COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF MATHEMATICS		
LEVEL OF STUDIES	UNDERGRADUATE PROGRAM		
COURSE CODE		**SEMESTER**	**E**
COURSE TITLE	PHYSICS I		
INSTRUCTOR	Agapitos Hatzinikitas		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**CREDITS**
		6	9
COURSE TYPE	General background		
PREREQUISITE COURSES:	NO		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	http://www.math.aegean.gr/index.php/en/academics/undergraduate-programs		

(2) LEARNING OUTCOMES

Learning outcomes

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:

- Define the fundamental and derived quantities of Classical Mechanics.
- State and understand the principles of Classical Mechanics.
- Discover the limitations of physical laws in applications.
- Apply the physical laws to solve idealized problems and problems in real life as well.
- Analyze and interpret specific physical phenomena.
- Model and make predictions about the evolution of a physical phenomenon by solving an ordinary differential equation.
- Evaluate the limitations of the applied mathematical method.
- Propose alternative approaches and decide which method is more effective.
- Devise simple experiments to measure physical quantities.

General Competences

Production of free, creative and inductive thinking. Working independently. Team working. Working in an interdisciplinary environment. Production of new research ideas.

(3) SYLLABUS

1. Classification and evolution of the branches of Physics. Relation of Physics with Applied Sciences. The role of experiment in Physics. Mathematical Methods I: Functions of one variable, derivative, indefinite, definite integral and fundamental functions. Solving the second order, linear, non-homogeneous ordinary differential equations with constant coefficients.
2. Mathematical Methods II: Functions of several variables. Vectors in three-dimensional space. Addition, scalar multiplication, inner product, vector product and mixed product. Scalar and

vector fields. The gradient of a scalar field, the divergence and curl of vector fields.
3. Orthogonal coordinate systems (Cartesian, polar, cylindrical and spherical coordinate systems). Parametrization of curves. Velocity and acceleration. General motion on the plane.
4. 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.
5. Newton's laws. Conservation theorems for linear momentum, angular momentum and energy. Stability and potential energy curves.
6. Relative motion, velocity and acceleration. Galilean transformations. Lorentz's transformations and velocity.
7. Oscillations. The simple harmonic oscillator. Energy of the simple harmonic oscillator. The damped harmonic oscillator. The simple and physical pendulum.
8. Gravity. Kepler's laws. Gravitational potential energy. Planetary motion.
9. 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.
10. 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.
11. 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.

TEACHING MATERIAL DISTRIBUTION	The teaching material of the course is uniformly distributed during the semester.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	• Communication with students via e-mail. • Uploading course material on moodle system.
TEACHING METHODS	

Activity	***Semester workload***
Lectures	52
Tutorials	26
Independent study	147
Course total (25 per ECTS)	***225***

COURSE COMMITMENTS	• Attending course and tutorial sessions is not obligatory.
STUDENT PERFORMANCE EVALUATION	• Students evaluation is based on written exams. There are two schemes of evaluation: 1st method: final exam paper 2nd method: two interim-exam papers, one during the semester and the other at the end of the semester. • Students with learning disabilities or suffering from serious health problems can alternatively be evaluated through oral exams. • The language of evaluation is Greek. • The exam papers consist of short-answer questions and problem solving.

(5) ATTACHED BIBLIOGRAPHY

1. Halliday, D., Resnick, R., Walker, J., (2014). "Physics" Vol. 1, 8th Edition, Publisher: John Wiley & Sons.
2. Serway, R., Jewett, J, (2013). "Physics for Scientists and Engineers with Modern physics", 8th Edition, Publisher: Brooks/Cole.
3. Young, H., Freedman, R. (1994). "University Physics", 13th Edition, Publisher: Pearson.
4. Alonso, M., Finn, E., (1981). "Fundamental University Physics, Vol. 1, Mechanics and Thermodynamics", Publisher: Addison-Wesley.
5. Spiegel, M., (1985). "Theory and Problems of Theoretical Mechanics", Publisher: McGraw-Hill.

- *Related academic journals:*

1. http://aapt.scitation.org/journal/ajp