COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF PHYSICS		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**M114**	**SEMESTER**	**2**
COURSE TITLE	Classical electrodynamics		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	9
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialised general knowledge
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

Upon successful completion of this course the student will be able to:

• Have a broad and in-depth knowledge of electromagnetic phenomena and mathematical tools of classical electrodynamics.

• Be able to process and analyse qualitatively and quantitatively the electromagnetic phenomena.

• Be able to use effectively mathematical techniques, such as vector and tensor analysis, to solve problems of classical electrodynamics.

• Having practiced his analytical and inductive thinking through solving the demanding exercises of classical electrodynamics to apply knowledge to research work on related subjects.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

Search for, production of free, creative and induction thinking, working independently

(3) SYLLABUS

Maxwell's equations. Plane electromagnetic waves. Electromagnetic energy and Poynting's theorem. Propagation of electromagnetic waves in (α) a conducting medium (β) a dielectric medium. Reflection and refraction on the surface of (α) a dielectric medium (β) a conducting medium. Wave guides. Scalar and vector potential. Lorentz condition and gauge transformations. Solution of the homogeneous wave equation. Retarded potentials. Multipole expansion for harmonically oscillating sources. Electric dipole, magnetic dipole and electric quadrupole radiation. Antennas. Radiation from a point charge. Lienard-Wiechert potentials. Larmor's formula. Scattering of electromagnetic waves. The special theory of relativity. Elements of tensor algebra and analysis in a Minkowski space-time. The electromagnetic tensor. Covariant formulation of Maxwell's equations. Lagrangian formulation of classical electrodynamics. The energy-momentum tensor of the electromagnetic field. Conservation equations.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY
Face-to-face, Distance learning, etc.

USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students

TEACHING METHODS
The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS

Activity	*Semester workload*
Lectures	52
Study of Bibliography	60
Independent study	50
Essay writing	60
Final exams	3
Course total	225

STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.

1) Weekly Homeworks
2) Written Exams at the end of the courses

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Classical Electrodynamics, 3rd edition, J. D. Jackson, Wiley (1998).
- Εισαγωγή στην Ηλεκτροδυναμική, D. Griffiths, Πανεπιστημιακές Εκδόσεις Κρήτης (2004).
- Electromagnetic fields, Roald K. Wangsness, Wiley (1986).
- Εισαγωγή στην Κλασική Ηλεκτροδυναμική, Κ. Ταμβάκη, εκδόσεις Liberal Books (2012).
- Κλασσική Ηλεκτροδυναμική, Ι.Δ. Βέργαδος, εκδόσεις Συμεών (2002).