COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF FINANCIAL AND MANAGEMENT ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΓΕ01030	SEMESTER	1st
COURSE TITLE	PHYSICS I		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	WEEKLY TEACHING HOURS	CREDITS
Courses	3	
Physics I – Lab	3	
Courses plus Physics I – Lab	6	6
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background/ engineering background/specialized general knowledge/skills development
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	http://www.fme.aegean.gr/en/c/physics-i

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

The main objective of the Physics I course is to present to the undergraduate students with an easy and logical way the basic concepts and principles of physics and furthermore to assist them in order to deeply understand those principles as well, through a big variety of their applications in the modern life. To achieve the above-mentioned objectives, an emphasis in the analysis of the correct scientific way of thinking is primarily given, as well as in the methodology and the problem-solving techniques. Very important objective is also the challenge to cause the interest of the undergraduate students in physics, using as a reference, several examples, achievements and applications of physics which have highlight the role of physics in other scientific sectors like those of Medicine and technical sciences.

The main objective of the Physics I – Lab is to present to the undergraduate students with an easy and scientific way all the basic concepts and principles of physics and furthermore to assist them to deeply understand those principles as well, through the experiments. Very important objective is also the challenge to cause the interest of the undergraduate students in experimental physics and at the same time to help familiarize themselves with all the modern experimental techniques for electrical measurements as well as with the usage of complex scientific instruments in the Laboratory. Additionally, the preparation of a technical report or note is thoroughly analyzed and it is mandatory from the undergraduate students in every laboratory exercise in order to help them to develop all the required skills necessary in the science of the engineer.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
……
Others…
…….

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations , decision-making, working in an international environment,
Production of new research ideas
Respect for the natural environment, Criticism and self-criticism
Production of free, creative and inductive thinking

(3) SYLLABUS

The courses cover basic topics of Classical Physics. At the beginning a reference in the specific chapter of classical mechanics called kinematics is made. It includes the study of a mass or a solid object in one or two dimensions, projectile motion and the uniform circular motion. Following the specific chapter of the mechanics called dynamics is also covered and studied in depth. It includes the definition and the interpretation of the Newton's laws and inertial frames. The principle of energy conservation is studied thoroughly as well as the work-kinetic energy theorem. After that, the collisions theory in one or two dimensions is analyzed as well as the conservation law of the linear momentum and the rotational motion of a rigid object around a constant axis. Additionally, the gravitational law and the Fluid mechanics are studied in detail. Finally, the periodic movements and the simple harmonic motion through which we understand the mechanical wave's propagation are also studied thoroughly.

COURCES	OUTLINE AND LEARNING OBJECTIVES
1	➢ Standards of Length, Mass, and Time, Matter and Model Building, Density and Atomic Mass, Dimensional Analysis, Conversion of Units, Coordinate Systems, Vector and Scalar Quantities, Some Properties of Vectors, Components of a Vector and Unit Vectors. Coordinate Systems, Position, Velocity, and Speed, Instantaneous Velocity and Speed, Acceleration, Motion Diagrams, One-Dimensional Motion with Constant Acceleration, Freely Falling Objects, Kinematic Equations Derived from Calculus
2	➢ The Position, velocity, and acceleration Vectors. Two -Dimensional Motion with Constant Acceleration. Projectile Motion. Relative Velocity and Relative Acceleration
3	➢ Relative motion. Lorenz transformations. Uniform Circular Motion. Tangential and Radial Acceleration

4	➢ The concept of force. Newton's first law and inertial frames. Newton's second law. The gravitational force and weight. Motion in accelerated frames.
5	➢ Applications on the Newton's second law to uniform circular motion. Newton's third law. Applications on Newton's laws. Forces of friction.
6	➢ Systems and Environments. Work done by a constant and a varying force. Kinetic energy and the work- kinetic energy theorem. Potential energy of a system. The non isolated system. Conservation of energy.
7	➢ Kinetic energy and the work-kinetic energy theorem. Conservative and non conservative forces. Changes in mechanical energy for non conservative forces. Relationship between conservative forces and potential energy.
8	➢ Linear momentum and its conservation. Impulse and momentum. Collisions in one dimension. Two-dimensional collisions.
9	➢ Angular position, velocity and acceleration. Rotational kinematics: Rotational motion with constant acceleration. Angular and linear quantities. Rotational kinetic energy. Calculation of moments of inertia.
10	➢ The vector product and torque. Angular momentum. Angular momentum of a rotating rigid object. Conservation of angular momentum. The motion of gyroscopes and tops. Angular momentum as a fundamental quantity.
11	➢ Torque. Relationship between torque and angular acceleration. Work, power and energy in rotational motion. Rolling motion of a rigid object. The center of mass. Motion of a system of particles. Rocket propulsion.
12	➢ Motion of an object attached to a spring. Mathematical representation of simple harmonic motion. Energy of the simple harmonic oscillator. Simple harmonic oscillator and uniform circular motion. The pendulum. Damped and forced oscillations
13	➢ Fluid mechanics. Variation of pressure with depth. Buoyant forces and Archimedes's principle. Bernoulli's equation.

The Physics I – Lab covers all the basic topics of Classical and Modern Physics in the field of the mechanics. More specifically the following topics are analyzed and studied thoroughly: Experimental data taking techniques. Statistical analysis of experimental data and errors. Length measurements with the use of a caliper. Study of Freely Falling objects. Measurement of the viscosity of the liquids. Measurement of the gravitational acceleration with the help of the mathematical and physical pendulum. Study of the simple harmonic oscillation. Calculation of the spring constant. Newton's Laws. Energy and Momentum conservation. The vector product and torque. Angular momentum conservation. Torsional oscillation.

More detailed the order of the Physics I – Lab training exercises are as in the following:

- Statistical analysis of experimental data
- Length measurements with the use of a calliper
- Study of Freely Falling objects

- Measurement of the viscosity of the liquids
- Measurement of the gravitational acceleration with the help of the mathematical and physical pendulum, Study of the simple harmonic oscillation.
- Calculation of the spring constant
- Experimental verification of Newton's Laws. Momentum conservation. Mechanical energy conservation.
- The vector product and torque. Angular momentum conservation. Torsional oscillation

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face-to-face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>Use of ICT in teaching</td></tr>
<tr><td>TEACHING METHODS
The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Laboratory training exercises</td><td>39</td></tr>
<tr><td>Study of bibliography</td><td>90</td></tr>
<tr><td>Seminars</td><td>20</td></tr>
<tr><td>Examinations</td><td>3</td></tr>
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<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>191</td></tr>
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</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td><td>For the PHYSICS I course: Final examination in writing at the end of the semester in Greek, which include questions (development), knowledge and understanding of the content of the course, and problem solving. The score of the final examinations in writing, counts 70% of the total score for the PHYSICS I course.

For the Physics I –Lab : The total number of the Labs training exercises is 6. One absent is allowed. Although the relative training exercise has to be done. The evaluation process of the students includes :

• Oral examination in each Lab
• Technical report
• Final oral examination

The final score in the Physics I – Lab is the outcome of the mean value of the score in the final oral examination (50%) and the score regarding the technical reports evaluation (50%).

The final score in the Physics I – Lab counts 30% of the total score for the PHYSICS I course.</td></tr>
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(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

The Physics I courses are based on the books of:

- ***R. Serway/Jewett, "Physics for scientists and Engineers,"***
- ***Hugh D. Young, "University Physics, Volume 1, Mechanism and Thermodynamics"***

Other useful books:

- ***Halliday and Resnick, "Physics, Vol. 1"***

For the Physics I – Lab :

- **«Laboratory Training Exercises », K. Papageorgiou, I. Gialas, K. Theodosiou, University of the Aegean, Department of Financial and Management Engineering, 2006**
- **Instructors notes**

- Related academic journals:

Physics Letters
Physical Review Letters
European Physical Journal (EPJ)
Journal of High Energy Physics (JHEP)
Nuclear Physics A
Nuclear Instruments and Methods in Physics
Journal of Instrumentation (**JINST**)