COURSE OUTLINE

(1) GENERAL

SCHOOL	NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF PHYSICS		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**43**	**SEMESTER**	**4**
COURSE TITLE	CLASSICAL MECHANICS II		

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**
	4	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*	Special background
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/enrol/index.php?id=388

(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*

After the successful completion of the course, the student should be able to:

1) Recall the basic principles and techniques of two additional methods, the Lagrange and the Hamilton formalism, that may describe a classical (non-quantum) system beyond the Newtonian approach.
2) Judge correctly the known parameters of the physical problem and choose one of the two aforementioned formalisms.
3) Solve realistic physical problems that involve motions and rotations of rigid bodies and spinning tops.
4) Apply the Lagrange and Hamilton formalism to solve problems that are difficult to solve with the usual Newton's equations.
5) Reproduce the conservation laws that follow from the symmetries of the physical systems according to the Noether theorem.
6) Apply the notion of the phase space and the Liouville theorem to solve many-body problems.
7) Apply the principle of stationary action (Hamilton's principle) to solve difficult

physical problems, and be able to convert it in order to study quantum systems.

8) Combine physical quantities and laws in a single framework in order to solve advanced problems (velocity of system of particles or bodies after an impulse, collisions of particles with rotations etc.)

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

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Decision-making
Working independently
Criticism and self-criticism
Production of free, creative and inductive thinking

(3) SYLLABUS

Lagrange Formalism: Euler-Lagrange equations, conservation laws, symmetries and Noether theorem, calculus of variations.
Study of Angular Momentum for constant or general direction: torque of a force, collisions with rotations, angular impulse, tensor of inertia, principal axes, Euler equations, symmetric spinning top.
Hamilton Formalism: Hamilton equations, Poisson brackets, conservation laws, phase space and Liouville theorem. Canonical Transformations.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of the distance-learning system Moodle to post notes, problem sheets and to communicate with the students
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-*	see table below

Activity	*Semester workload*
Lectures	39
Problem Solving	13
Study of Bibliography	70
Independent Study	25
Exams	3

directed study according to the principles of the ECTS		
	Course total	***150***

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.*	Mid-semester written exams (2 hours) and end-of-semester written exams (3 hours) on problem solving and the comprehension of the material taught in the course.

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1) David Morin, Introduction to Classical Mechanics, Cambridge University Press, 2008.

2) T.W.B Kibble and F. H. Berkshire, Classical Mechanics, 5th Edition, 2004 [translated in Greek in 2012 by the Publications of the University of Crete]

- Related bibliography:

3) John Taylor, Classical Mechanics, University Science Books (2005).

4) S. T. Thornton and J. B. Marion, Classical Dynamics of Particles and Systems, Brooks/Cole, 5th edition, 2003.

5) H. Goldstein, C. P. Poole and J.L. Safko, Classical Mechanics, 3rd Edition, 2001 (Advanced/Post-graduate level).

6) L. D. Landau and E.M. Lifshitz, Mechanics, Third Edition, Vol.1, 1976 (Advanced/Post-graduate level).

7) E.S. Triantafyllopoulos, Classical Mechanics, Symeon Publications.

8) K. Tsigganos, Introduction to Theoretical Mechanics, Stamoulis Publications, 2004.

9) Murray R. Spiegel, Theoretical Mechanics, McGraw Hill New York, ESPI Athens.