COURSE OUTLINE

(1) OVERVIEW

SCHOOL	MARITIME & INDUSTRY		
DEPARTMENT	INDUSTRIAL MANAGEMENT & TECHNOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΤΕΠΑΡ01-2	SEMESTER	3
COURSE TITLE	CHEMICAL INDUSTRIES		
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 aims to deepen students' understanding of production processes and product characteristics in key sectors of the chemical and manufacturing industries, both organic and inorganic. It focuses on developing the ability to analyze and synthesize industrial systems using techno-economic and environmental criteria, through appropriate visualization, calculation, and evaluation tools. The course includes case studies focusing on:

- Identifying critical operational parameters that affect the quality and properties of final products.
- Saving materials and energy, recycling, and utilizing by-products.
- Evaluating environmental emissions and selecting improvement measures.
- Techno-economic assessment of production processes.

The course approach is supported by the use of computational tools for simulation, visualization, and evaluation (where applicable), with the goal of cultivating analytical and decision-making skills in the design and optimization of production systems.

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

- Analyze and represent complex production chains using flow diagrams and identify critical stages and parameters.
- Evaluate the effects of operational parameters on product quality and process efficiency.
- Use basic computational tools and models to estimate material flows and techno-economic indicators.
- Propose strategies to optimize raw material consumption, reduce waste, and improve environmental compatibility.
- Formulate solutions for by-product utilization and apply circular economy principles within industrial units.

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
- 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

During the course lectures, the following units are presented:

- Introduction to Inorganic Industrial Sectors: Characteristic industries, flow diagrams, individual industrial processes, by-product, waste, and gas emissions management, vertical and horizontal integration. Computational topics included.
- Water Use in Industry: Basic applications, water consumption in mining activities and product manufacturing, water treatment, recycling, and desalination. Computational topics included.
- Greek Mining Enterprises: Cast Iron and Steel: Case study: Environmental degradation from mining activities and methods of remediation. Computational topics: Raw material purity and quality control.
- Special Applications in the Production and Processing of Iron-Based Mining Products: Development of models and parameter estimation. Computational topics: Iron ore reduction (direct and indirect) and product beneficiation.
- Other Greek Mining Enterprises: Production of other metals and alloys from primary and secondary (recycled) materials. Computational topics: Processing of minerals with varying composition – Qualitative and quantitative determination of final products.
- Aluminium Industry: Raw materials, production methods, energy requirements, and energy-saving strategies. Computational topics: Production of alumina and aluminium from bauxite.
- Optimization of Aluminium Production Using Techno-Economic and Environmental Criteria. Case study: Material and energy saving in aluminium production.
- Utilization of By-Products from Energy Production. Case study: Co-production of fuel gas and raw materials.
- Construction Materials Industry: Raw materials, production processes, products, and applications. Case study: Raw material selection for construction materials production and minimization of environmental impact – Recycling and alternative uses of construction waste.
- Special Applications in Calculating Final Product Composition from Given Raw Materials and Mixing Raw Materials to Meet Specifications.
- Fertilizer Industry: Phosphate, nitrogen-based, and potassium-based fertilizers. Case study: Production of phosphate and potassium fertilizers.
- Gas Production. Case study: Ammonia production.
- 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

<table>
<tr><td>TEACHING MODE
Face-to-face, in-class lecturing, distance teaching and distance learning etc.</td><td>• Face-to-face in a classroom
• Distance teaching & learning (if required)</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATION TECHNOLOGY
Use of ICT in Teaching, Laboratory Education, Communication with students</td><td>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</td></tr>
<tr><td>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</td><td>
<table>
<tr><th>Activity</th><th>Semester Workload</th></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td>Case studies / exercises</td><td>18</td></tr>
<tr><td>Project</td><td>30</td></tr>
<tr><td>Self-study of lecture material and exercises</td><td>35</td></tr>
<tr><td>Consultation Support</td><td>0.5</td></tr>
<tr><td>Exams (written)</td><td>2</td></tr>
<tr><td>Course Total</td><td>137.5</td></tr>
</table>
</td></tr>
<tr><td>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.</td><td>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.</td></tr>
</table>

(5) SUGGESTED BIBLIOGRAPHY

- Books:

- Sdoukou A., Pomonis, F. (2010). Inorganic Chemical Technology, Tziolas Publications, ISBN: 9789604182411 [18548719] – in Greek
- Pegiadou-Koemtzopoulou, S., Tsatsaroni, E., Eleftheriadis, I. (2009). Industrial Organic Chemistry, Gartaganis Publications, ISBN: 9789609828888 [1945] – in Greek
- Karvounis, S. (2017). Technology Systems Analysis and Industrial Processing Sectors, Varvarigou Publications, ISBN: 9789607996640 [68398900] – in Greek

- Journals:

- Critical Reviews in Environmental Science and Technology
- Journal of Cleaner Production
- Journal of Hazardous Materials

- Other educational material:

- Lecture Notes and Supporting Material provided by the Instructor