

## COURSE OUTLINE

### (1) GENERAL

<b>SCHOOL</b>	SCHOOL OF SCIENCES		
<b>ACADEMIC UNIT</b>	DEPARTMENT OF MATHEMATICS		
<b>LEVEL OF STUDIES</b>	UNDERGRADUATE PROGRAM		
<b>COURSE CODE</b>	<b>311-0560</b>	<b>SEMESTER</b>	<b>E</b>
<b>COURSE TITLE</b>	PHYSICS I		
<b>INSTRUCTOR</b>			
<b>INDEPENDENT TEACHING ACTIVITIES</b>	<b>WEEKLY TEACHING HOURS</b>	<b>CREDITS</b>	
	6	9	
<b>COURSE TYPE</b>	General background		
<b>PREREQUISITE COURSES:</b>	NO		
<b>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</b>	GREEK		
<b>IS THE COURSE OFFERED TO ERASMUS STUDENTS</b>	YES		
<b>COURSE WEBSITE (URL)</b>	<a href="https://www.math.aegean.gr/index.php/en/education/undergraduate-programs">https://www.math.aegean.gr/index.php/en/education/undergraduate-programs</a>		

### (2) LEARNING OUTCOMES

<b>Learning outcomes</b>
<p>The purpose of the course is to bridge the gap between the basic concepts and principles of Classical Mechanics with different branches of Mathematics. Students are expected, by developing a general problem-solving strategy, to learn how to approach and solve complicated problems in real life. After completing this course, students should demonstrate competency in the following skills:</p> <ul style="list-style-type: none"> <li>• Define the fundamental and derived quantities of Classical Mechanics.</li> <li>• State and understand the principles of Classical Mechanics.</li> <li>• Discover the limitations of physical laws in applications.</li> <li>• Apply the physical laws to solve idealized problems and problems in real life as well.</li> <li>• Analyze and interpret specific physical phenomena.</li> <li>• Model and make predictions about the evolution of a physical phenomenon by solving an ordinary differential equation.</li> <li>• Evaluate the limitations of the applied mathematical method.</li> <li>• Propose alternative approaches and decide which method is more effective.</li> <li>• Devise simple experiments to measure physical quantities.</li> </ul>
<b>General Competences</b>
<p>Production of free, creative and inductive thinking. Working independently. Team working. Working in an interdisciplinary environment. Production of new research ideas.</p>

### (3) SYLLABUS

<ol style="list-style-type: none"> <li>1. Classification and development of the branches of Physics. Interrelation between Physics and other Natural Sciences. The role of experimentation in Physics. Velocity and acceleration. Planar curvilinear motion. Review of fundamental concepts and Theorems from Calculus III–IV and Differential Geometry, including (but not limited to): equations of curves and surfaces, line and surface integrals, orthonormal coordinate systems, Green's, Stokes', and Gauss' theorems, curvature and torsion of regular curves, and the Frenet frame.</li> <li>2. Review of solution methods for specific classes of Ordinary Differential Equations, including (but not limited to): separable equations, second-order linear equations, homogeneous and nonhomogeneous ordinary differential equations with constant coefficients.</li> <li>3. Fundamental quantities (mass, space, time, electric charge) and dimensional analysis. Momentum, force, angular momentum, work and energy. Classification of the forces from macrocosmos to microcosmos.</li> </ol>
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4. Newton's laws. Conservation theorems for linear momentum, angular momentum and energy. Stability and potential energy curves.	
5. Relative motion, velocity and acceleration. Galilean transformations. Lorentz's transformations and velocity.	
6. Oscillations. The simple harmonic oscillator. Energy of the simple harmonic oscillator. The damped harmonic oscillator. The simple and physical pendulum.	
7. Gravity. Kepler's laws. Gravitational potential energy. Planetary motion.	
8. Discrete and continuous systems. Momentum, angular momentum, kinetic energy and potential energy of a system of particles. Center of mass. Motion relative to the center of mass. Conservation laws. Collisions.	
9. Rigid body. Translations and rotations. Angular velocity of the rigid body. Moments of inertia and theorems. Kinetic energy and angular momentum about a fixed axis. Motion of a rigid body about a fixed axis.	
10. Fluids. Density and pressure. Variation of pressure with respect to the depth. Buoyancy and the Archimedes principle. Characteristic properties of flow. Continuity equation. Bernoulli's equation.	
<b>TEACHING MATERIAL DISTRIBUTION</b>	The teaching material of the course is uniformly distributed during the semester.

#### (4) TEACHING and LEARNING METHODS - EVALUATION

<b>DELIVERY</b>	Face-to-face lectures.	
<b>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</b>	<ul style="list-style-type: none"> <li>• Communication with students via e-mail.</li> <li>• Uploading course material on Moodle platform.</li> </ul>	
<b>TEACHING METHODS</b>	<b>Activity</b>	<b>Semester workload</b>
	Lectures	52
	Tutorial	26
	Independent Study	147
	Course total (25 per ECTS)	<b>225</b>
<b>COURSE COMMITMENTS</b>	Attending course and tutorial sessions is not obligatory.	
<b>STUDENT PERFORMANCE EVALUATION</b>	Student's evaluation is done in Greek through a written examination. For students with disabilities, evaluation takes place via oral exams.	

#### (5) ATTACHED BIBLIOGRAPHY

1. D. Halliday, R. Resnick, J. Walker, Physics Vol. 1, 8th Edition, Publisher: John Wiley & Sons, 2014.
2. R. Serway, J. Jewett, Physics for Scientists and Engineers with Modern physics, 8th Edition, Publisher: Brooks/Cole, 2013.
3. H. Young, R. Freedman, University Physics, 13th Edition, Publisher: Pearson, 1994.
4. M. Alonso, E. Finn, Fundamental University Physics, Vol. 1, Mechanics and Thermodynamics, Publisher: Addison-Wesley, 1998.
5. M. Spiegel, Theory and Problems of Theoretical Mechanics, Publisher: McGraw-Hill, 1985.
6. Electronic lecture notes and digital educational material prepared by the instructor are made available to students upon their enrollment in the course and through the Moodle asynchronous e-learning platform.