

## COURSE OUTLINE

### 1. GENERAL

|                                                                                                                                                                                                                                                                             |                                                                                       |                                |                     |
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| <b>SCHOOL</b>                                                                                                                                                                                                                                                               | OF SCIENCES                                                                           |                                |                     |
| <b>DEPARTMENT</b>                                                                                                                                                                                                                                                           | OF PHYSICS                                                                            |                                |                     |
| <b>LEVEL OF STUDIES</b>                                                                                                                                                                                                                                                     | UNDERGRADUATE                                                                         |                                |                     |
| <b>COURSE CODE</b>                                                                                                                                                                                                                                                          | Y504                                                                                  | <b>SEMESTER</b>                | 5 <sup>o</sup>      |
| <b>COURSE TITLE</b>                                                                                                                                                                                                                                                         | QUANTUM MECHANICS I                                                                   |                                |                     |
| <b>TEACHING ACTIVITIES</b><br><i>If the ECTS Credits are distributed in distinct parts of the course e.g. lectures, labs etc. If the ECTS Credits are awarded to the whole course, then please indicate the teaching hours per week and the corresponding ECTS Credits.</i> |                                                                                       | <b>TEACHING HOURS PER WEEK</b> | <b>ECTS CREDITS</b> |
| LECTURES                                                                                                                                                                                                                                                                    |                                                                                       | 4                              | 5                   |
|                                                                                                                                                                                                                                                                             |                                                                                       |                                |                     |
|                                                                                                                                                                                                                                                                             |                                                                                       |                                |                     |
| <i>Please, add lines if necessary. Teaching methods and organization of the course are described in section 4.</i>                                                                                                                                                          |                                                                                       |                                |                     |
| <b>COURSE TYPE</b><br><i>Background, General Knowledge, Scientific Area, Skill Development</i>                                                                                                                                                                              | Scientific Area                                                                       |                                |                     |
| <b>PREREQUISITES:</b>                                                                                                                                                                                                                                                       | -                                                                                     |                                |                     |
| <b>TEACHING &amp; EXAMINATION LANGUAGE:</b>                                                                                                                                                                                                                                 | GREEK                                                                                 |                                |                     |
| <b>COURSE OFFERED TO ERASMUS STUDENTS:</b>                                                                                                                                                                                                                                  | NO                                                                                    |                                |                     |
| <b>COURSE URL:</b>                                                                                                                                                                                                                                                          | <a href="https://eclass.emt.duth.gr/courses/">https://eclass.emt.duth.gr/courses/</a> |                                |                     |

### 2. LEARNING OUTCOMES

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                             |
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| <b>Learning Outcomes</b><br><i>Please describe the learning outcomes of the course: Knowledge, skills and abilities acquired after the successful completion of the course.</i>                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                             |
| <p>Upon successful completion of the course, students will be able to: understand the fundamental concepts, principles, and laws of Quantum Mechanics, including wave–particle duality, the Schrödinger equation, the uncertainty principle, and their applications. To demonstrate knowledge of model quantum systems such as potential wells, the harmonic oscillator, and the hydrogen atom. To apply this knowledge to the solution of related complex problems and develop critical thinking skills to evaluate, analyze, and interrelate quantum mechanical principles and their implications.</p> |                                                                                                                                                                                                                                                                                                                                             |
| <b>General Skills</b><br><i>Name the desirable general skills upon successful completion of the module</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                             |
| <i>Search, analysis and synthesis of data and information,</i><br><i>ICT Use</i><br><i>Adaptation to new situations</i><br><i>Decision making</i><br><i>Autonomous work</i><br><i>Teamwork</i><br><i>Working in an international environment</i><br><i>Working in an interdisciplinary environment</i><br><i>Production of new research ideas</i>                                                                                                                                                                                                                                                        | <i>Project design and management</i><br><i>Equity and Inclusion</i><br><i>Respect for the natural environment</i><br><i>Sustainability</i><br><i>Demonstration of social, professional and moral responsibility and sensitivity to gender issues</i><br><i>Critical thinking</i><br><i>Promoting free, creative and inductive reasoning</i> |
| <ul style="list-style-type: none"> <li>• Application of knowledge in practice</li> <li>• Exercise of critical and self-critical thinking</li> <li>• Promotion of free, creative, and inductive thinking</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                             |

### 3. COURSE CONTENT

Wave-particle duality of light and matter; statistical interpretation of the Schrödinger equation; uncertainty principle; vector spaces; linear operators; algebra of quantum mechanical operators; Dirac notation; simple quantum systems; three-dimensional problems: quantization of a particle in a box; central potentials; hydrogen atom.

### 4. LEARNING & TEACHING METHODS - EVALUATION

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                     |                          |
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| <b>TEACHING METHOD</b><br><i>Face to face, Distance learning, etc.</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Face to Face                                                        |                          |
| <b>USE OF INFORMATION &amp; COMMUNICATIONS TECHNOLOGY (ICT)</b><br><i>Use of ICT in Teaching, in Laboratory Education, in Communication with students</i>                                                                                                                                                                                                                                                                                                                                                                                   | Use of ICT in Teaching<br>Use of ICT in Communication with students |                          |
| <b>TEACHING ORGANIZATION</b><br><i>The ways and methods of teaching are described in detail.</i><br><i>Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliographic research &amp; analysis, Tutoring, Internship (Placement), Clinical Exercise, Art Workshop, Interactive learning, Study visits, Study / creation, project, creation, project. Etc.</i><br><br><i>The supervised and unsupervised workload per activity is indicated here, so that total workload per semester complies to ECTS standards.</i>                 | <b>Activity</b>                                                     | <b>Workload/semester</b> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Lectures                                                            | 100                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Tutorial                                                            | 25                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                     |                          |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Course total (25 hours / ECTS)</b>                               | <b>125</b>               |
| <b>STUDENT EVALUATION</b><br><i>Description of the evaluation process</i><br><br><i>Assessment Language, Assessment Methods, Formative or Concluding, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Essay / Report, Oral Exam, Presentation in audience, Laboratory Report, Clinical examination of a patient, Artistic interpretation, Other/Others</i><br><br><i>Please indicate all relevant information about the course assessment and how students are informed</i> | Final written examination (100%) (use of notes is not permitted).   |                          |

### 5. SUGGESTED BIBLIOGRAPHY

- Suggested bibliography:  
 - Related academic journals:

- Quantum Mechanics I, S. Trachanas, ITE/PEK
- Quantum Mechanics, N. Zettili, Sophia Publications
- Quantum Physics, S. Gasiorowicz, Kleidarithmos Publications

