COURSE SYLLABUS

1. Program information

1.1. Institution	Petroleum – Gas University of Ploiești
1.2. Faculty	Petroleum Technology and Petrochemistry
1.3. Department	Petroleum Processing Engineering and Environmental Protection
1.4. Field of study	Chemical Engineering
1.5. Study cycle	Master
1.6. Study program	Chemical Engineering for Refineries and Petrochemistry

2. Course information

2.1. Course title	Chemical plant design and economics
2.2. Course coordinator	Prof. Dragoș Ciuparu
2.3. Laboratory / seminar / coordinator	Prof. Dragoș Ciuparu
2.4. Project coordinator	Prof. Dragoș Ciuparu
2.5. Year of study	2
2.6. Semester *	3
2.7. Evaluation type	E
2.8. Course type - formative category **/ Type of subject matter ***	SC

* The semester number is according to the curriculum.

** FC – Fundamental courses; SC – Specialization courses; CC – Complementary courses.

*** Mandatory/imposed = MND; Optional = OPT; Elective = ELE.

3. Total estimated time (teaching hours per semester)

3.1. Number of hours per week	5	of which: 3.2. course	2	3.3.Seminar/laboratory	2	3.4.Project	1
3.5. Total hours from curriculum	70	of which: 3.6. course	28	3.7. Seminar/laboratory	28	3.8. Project	14
3.9. Total hours of individual study (Study of textbook, course support, bibliography, study of textbook, course support, further reading in the library, on online platforms, preparing seminars/laboratories, homework, portfolios and essays)							140
3.10. Total hours per semester							210
3.11. Number of credits							7

4. Requirements (where applicable)

4.1. Curriculum requirements	➢ Chemical reaction engineering/Chemical rectors ➢ Transfer phenomena
4.2. Course requirements:	➢
4.3.Seminar/Laboratory requirements:	➢

5. Specific competences acquired and learning achievements* outcomes

Professional competences	Learning achievements*
1. Develops and optimizes complex chemical processes	**K1 -** The student describes and correlates advanced models of chemical kinetics and applied thermodynamics **K2 -** The student explains mechanisms of mass, heat, and momentum transfer in complex reactive systems **K3 -** The student defines computational methods for process simulation and optimization **S1 -** The student applies specialized software for process design and analysis **S2 -** The student integrates experimental data with mathematical models for process optimization **LO1 -** The student makes autonomous decisions regarding process efficiency, safety, and sustainability **LO2 -** The student documents and presents results in technical-scientific reports
2. Designs equipment and installations for the chemical industry	**K1 -** The student describes advanced principles of equipment sizing and operation **K2 -** The student identifies modern technological solutions for process intensification **K3 -** The student defines criteria for selecting materials and equipment depending on applications **S1 -** The student uses computer-aided design methods **S2 -** The student develops technological schemes and mass and energy balances **LO1 -** The student assumes responsibility for coordinating engineering projects **LO2 -** The student collaborates effectively in multidisciplinary teams
Transversal competences	**Learning achievements***
1. Develops critical thinking and the ability to solve complex problems	**K1 -** The student identifies reasoning models applicable in interdisciplinary contexts **S1 -** The student applies methods of analysis and synthesis to solve complex problems **S2 -** The student uses modern tools for decision evaluation and substantiation **LO1 -** The student takes responsibility for the proposed solutions and their impact **LO2 -** The student demonstrates autonomy in the critical approach of complex situations
2. Communicates effectively orally and in writing in Romanian and in an international language	**K1 -** The student explains the specialized terminology in Romanian and in a foreign language **S1 -** The student drafts reports, presentations, and professional documents **S2 -** The student delivers oral presentations and debates in academic and professional contexts **LO1 -** The student takes responsibility for the correct and clear transmission of information **LO2 -** The student demonstrates autonomy in selecting means and communication strategies
3. Displays social responsibility, professional ethics, and civic spirit	**K1 -** The student describes the principles of professional ethics and social responsibility **K2 -** The student explains the ethical implications of professional decisions **S1 -** The student applies ethical principles in professional and academic activities **LO1 -** The student takes responsibility for the ethical consequences of decisions **LO2 -** The student demonstrates autonomy in promoting ethical and civic conduct

* K – knowledge; S – skills; LO – responsibility and autonomy.

6. Course objectives (derived from the list of specific competences acquired)

6.1. General objective	Apply general chemical engineering knowledge to design petroleum refining processes

	and plants using process modelling and simulation software
6.2. Specific objectives	➢ Learn how to assess the economics of process and plant design; ➢ Learn how to develop and review process flow diagrams; ➢ Learn how to use process modelling and simulation software for plant design; ➢ Learn how to estimate capital expenditure and operational expenditure for a plant.

7. Contents

7.1. Course	Time	Teaching methods	Comments
1. Introduction	1	Multimedia techniques	
2. Process conception and design	7		
3. Use of simulation software for process and plant design	4		
4. Process economics and cost assessment	6		
5. Risk assessment, process safety and environmental impact analysis	6		
6. Optimizing process design	4		
Bibliography a) Books Gavin Towler, Ray Sinnott, Chemical Engineering Design Principles, Practice and Economics of Plant and Process Design, Second Edition, Elsevier, 2013 Peters, M.S., Timmerhaus, K.D., Plant Design and Economics for Chemical Engineers, McGraw-Hill, Inc. New York 1991. b) Periodicals Chemical Engineering Petroleum Technology Quarterly Magazine Suite			
7.2. Seminar / laboratory	Time	Teaching methods	Comments
1. Project statement of work and project simulation definition;	4	Hands-on, interactive	
2. Initial estimations, model convergence and recycle simulation;	4		
3. Economic assessment and cost estimation;	8		
4. Case study and process optimization;	6		
5. Process profitability and sensitivity analysis.	6		
Bibliography ProII Input manual, class notes and Course support books			
7.3 Project	Time	Teaching methods	Comments
1. Defining project statement of work and assessment of profitability potential;	2	Hands-on, interactive	
2. Development of the process flow diagram;	2		
3. Process simulation and optimal design;	4		
4. Economic assessment and cost estimation;	4		
5. Profitability and sensitivity analysis	2		
Bibliography ProII Input manual, class notes and Course support books			

8. Correlation of the course contents with the demands of the epistemic community representatives, professional associations, and representative employers in the field of the program

The course syllabus was developed in cooperation with representatives of engineering companies in Ploiești and Bucharest that have hired alumni of similar master programs

9. Evaluation

Activity	9.1. Evaluation criteria	9.2. Evaluation methods	9.3. Percentage of final grade
9.4. Course	The design approach technique	Practical	25%
	Accuracy and precision of technical and economic calculations	Practical	25%
	Correctness of design decisions	Practical	10%
	Complying with ethical principles	Practical	5%
	Quality of presentation of design results	Practical	5%
9.5. Seminar/laboratory	Degree of completion of lab assignments	Practical	5%
9.6. Project	Completion of design project	Practical	25%
9.7. Minimum performance standard			
➢ Students complete their project work with satisfactory results; ➢ Students are capable to elaborate an original design project, employing process simulation software, and performing an order of magnitude estimate of project costs and profitability analysis.			

Signature/date	Course coordinator	Laboratory coordinator	Project coordinator
22.09.2025	Prof. Dragoș Ciuparu	Prof. Dragoș Ciuparu	Prof. Dragoș Ciuparu

Date of approval in the department	Head of department	Dean
26.09.2025		