COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering		
ACADEMIC UNIT	Mechanical Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	MM826	**SEMESTER**	8th
COURSE TITLE	Computational Dynamics of Engineering Systems		

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	5	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, specialized general knowledge, skills development*	General background
PREREQUISITE COURSES:	N/A
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	http://www.mie.uth.gr/n_one_mathima.asp?id=57&cat=1&tp=EK2

(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 aims is to present the analytical and computational methodologies applied to the analysis of the dynamics of complex mechanical systems and mechanisms, the prediction of dynamic and oscillatory behavior, and the experimental identification of important features such as modal characteristics.

Upon successful completion of this course, the student will be able to:

- Develop models of complex mechanical systems consisting of one or more interrelated deformable members
- Formulate the governing equations of motion of complex mechanical systems using methods such as the principle of virtual work and the Lagrange equations
- Apply computational methods to solve the equations of motion
- Develop and use software to solve the equations of motion
- Predict the dynamic and oscillatory behavior of systems based on model analysis
- Understand the principles of reducing the degrees of freedom of models of complex mechanical systems
- Be able to experimentally estimate the modal characteristics of mechanical systems and to understand the basic principles of experimental estimation of mechanical properties
- Understand the key dynamic characteristics that influence the dynamics of mechanical systems
- Become familiar with useful mechanical engineering applications

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…*
	…….

- Retrieving, analyzing and synthesizing data and information, with the use of necessary technologies
- Autonomous work
- Decision making
- Exercising judgment and self-evaluation
- Promotion of free, innovative and inductive thinking

(3) SYLLABUS

Analytical dynamics: Principle of virtual work. Lagrange equations, Hamilton principle, equilibrium, stability – Discrete linear systems with symmetric and asymmetric matrices, modal analysis – Numerical methods for solving eigenvalue problems (iterative, Jacobi, Rayleigh-Ritz, subspace iteration) – Numerical methods for solving the equations of motion (central difference, Newmark method), stability of numerical schemes – Approximate methods of analysis of continuum medium (Galerkin, finite element method) – Model reduction techniques – Introduction to mulit-body dynamics – Experimental estimation of modal characteristics using vibration measurements (theory and applications) – Applications to machine dynamics, dynamics of complex mechanical systems (mechanical, aerospace, naval, civil, wind turbines)

(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 class web page

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	70
Homework	35
Autonomous work	45
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.*	I. Written final exams (70%) II. Homework (30%)

(5) ATTACHED BIBLIOGRAPHY

-Suggested bibliography:

- Νατσιάβας Σ. ,Ταλαντώσεις Μηχανικών Συστημάτων, Εκδόσεις Ζήτη 2016.
- Νατσιάβας Σ. , Εφαρμοσμένη Δυναμική, Εκδόσεις Ζήτη, 2017.
- Meierovitch L., Computational Methods in Structural Dynamics, Sijthoff and Noordhoff, The Nederlands, 1988.
- Shabana A., Dynamics of Multi-Body Systems, University Press, Cambridge 1998.
- Craig, Jr., R.R., Strucutral Dynamics: An Introduction to Computer Methods, John Wiley and Sons, 1981.
- Saad, Y., Iterative Methods for Sparse Linear Systems, 2nd Edition, SIAM, 2003.
- Pintelon, R., Schoukens, J., System Identification: A Frequency domain Approach, IEEE Press, 2001.
- Ewins, D.J., Modal Testing: Theory, Practice and Application, Research Studies Press LTD, 2000.