Ltd., 1975

- W.K.H. Panofsky and M. Phillips CLASSICAL ELECTRICITY AND MAGNETISM, Addison-Wesley Publishing Company, Inc., 1962