

## COURSE OUTLINE

### (1) GENERAL

<b>SCHOOL</b>	SCHOOL OF SCIENCES		
<b>ACADEMIC UNIT</b>	DEPARTMENT OF PHYSICS		
<b>LEVEL OF STUDIES</b>	POSTGRADUATE		
<b>COURSE CODE</b>	M114	<b>SEMESTER</b>	2
<b>COURSE TITLE</b>	Classical electrodynamics		
<b>INDEPENDENT TEACHING ACTIVITIES</b> <i>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</i>	<b>WEEKLY TEACHING HOURS</b>	<b>CREDITS</b>	
	4	9	
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>			
<b>COURSE TYPE</b> <i>general background, special background, specialised general knowledge, skills development</i>	Specialised general knowledge		
<b>PREREQUISITE COURSES:</b>			
<b>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</b>	Greek		
<b>IS THE COURSE OFFERED TO ERASMUS STUDENTS</b>	Yes		
<b>COURSE WEBSITE (URL)</b>			

### (2) LEARNING OUTCOMES

<p><b>Learning outcomes</b></p> <p><i>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.</i></p> <p><i>Consult Appendix A</i></p> <ul style="list-style-type: none"> <li>• <i>Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area</i></li> <li>• <i>Descriptors for Levels 6, 7 &amp; 8 of the European Qualifications Framework for Lifelong Learning and Appendix B</i></li> <li>• <i>Guidelines for writing Learning Outcomes</i></li> </ul>
<p>Upon successful completion of this course the student will be able to:</p> <ul style="list-style-type: none"> <li>• Have a broad and in-depth knowledge of electromagnetic phenomena and mathematical tools of classical electrodynamics.</li> <li>• Be able to process and analyse qualitatively and quantitatively the electromagnetic phenomena.</li> <li>• Be able to use effectively mathematical techniques, such as vector and tensor analysis, to solve problems of classical electrodynamics.</li> <li>• Having practiced his analytical and inductive thinking through solving the demanding exercises of classical electrodynamics to apply knowledge to research work on related subjects.</li> </ul>

### 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

Adapting to new situations

Decision-making

Working independently

Team work

Working in an international environment

Working in an interdisciplinary environment

Production of new research ideas

Project planning and management

Respect for difference and multiculturalism

Respect for the natural environment

Showing social, professional and ethical responsibility and

sensitivity to gender issues

Criticism and self-criticism

Production of free, creative and inductive thinking

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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 ( $\alpha$ ) a conducting medium ( $\beta$ ) a dielectric medium. Reflection and refraction on the surface of ( $\alpha$ ) a dielectric medium ( $\beta$ ) 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

<b>DELIVERY</b> <i>Face-to-face, Distance learning, etc.</i>		
<b>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</b> <i>Use of ICT in teaching, laboratory education, communication with students</i>		
<b>TEACHING METHODS</b> <i>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</i>	<b>Activity</b>	<b>Semester workload</b>
	Lectures	52
	Study of Bibliography	60
	Independent study	50
	Essay writing	60
	Final exams	3
	Course total	225
<b>STUDENT PERFORMANCE EVALUATION</b> <i>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.</i>	<ol style="list-style-type: none"> <li>1) Weekly Homeworks</li> <li>2) Written Exams at the end of the courses</li> </ol>	

#### (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).
- Κλασική Ηλεκτροδυναμική, Ι.Δ. Βέργαδος, εκδόσεις Συμεών (2002).

