

COURSE OUTLINE

(1) OVERVIEW

SCHOOL	MARITIME & INDUSTRY		
DEPARTMENT	INDUSTRIAL MANAGEMENT & TECHNOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	TEMBE01	SEMESTER	7
COURSE TITLE	INTRODUCTION TO SYSTEMS' MODELLING, SIMULATION & OPTIMIZATION		
DISCRETE TEACHING ACTIVITIES <i>In cases where ECTS credits are awarded to distinct components of the course (e.g., Lectures, Laboratory Exercises, etc.), please indicate them separately. If the credits are awarded as a whole for the entire course, please state the weekly teaching hours and the total number of credits</i>		WEEKLY TEACHING HOURS	ECTS
Lectures, Laboratory, Project		4+2	5.5
<i>Please add additional rows if needed. A detailed description of the teaching organization and instructional methods is provided in Section (4).</i>			
COURSE TYPE <i>core (C), core elective (CE), elective (E) - background, specialization, skill development</i>	E - Specialization		
PREREQUISITE COURSES:	None.		
LANGUAGE OF TEACHING AND EXAMINATIONS:	Greek (English for ERASMUS students)		
THIS COURSE IS AVAILABLE TO ERASMUS STUDENTS	Yes		
COURSE WEBPAGE (URL)			

(2) LEARNING OUTCOMES

Learning Outcomes <i>The learning outcomes of the course are described, specifying the particular knowledge, skills, and competencies at the appropriate level that students will acquire upon successful completion of the course.</i> <i>Please refer to Appendix A</i> • Description of the Level of Learning Outcomes for each study cycle according to the Qualifications Framework of the European Higher Education Area. • Descriptive Indicators of Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B. • Concise Guide for Writing Learning Outcomes
The course aims to introduce students to methods of modeling, simulation, and optimization of physical systems and processes. Students will develop skills in formulating mathematically equivalent systems across various fields such as engineering, energy, and economics. Through simple applications, the course focuses on understanding the basic concepts and properties of modeling and simulation methods (e.g., analytical models, numerical models, statistical models, etc.). In addition, students will gain hands-on experience in performing simulations and analyzing their results. To achieve these objectives, the course includes laboratory sessions where students will develop, parameterize, and run simulations, as well as present the conclusions derived from them. Finally, the course emphasizes student collaboration by assigning group projects aimed at solving real-world problems using modeling techniques, and it also fosters public speaking skills by giving each student the opportunity to present modeling results in front of their peers. Upon successful completion of the course, students will be able to: • Understand fundamental concepts and methods of modeling, simulation, and optimization of physical and technological systems. • Develop simple mathematical models (analytical, numerical, or statistical) for applications in engineering, energy, and economics. • Use software tools for building models, running simulations, and analyzing their results. • Collaborate in teams to solve real-world problems using modeling and simulation techniques. • Present their work results clearly and with proper justification, developing public speaking and technical communication skills.
General Competences

Taking into account the general competences that a graduate should have acquired (as listed in the Diploma Supplement and outlined below), which of these competences does the course aim to develop?

Searching, analyzing, and synthesizing data and information, using the necessary technologies
Adaptation to new situations
Decision making
Autonomous work
Teamwork
Working in an international environment
Working in an interdisciplinary environment
Generation of new research ideas

Project design and management
Respect for diversity and multiculturalism
Respect for the natural environment
Demonstration of social, professional, and ethical responsibility and sensitivity to gender issues
Exercising critical and self-critical thinking
Promotion of free, creative, and inductive thinking
...
Other competences: ...

- Searching, analyzing, and synthesizing data and information, using the necessary technologies
- Adaptation to new situations
- Decision making
- Autonomous work
- Generation of new research ideas
- Project design and management
- Demonstration of social, professional, and ethical responsibility and sensitivity to gender issues
- Exercising critical and self-critical thinking
- Promotion of free, creative, and inductive thinking

(3) COURSE CONTENT

The course covers the following topics:

- Introduction to systems (definition of a system, types of systems, relationships between system elements, system boundaries and interactions with the environment, system visualization).
- Simulation and optimization (definitions, applications, connection between the two methods, examples from everyday systems).
- Methods for generating mathematically equivalent physical systems.
- Analytical, numerical, statistical, and dynamic models – their properties and fields of application.
- Variables, parameters, and basic operations (arithmetic, relational, and logical operators).
- Simulation software tools.
- Model applications in the energy sector.
- Hands-on laboratory sessions and group projects.
- Case studies.

The course adopts a multidimensional combination of teaching and learning methods aimed at deep understanding and active student engagement. Lectures will incorporate the use of modern audiovisual tools to support the comprehension of complex concepts and foster interaction within the classroom. The analysis and discussion of scientific applications will give students the opportunity to develop scientific and analytical thinking. Simultaneously, hands-on laboratory sessions—conducted in the Laboratory of Production Management Information Systems—and group projects will provide a practical environment in which students apply their knowledge, collaborate on problem-solving, and develop models.

The eClass platform will serve as a dynamic learning resource. It will host lecture material, spreadsheets, reading lists, and other supporting content. Students will also have access to case studies and exercises that allow them to further practice and deepen their understanding of the concepts taught.

(4) TEACHING and LEARNING METHODS - ASSESSMENT

TEACHING MODE <i>Face-to-face, in-class lecturing, distance teaching and distance learning etc.</i>	• Face-to-face in a classroom or the Lab • Distance teaching & learning (if required)		
USE OF INFORMATION AND COMMUNICATION TECHNOLOGY <i>Use of ICT in Teaching, Laboratory Education, Communication with students</i>	Teaching: Lectures using modern audiovisual equipment, learning support through the eClass electronic platform, synchronous distance teaching via MS Teams. Laboratory training: Use of open-access software and specialized software. Communication with students: face-to-face during office hours, email, eClass platform, MS Teams tools		
Organization of Teaching		Activity	Semester Workload

A detailed description of the teaching methods and approach is provided. Lectures, seminars, laboratory exercises, fieldwork, study and analysis of literature, tutorials, internships (placements), clinical practice, artistic workshops, interactive teaching, educational visits, project work, writing assignments, artistic creation, etc. The student's study hours for each learning activity, as well as the hours of independent study, are specified in accordance with the principles of ECTS	Lectures	52
	Laboratory	26
	Project	30
	Self-study of lecture material and exercises	26
	Project presentation	1
	Consultation Support	0.5
	Exams (written)	2
	Course Total	137.5
STUDENT ASSESSMENT <i>Description of the assessment process</i> Language of assessment, assessment methods, formative or summative evaluation, multiple-choice tests, short-answer questions, essay questions, problem-solving, written assignments, reports, oral examinations, public presentations, laboratory work, clinical patient examination, artistic interpretation, other(s) Explicitly state assessment criteria and information on whether and where these criteria are accessible to students are included.		
Language of Assessment: Greek (English for ERASMUS students) Assessment Mode: Face-to-face and/or distance learning (if required) Assessment Methods: The final course grade is formed as follows: • 50% from the project • 50% from the written exams taken in the examination period of the winter semester and, in case of failure, in the September resits A minimum score of 40% in the final exam and 40% in the completion and presentation of assignments is required in order to achieve a passing grade in the course. The written exam includes problem-solving and short-answer questions. It is conducted closed-book. Students with Learning Difficulties: Students with certified learning difficulties in reading and writing (as recognized by the competent authority) are assessed according to the procedures established by the Department. Disclosure of Assessment Criteria: The assessment criteria are communicated during the first class and are clearly stated on the course website and the eClass platform. The exam syllabus is announced on eClass following the final lecture of the semester. The exam answers are posted on eClass after the examinations take place. Students have the right to review their graded exams and receive explanations regarding their grades. In cases of further requests, the procedures outlined in the current Study Regulations apply.		

(5) SUGGESTED BIBLIOGRAPHY

- Books: • Roumeliotis, M., Souravlas, S. (2015). Simulation Techniques, Tziolas Publications, ISBN: 9789604184804 [41958885] – in Greek • Kouikoglou, V., Konstantas, D. (2016). Discrete Event Systems Simulation, Disigma Publications, ISBN: 9789609495837 [77112270] – in Greek • Sfakianakis, M. (2020). Simulation and Applications, Broken Hill Publishers, ISBN: 9789925576593 [94643855] – in Greek - Journals: • Journal of Optimization Theory and Applications • Mathematical and Computer Modelling of Dynamical Systems • Simulation Modelling Practice and Theory - Other educational material: • Lecture Notes and Supporting Material provided by the Instructor • Laboratory Workbook
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