COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Science		
ACADEMIC UNIT	Physics		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**10EKO01**	**SEMESTER**	**4**
COURSE TITLE	**THEORETICAL MECHANICS II (Analytical Mechanics)**		

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 (suggested: Basic Mathematical Methods, Mechanics I, Analysis I & Applications, Analysis II)
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	url of eclass https://eclass.uoa.gr/courses/PHYS288/

(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*

In this course the student acquires the necessary knowledge for the understanding of the least action principle, and the physical context of Lagrangian and Hamiltonian formulation.

With the completion of the course the student is able to

- Describe various mechanical systems in Lagrangian and Hamiltonian formulation.
- Recognize the symmetries and the corresponding conserved quantities in a mechanical system.
- Explain the physical context of the least action principle.
- Calculate the normal modes and eigenfrequencies of a system near equilibrium.
- Be able to explain the conserved quantities as a consequence of symmetries.
- Be able to combine the Lagrangian description in order to analyze various mechanical systems.
- Be able to compute the Hamiltonian of a system. Understands the flow in phase space. Be able to perform canonical transformations to solve a problem. Know how to use the Poisson brackets.

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

Production of new research ideas
Production of free, creative and inductive thinking
Analytical and synthetic thinking
Critical thinking
Problem solving

(3) SYLLABUS

- The principle of least action.
- Calculus of variations, Euler-Lagrange equations, Lagrangian of a charged particle in an electromagnetic field.
- Symmetries and Noether theorem, Lagrange multipliers and constraints.
- Normal modes of an oscillating system.
- Legendre transformation, Hamilton's equations, phase space flow, Poisson brackets.
- Symmetries and conserved quantities in Hamiltonian mechanics, canonical transformations.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face-to-face

Parallel live distance learning and recording.</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 eclass platform</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>
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<tr><td></td><td></td></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Exercises</td><td>26</td></tr>
<tr><td>Individual Study/ Study and Analysis of bibliography / Preparation</td><td>110</td></tr>
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<tr><td>Course Total</td><td>175</td></tr>
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<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

Problems for students to solve at home (optional). The problems are uploaded in eclass.</td></tr>
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(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. Theoretical Mechanics (P. Ioannou, T. Apostolatos) in Greek [Κωδ. Ευδ. 68401837]
2. Theoretical Mechanics, Vol. 2 (J. Hatzidimitriou) in greek [Κωδ. Ευδ. 8797]
3. Classical Mechanics (Kibble T.W.B., Berkshire F.H.) transl. in greek Εκδ. ΙΔΡΥΜΑ ΤΕΧΝΟΛΟΓΙΑΣ & ΕΡΕΥΝΑΣ-ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ [Κωδ. Ευδ. 22695091]

- Related academic journals:

Physical Review Letters (selected articles)