Condensed Mater Physics

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 404**	**SEMESTER**	4th Semester
COURSE TITLE	**Condensed Mater Physics**		
TEACHING ACTIVITIES Lectures, tutorials/problem sessions, laboratory/computer exercises (where applicable), case studies and guided self-study.		**TEACHING HOURS PER WEEK**	**ECTS CREDITS**
		4	6
COURSE TYPE	This course introduces the principles of condensed matter physics with a focus on applications in materials engineering. It covers the structure, properties, and behavior of solids, linking microscopic theories to macroscopic material properties. The course emphasizes understanding crystalline structures, electronic behavior, thermal and mechanical properties, and modern materials applications.		
PREREQUISITES	Students should have a solid foundation in general physics, calculus, linear algebra, basic materials science, and chemistry. Familiarity with data analysis and graphing tools is also recommended to support understanding of experimental results and material behavior.		
TEACHING AND EXAMINATION METHODS	Lectures, Homework assignments, Quizzes, Midterm examination, Final exam		
COURSE OFFERED TO ERASMUS STUDENTS	Yes.		
COURSE URL	https://elearning.auth.gr/course/view.php?id=xxxxx		

2. LEARNING OUTCOMES	
Learning Outcomes	Students completing this course will be able to: ● Understand and describe crystal structures and lattice defects. ● Apply diffraction and characterization techniques to analyze materials. ● Explain electronic, thermal, optical, and magnetic properties of solids. ● Relate microscopic theories to macroscopic material behavior. ● Analyze material properties for engineering applications.
General Skills	Students will develop analytical and problem-solving skills, interpret and apply mathematical and physical models, analyze experimental data, and use computational tools to support materials engineering applications. They will also gain the ability to communicate scientific results clearly and effectively..

3. COURSE CONTENT

This course covers the physical principles underlying the structure and properties of solids, including crystal structures, lattice vibrations, electronic, thermal, optical, and magnetic properties. Students will learn characterization techniques such as X-ray diffraction, explore superconductivity and modern nanomaterials, and apply these concepts to understand and engineer material behavior in practical applications.

4. LEARNING & TEACHING METHODS - EVALUATION

Teaching method	Face-to-face.
Use of ICT	ICT plays a significant role in enhancing teaching, learning, experimentation, visualization, and assessment in this course as follows: **Computational Tools for Problem Solving:** Spreadsheet calculations (Excel, Google Sheets), Coding solutions in Python, MATLAB, or Mathematica **Online Learning Platforms:** Learning management systems (LMS) like Moodle, Online lectures, video tutorials, and animations, **Communication and Collaboration:** Online discussion forums, Collaborative documents, Sharing of data and reports **Presentation and Reporting Tools:** Lab reports (word processors), Data plots and charts (graphing tools), Presentations (PowerPoint, Google Slides).
Teaching organization	The supervised and unsupervised workload per activity is indicated below (total workload complies with ECTS standards).

Activity	Workload/semester (hours)
Lectures	52
self-study, quizzes, on-line tests	46
Independent study	50
Final written exam	2
Total	**150**

Student evaluation	Assessment Language: English • Assessment Methods: Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Written Exams

5. SUGGESTED BIBLIOGRAPHY

Course Bibliography

Fundamentals of Condensed Matter and Crystalline Physics | ISBN 9781139062077 | Cambridge University Press, 2012

Additional bibliography for study

Fundamentals of Condensed Matter Physics | ISBN 9780521513319 | Cambridge University Press 2016