COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF FINANCIAL AND MANAGEMENT ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΓΕ0147	SEMESTER	4th
COURSE TITLE	Dynamics-Kinematics		

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
	3	4,5
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, special background, specialized general knowledge
PREREQUISITE COURSES:	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	http://www.fme.aegean.gr/en/c/dynamics-and-kinematics

(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 this course is to introduce the undergraduate student with completeness and with the easiest way into the basic principles of the classical kinematics and dynamics as well as into these of special relativity, the understanding of which will allow him/her not only to easily deal with problems in practical applications, but also to further deepening in more complex topics of mechanics. Very important objective is also the challenge to cause the interest of the undergraduate students by solving a lot of examples and problems in order not only to highlight the strength of the new Models and techniques used in modern physics for the description of complex systems but also to be able to

apply the mathematic formalism in several complex problems and physics applications which are associated with the specialty of an 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	*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
Adapting to new situations
Decision making
Production of new research ideas
Criticism and self-criticism
Production of free, creative and inductive thinking

(3) SYLLABUS

The courses cover all the basic physics topics of the classical kinematics and dynamics and includes: Kinematics of a point-like body and that of a solid body. Dynamics of a point-like body and that of a solid body. D' Alembert – Lagrange principle. Collisions. Introduction to the Analytical Mechanics. . Lagrange equations. Principle of least action. Calculus of variations. Hamilton equation. Oscillations. Special relativity concepts. Lorentz transformations.

Module Contents (Syllabus):

1	➢ Kinematics of a point like body. Displacements and motion. Velocity and acceleration. Methods for determination of a point like object motion. Curvilinear and plane motion.
2	➢ Harmonic oscillation. Mathematical pendulum. Central motion.
3	➢ Solid object kinematics. Rotational kinematics. Rotation of a body around a fixed axis.
4	➢ Rotation of a solid body around a point. Euler angles and equations. Planar motion of a solid object. Kinematical constrains. Velocity projection theorem. Absolute and relative motion. Coriolis theorem.
5	➢ Dynamics of a point like body. Angular momentum and acceleration definition. Work – kinetic energy theorem. Angular momentum and angular momentum theorem
6	➢ Conservative systems. Static torque. Energy conservation. D' Alembert principle. Relative motion. Euler equations.

7	➢ Dynamics of a solid body. Impulse. Center of mass. Torque of inertia. Parallel axes theorem. Inertia ellipsoid. Kinetic energy. Euler dynamical equations
8	➢ D' Alembert – Lagrange principle. Possible displacements. Motion degrees of freedom. Unilateral and bilateral constrains. General equation of dynamics.
9	➢ Collision. General theorems of collision. Momentum and impulse. Conservation of momentum. Collisions and kinetic energy. Elastic and inelastic collisions. Friction. Collision coefficient. Central collisions. Head-on and off-center collisions.
10	➢ Introduction to Analytical Dynamics. Generalized coordinates. Lagrange equations.
11	➢ Principle of least action. Calculus of variations. Hamilton equation.
12	➢ Small oscillations. Free and forced oscillation. Systems and oscillations of systems with two or more degrees of freedom. Lagrange equations.
13	➢ Special Relativity. Introductory concepts. The covariant of the laws of motion. Principle of special relativity. Lorentz transformations. Minkowski time and space. Time dilation.

(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 ICT in teaching and laboratory education
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*	

Activity	*Semester workload*
Lectures	39
Tutorial	13
Study and analysis of bibliography	90
Examinations	3
Course total	145

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.*	One final examination (100% of the total score) at the end of the semester in Greek. In the examination are included questions and topics development, in order to check the degree of knowledge and understanding of the content of the course, and problem solving.

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

The courses are based on the books of:

- *"Theoretical Mechanics "*, ***G. Karachalios and V. Loukopoulos***
- *"Technical Mechanics II - Dynamics)"*, ***S.A. Paipetis***

Additional references:

- *"Theoretical Mechanics (Kinematics and dynamics of a point like and a solid body)"*, ***Panagiotounakos and Papadopoulos (National Technical University of Athens)***
- *"Technical Mechanics (Kinematics and dynamics of a point like and a solid body)"*, ***S. Timoshenko***

- Related academic journals:

International Journal of Theoretical and Applied Mechanics (IJTAM)
Theoretical and Applied Mechanics Letters
Journal of Applied Mechanics (ASME)