COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Science		
ACADEMIC UNIT	Physics		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**10YKO31**	**SEMESTER**	**3**
COURSE TITLE	**Theoretical Mechanics 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**
Lectures (theory and exercises)	5	7

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special Background
PREREQUISITE COURSES:	No (recommended: Basic Mathematical Methods, Physics I, Analysis I and Applications, Analysis II and Applications, Ordinary Differential Equations and Linear Algebra)
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.uoa.gr/courses/PHYS340/

(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*

This course aims to present to the students the basic principles of Classical Mechanics and how problems of particle dynamics can be studied using Newton's laws and the integrals that arise from them.

At the end of the course, the students will be able to:

- Choose ways to describe the motion of particles in various coordinate systems.
- Write the equations of motion.
- Solve these differential equations and determine the motion as a function of time.
- Analyze, evaluate and describe qualitatively the results.
- Apply the above to a number of problems such as those listed in the syllabus.
- Be able to use the Lagrangian formulation to describe mechanical systems.
- Know the characteristics of Newtonian gravity.

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…
…….

The course aims at the following general competences

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Decision-making
Working independently
Analytical and synthetic thinking
Critical thinking
Time management
Creativity
Meeting Deadlines and Keeping Schedules
Problem solving

(3) SYLLABUS

- Kinematics of a point object. Inertial systems, Newton's laws.
- Conservation laws, conservative forces, integrals of motion.
- Systems with one degree of freedom: Motion boundaries, study of equilibrium points with perturbation methods and phase diagrams, harmonic oscillator.
- Impulsive forces, collisions, moving coordinate systems: Motion in a non-inertial system and applications.
- Central forces: Integrals of motion, circular orbits and their stability, inverse square forces, Kepler’s laws.
- The two-body problem. Gravitational field, gravitation from extended bodies, tidal forces.
- Lagrangian and Hamiltonian formulation. Dynamics of the rigid body.

(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>Yes

Electronic communication with the students using ICT (Information and Communications Technology)
eclass platform where sets of problems are posted and solutions from students are uploaded</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>52</td></tr>
<tr><td>Exercises</td><td>13</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Individual Study/ Study and Analysis of bibliography / Preparation</td><td>78</td></tr>
<tr><td>Laboratory practice</td><td></td></tr>
<tr><td>Writing reports/ essays</td><td>26</td></tr>
<tr><td>Midterm exam</td><td>3</td></tr>
<tr><td>Exams</td><td>3</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course Total</td><td>175</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>Final written exams in Greek
Homeworks wih problems to solve
Mid-term written examination</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography (given through the EYDOXUS platform):

- Βιβλίο [Κωδ. Ευδ. 102072910]: Σύγχρονη Θεωρητική Μηχανική, Τσίγκανος Κανάρης
- Βιβλίο [22695091]: ΚΛΑΣΙΚΗ ΜΗΧΑΝΙΚΗ, KIBBLE, T.W.B. & BERKSHIRE, F.H.
- Βιβλίο [8787]: ΘΕΩΡΗΤΙΚΗ ΜΗΧΑΝΙΚΗ ΤΟΜΟΣ Α' , ΧΑΤΖΗΔΗΜΗΤΡΙΟΥ ΙΩΑΝΝΗΣ

- Other:

- The Feynman lectures on Physics, Volume 1, Feynman, Leighton, Sands, Addison-Wesley pub.co.
- Classical Dynamics of Particles and Systems, Thornton & Marion, Brooks Cole, 5th edition
- Ιωάννου, Π., Αποστολάτος, Θ., 2016. Νευτώνεια Μηχανική. [ηλεκτρ. βιβλ.] Αθήνα: Σύνδεσμος Ελληνικών Ακαδημαϊκών Βιβλιοθηκών. Διαθέσιμο στο: http://hdl.handle.net/11419/6479