

Physics for Scientists and Engineers II– Electricity & Magnetism

1. GENERAL			
SCHOOL	Faculty of Sciences in collaboration with Faculty of Engineering, Aristotle University of Thessaloniki		
DEPARTMENT	Materials Science and Engineering		
LEVEL OF STUDIES	ISCED level 7 (5-year Integrated Master's programme) ISCED level 6 (4-year BSc programme)		
COURSE CODE	MSEN 203	SEMESTER	2 nd Semester
COURSE TITLE	Physics for Scientists and Engineers II– Electricity & Magnetism		
TEACHING ACTIVITIES	TEACHING HOURS PER WEEK	ECTS CREDITS	
Lectures, tutorials/problem sessions, laboratory/computer exercises (where applicable), case studies and guided self-study.	4	6	
COURSE TYPE	<p>Students will develop:</p> <ul style="list-style-type: none"> • A foundational understanding of the physical principles needed for later courses in physics, engineering, and applied sciences. • Familiarity with the scientific method, evidence-based reasoning, and quantitative analysis, forming the conceptual groundwork for scientific problem-solving. <p>Students will be able to:</p> <ul style="list-style-type: none"> • Understand and apply the principles of conservation (energy, momentum, angular momentum). • Demonstrate an understanding of experimental measurement, units, and dimensional analysis. <p>The course helps students develop important scientific and engineering skills such as:</p> <ul style="list-style-type: none"> • Translating physical situations into mathematical equations. • Solving multi-step quantitative problems. • Using calculus-based methods to analyze motion and waves. 		
PREREQUISITES	<p>Mathematics Background</p> <ul style="list-style-type: none"> • Calculus I (or concurrent enrollment) <p>Students should understand:</p> <ul style="list-style-type: none"> • Limits and derivatives • Basic integral concepts • Algebraic manipulation and trigonometry <p>Students benefit from prior exposure to:</p> <ul style="list-style-type: none"> • Newton's laws • Basic kinematics • Simple energy and momentum ideas <p>Students should be able to:</p> <ul style="list-style-type: none"> • Apply mathematical reasoning • Analyze graphs and quantitative data <p>Solve multi-step problems</p>		
TEACHING AND EXAMINATION METHODS	Lectures, Written Assignments, eLearning quizzes, Written exams		
COURSE OFFERED TO ERASMUS STUDENTS	Yes.		

COURSE URL	https://elearning.auth.gr/course/view.php?id=xxxxx
-------------------	---

2. LEARNING OUTCOMES	
Learning Outcomes	<p>By the end of the course, students will acquire:</p> <p>Conceptual Understanding: Explain fundamental principles, Describe the physics of relative phenomena, Connect physical principles to real-world phenomena in science and engineering contexts.</p> <p>Analytical and Mathematical Skills: Apply calculus-based methods to analyze, Solve multi-step physics problems using algebra, trigonometry, derivatives, and integrals</p> <p>Problem-Solving Abilities: Break down complex physical scenarios into solvable components, Evaluate the validity of assumptions, approximations, and results.</p>
General Skills	<p>By the end of the course, students will acquire:</p> <p>Communication Skills: Communicate scientific reasoning and solutions clearly in written and oral formats.</p> <p>Application and Transfer of Knowledge: Apply mechanics and wave principles to engineering systems, materials, and everyday physical situations, Use physics concepts to predict system behavior and evaluate engineering design choices, Demonstrate readiness for advanced courses on Materials' Engineering.</p>

3. COURSE CONTENT
<p>This course introduces the fundamental laws governing electric and magnetic fields, how they interact with matter, and how they combine to produce electromagnetic waves. Students learn how charges create electric fields, how currents produce magnetic fields, how changing fields generate induction, and how Maxwell's equations unify all of classical electromagnetism. The course builds strong physical intuition supported by calculus and vector analysis.</p>

4. LEARNING & TEACHING METHODS - EVALUATION					
Teaching method	Face-to-face.				
Use of ICT	<p>ICT plays a significant role in enhancing teaching, learning, experimentation, visualization, and assessment in this course as follows:</p> <p>Computational Tools for Problem Solving: Spreadsheet calculations (Excel, Google Sheets), Coding solutions in Python, MATLAB, or Mathematica</p> <p>Online Learning Platforms: Learning management systems (LMS) like Moodle, Online lectures, video tutorials, and animations,</p> <p>Communication and Collaboration: Online discussion forums, Collaborative documents, Sharing of data and reports</p> <p>Presentation and Reporting Tools: Lab reports (word processors), Data plots and charts (graphing tools), Presentations (PowerPoint, Google Slides).</p>				
Teaching organization	<p>The supervised and unsupervised workload per activity is indicated below (total workload complies with ECTS standards).</p> <table border="1" data-bbox="523 2004 1337 2038"> <thead> <tr> <th>Activity</th> <th>Workload/semester (hours)</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> </tr> </tbody> </table>	Activity	Workload/semester (hours)		
Activity	Workload/semester (hours)				

	Lectures	52
	self-study, quizzes, on-line tests	48
	Independent study	48
	Final written exam	2
	Total	150
Student evaluation	Assessment Language: English <ul style="list-style-type: none"> Assessment Methods: Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Written Exams 	

5. SUGGESTED BIBLIOGRAPHY

Course Bibliography

Principles & Practice of Physics | E. Mazur | (Volume 1) | ISBN 13: 978-0321949202 | Pearson 2014

Additional bibliography for study

Principles & Practice of Physics | E. Mazur | (Volume 2) | ISBN: 978-0321957771 | Pearson 2014