# Industrial Process Design and Economics

| 1. GENERAL | | | |
|---|---|---|---|
| **SCHOOL** | Faculty of Sciences in collaboration with Faculty of Engineering, Aristotle University of Thessaloniki | | |
| **DEPARTMENT** | Materials Science and Engineering | | |
| **LEVEL OF STUDIES** | ISCED level 7 (5-year Integrated Master's programme)<br>ISCED level 6 (4-year BSc programme) | | |
| **COURSE CODE** | **MSEN 603** | **SEMESTER** | 6th Semester |
| **COURSE TITLE** | **Industrial Process Design and Economics** | | |
| **TEACHING ACTIVITIES**<br>Lectures, tutorials/problem sessions, laboratory/computer exercises (where applicable),<br>case studies and guided self-study. | | **TEACHING HOURS PER WEEK** | **ECTS CREDITS** |
| | | Lectures: 2<br>Lab work: 2<br>Total: 4 | 6 |
| **COURSE TYPE** | Background | | |
| **PREREQUISITES** | No prerequisities | | |
| **TEACHING AND EXAMINATION METHODS** | English | | |
| **COURSE OFFERED TO ERASMUS STUDENTS** | Yes. | | |
| **COURSE URL** | https://elearning.auth.gr/course/view.php?id=xxxxx | | |

| 2. LEARNING OUTCOMES | |
|---|---|
| **Learning Outcomes** | By the end of this course, students will be able to:<br>• Conduct complete techno-economic feasibility studies for chemical processes, with emphasis on materials processing industry.<br>• Employ specialized software tools for the design and economic evaluation of an industrial plant.<br>• Develop and interpret methodological flow diagrams, and apply mass and energy balance principles to process systems.<br>• Perform preliminary sizing and selection of major process equipment based on design requirements and operating conditions.<br>• Carry out cost estimation, economic evaluation, and profitability assessment of materials processing industrial projects.<br>• Analyze process throughput, identify bottlenecks, and propose effective debottlenecking strategies.<br>• Optimize process operating conditions using techno-economic criteria and apply scale-up principles to industrial systems.<br>• Determine and evaluate processing parameters in outlet streams to ensure regulatory compliance and sustainable operation. |
| **General Skills** | • Search for, analysis and synthesis of data and information, with the use of the necessary technology<br>• Decision-making |

| | |
|---|---|
| | • Team-work<br>• Generate new research ideas<br>• Project planning and management with emphasis on the environmental dimension<br>• Modeling and solving real-world problems<br>• Working in a multidisciplinary environment<br>• Respect for the natural environment |

## 3. COURSE CONTENT

The course introduces students to the application of techno-economic feasibility studies in chemical process industries, with particular emphasis on materials processing industrial plants. It is based on a thorough feasibility study of a selected plant, which varies each year, and the preparation of a detailed report that constitutes an important part of the overall course grade. The course covers the development and interpretation of methodological flow diagrams and the application of mass and energy balances for process analysis. Students learn the preliminary sizing and selection of key process equipment, as well as methods for cost estimation, economic evaluation, and assessment of project profitability. To support this, the course includes an extensive lab component where students use specialized software tools for plant design and economic evaluation. The course also addresses throughput analysis, identification of bottlenecks, and strategies for process optimization. Additionally, students explore the optimization of operating conditions using techno-economic criteria and the principles of process scale-up. Finally, the course examines the determination and evaluation of processing parameters in outlet streams to ensure compliance with material quality standards and sustainable operation.

## 4. LEARNING & TEACHING METHODS - EVALUATION

**Teaching method**

Face-to-face.

**Use of ICT**

Use of ICT in Course Teaching, Use of ICT in Laboratory Teaching, Use of ICT in Communication with Students
Description: Use of Information and Communication Technologies (ICT) in teaching the course with tools of modern distance learning (ZOOM) and asynchronous education (eclass).
Use of learning aids based on ICT: Excel
Use of ICT in student assessment: Electronic grading (eclass, universis).
Use of ICT in communication with students: eclass, email, ZOOM.

**Teaching organization**

The supervised and unsupervised workload per activity is indicated below (total workload complies with ECTS standards).

| Activity | Workload/semester (hours) |
|---|---|
| Lectures | 26 |
| Bibliographic research and analysis | 50 |
| Laboratory exercises | 22 |
| Writing of assignments | 50 |
| Final written exam | 2 |
| **Total** | **150** |

**Student evaluation**

Assessment Language: English
Assessment Methods:
- Written assignment
- Problem Solving
- Presentation in audience
- Laboratory report

| 5. SUGGESTED BIBLIOGRAPHY |
| --- |
| **Course Bibliography** |
| Peters, M. S., Timmerhaus, K. D., & West, R. E. (2003). Plant design and economics for chemical engineers (5th ed.). McGraw-Hill. |
| **Additional bibliography for study** |
| Developing An Industrial Chemical Process: An Integrated Approach. Author, Joseph Mizrahi. Edition, illustrated. Publisher, CRC Press, 2002. |