COURSE OUTLINE

(1) OVERVIEW

SCHOOL	MARITIME & INDUSTRY		
DEPARTMENT	INDUSTRIAL MANAGEMENT & TECHNOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΤΕΠΑΡ25-2	**SEMESTER**	5
COURSE TITLE	SIMULATION & OPTIMIZATION OF INDUSTRIAL PROCESSES		

DISCRETE TEACHING ACTIVITIES *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*	**WEEKLY TEACHING HOURS**	**ECTS**
Lectures & Project	4	5.5
Please add additional rows if needed. A detailed description of the teaching organization and instructional methods is provided in Section (4).		

COURSE TYPE *core (C), core elective (CE), elective (E) - background, specialization, skill development*	CE - 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

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.

Please refer to Appendix A

- *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 centers on an analytical and systematic deepening of the operation of complex production systems, aiming to enhance students' ability to analyze, simulate, evaluate, and optimize industrial processes using techno-economic and environmental criteria. Specifically, students will become familiar with:

- Analyzing and synthesizing dynamic and complex industrial systems
- Using computational tools, mathematical models, and commercial simulation software to simulate complex industrial systems under variable operating conditions
- Determining the optimal capacity and performance of industrial units
- Evaluating scale-up scenarios from laboratory to pilot and subsequently to industrial scale
- Investigating combined technologies and subsystems (e.g., material and energy recycling, substitution of raw materials and energy resources)
- Defining the relationship between process conditions and the quality of intermediate or final products
- Integrating green technologies and energy-saving technologies
- Understanding the functional interconnection between processes, energy, and the environment through case studies
- Incorporating computational applications using digital simulation and decision-support tools related to industrial processes

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

- Apply computational tools to industrial process systems to optimize product quality and resource efficiency.

- Select, configure, and use specialized simulation software for the analysis and optimization of production units.
- Design and assess alternative scenarios for green management of material and energy resources, within the framework of zero-waste circular economy principles.
- Identify and propose improvements in specific processes of industrial production systems, based on technical and economic criteria.
- Approach industrial production as a dynamic system subject to energy, environmental, economic, and quality constraints.

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	*Project design and management*
Adaptation to new situations	*Respect for diversity and multiculturalism*
Decision making	*Respect for the natural environment*
Autonomous work	*Demonstration of social, professional, and ethical responsibility and sensitivity to gender issues*
Teamwork	*Exercising critical and self-critical thinking*
Working in an international environment	*Promotion of free, creative, and inductive thinking*
Working in an interdisciplinary environment	*…*
Generation of new research ideas	*Other competences: …*

- Searching, analyzing, and synthesizing data and information, using the necessary technologies
- Adaptation to new situations
- Autonomous work
- Project design and management
- 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

(3) COURSE CONTENT

The course covers the following units:

- Dimensional analysis. Scale-up. Energy conservation equations. Flow analysis in pipelines. Dimensionless groups. Pipeline flow exercises.
- Operating principles and characteristics of pumps. Pump exercises.
- Mass transfer and heat transfer. Heat exchangers. Exercises on heat exchangers.
- Simulation and optimization of industrial product manufacturing systems.
- Analysis of physical systems based on energy and techno-economic criteria.
- Mass and energy conservation equations. Basic physical processes (Unit Operations). Distillation. Exercises.
- Extraction, filtration, evaporation, and drying. Exercises.
- Condensation, sedimentation, and crystallization. Exercises.
- Adsorption and absorption. Size reduction and mechanical separation of particles. Exercises.
- Commercial software for simulation and optimization of industrial processes.
- Integration of individual industrial processes into complete production systems.
- Material balances under steady-state conditions in single processes and integrated industrial systems.
- Review Topics

The course includes lectures, case studies, and a project. Furthermore, articles, audiovisual lecture material, web links to useful resources, exercises, and software are uploaded in electronic format on the eClass platform.

(4) TEACHING and LEARNING METHODS - ASSESSMENT

TEACHING MODE *Face-to-face, in-class lecturing, distance teaching and distance learning etc.*	• Face-to-face in a classroom • Distance teaching & learning (if required)

USE OF INFORMATION AND COMMUNICATION TECHNOLOGY

Use of ICT in Teaching, Laboratory Education, Communication with students

Teaching: Lectures using modern audiovisual equipment, learning support through the eClass electronic platform, synchronous distance teaching via MS Teams.
Communication with students: face-to-face during office hours, email, eClass platform, MS Teams tools

Organization of Teaching

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

Activity	Semester Workload
Lectures	52
Case studies / exercises	18
Project	30
Self-study of lecture material and exercises	35
Consultation Support	0.5
Exams (written)	2
Course Total	**137.5**

STUDENT ASSESSMENT

Description of the assessment process

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 grade of the course is determined as follows:

- 60% by the written exams during the winter semester examination period and, in case of failure, during the September resits.
- 40% from the project

During the September resits, the final grade is determined by 100% from the written exam.

The written exam includes problem-solving exercises and it is conducted with open books.

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:

- McCabe, W., Smith, J., Harriott, P. (2015). Fundamental Processes of Chemical Engineering, 7th Edition, Tziolas Publications, ISBN: 978-960-418-566-5 [50655948] – in Greek

- Journals:

- Other educational material:

- Lecture Notes and Supporting Material provided by the Instructor