3.3 CE0330 – Rigid Body Dynamics

(1) GENERAL

SCHOOL	ENGINEERING SCHOOL		
ACADEMIC UNIT	CIVIL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**CE0330**	**SEMESTER**	**3**
COURSE TITLE	**Rigid Body Dynamics**		

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	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*	Special Background Course
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	
COURSE WEBSITE (URL)	https://eclass.uniwa.gr/courses/CIV246/

(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 aim of the course is to give the students fundamental knowledge on the concepts of Dynamics of Rigid Bodies.

Upon completion of the course, students will have:

3. Knowledge and understanding of the basic concepts of dynamics of particles and rigid bodies.
4. Solve problems using various principles in various coordinate systems.

Specifically, students will be able to:

1. Have adequate comprehension skills of particle kinematics and the necessary mathematical tools for analysis.
2. Understand the differences between various coordinate systems (Cartesian, polar, cylindrical, intrinsic).
3. Use Newton's second law in various coordinate systems.
4. Solve problems involving pulleys and non-extensible cables.

5. Have a basic understanding of planetary mechanics (Newton's law of gravity, Kepler's laws of planetary movement, central forces, conservation of angular momentum).
6. Use energy and momentum methods to solve problems.
7. Understand the difference between conservative and non-conservative forces.
8. Use impulse and momentum methods to solve problems.
9. Solve problem of elastic and inelastic impacts.
10. Understand the principles of the kinematics of rigid bodies (translation, rotation, plane/space motion, relative velocity, instantaneous center of rotation).
11. Understand the basic principles of the kinetics of rigid bodies.
12. Manage time in an appropriate manner.

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…*

Specifically, students will be able to perform:

- Search, analysis and synthesis of data and information, using the necessary technologies.
- Decision Making.
- Autonomous work.

(3) SYLLABUS

1. Kinematics of particles (rectilinear motion, plane motion, curvilinear motion, vector functions and their derivatives, position vector, velocity vector, acceleration vector, relative motion).
2. Coordinate systems (Cartesian, polar, cylindrical, intrinsic).
3. Pulleys and non-extensible cables.
4. Kinetics of particles: Newton's second law.
5. Angular momentum and central forces.
6. Newton's law of gravity. Kepler's laws of planetary movement.
7. Kinetics of particles: Energy and momentum methods (work of a force, work and energy principle, potential energy).
8. Conservative forces. Friction.
9. Principle of conservation of energy.
10. Principle of impulse and momentum.
11. Impacts.
12. Kinematics of rigid bodies (translation, fixed axis rotation, general plane motion, general space motion, instantaneous center of rotation).
13. Kinetics of rigid bodies (plane motion equations, moments and products of inertia, translation, rotation, general plane motion, general space motion, D' Alembert forces).

(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*	Teaching using ICT, Communication and Electronic Submission.
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*	
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.*	Language of evaluation: Greek Final written examination: 100%

Activity	***Semester workload***
Lectures	52
Classwork	18
Preparation for Project	55
Personal Study	
Course total	**125**

(5) ATTACHED BIBLIOGRAPHY

Foreign Bibliography:

2. Beer F., Johnston E.R. Jr, Cornwell P. J., Self B. P. (2015) Dynamics, 11th edition, McGraw Hill.
3. Meriam J.L., Kraige L.G., Bolton J.N. (2015) Engineering Mechanics: Dynamics, 8th edition, Wiley.
4. Hibbeler R.C. (2016) Engineering Mechanics: Dynamics in SI Units, 14th edition, Pearson.