COURSE SYLLABUS

1. Program information

1.1. Institution	Petroleum-Gas University of Ploieşti
1.2. Faculty	Petroleum Refining and Petrochemistry
1.3. Department	Petroleum Processing and Environmental Engineering
1.4. Field of study	Chemical engineering
1.5. Study cycle	Master Degree
1.6. Study program	Chemical Engineering for Refineries and Petrochemistry

2. Course information

2.1. Course title	Technologies for alternative fuels manufacturing
2.2. Course coordinator	Assist prof. Matei Danuta
2.3. Laboratory / seminar / coordinator	Assist prof. Matei Danuta
2.4. Project coordinator	-
2.5. Year of study	1
2.6. Semester *	1
2.7. Evaluation type	Exam
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	4	of which: 3.2. course	2	3.3.Seminar/laboratory	2	3.4.Project	-
3.5. Total hours from curriculum	56	of which: 3.6. course	28	3.7. Seminar/laboratory	28	3.8. Project	-
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)							154
3.10. Total hours per semester							210
3.11. Number of credits							7

4. Requirements (where applicable)

4.1. Curriculum requirements	➢ Thermo catalytic Processes ➢ Organic chemistry, Petrochemistry, Environmental Protection
4.2. Course requirements:	➢ Course room equipped with video projector and screen
4.3.Seminar/Laboratory requirements:	➢ Laboratory equipped specific with related infrastructure

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. Integrates principles of sustainable development and circular economy	K1 - The student describes advanced concepts of sustainable development applicable in chemical engineering. K2 - The student identifies strategies for reducing, reusing, and valorizing resources. K3 - The student defines performance indicators for sustainable processes. S1 - The student evaluates the environmental impact of chemical processes. S2 - The student proposes technological solutions for pollution reduction and energy efficiency. LO1 - The student makes decisions in accordance with environmental legislation and sustainability principles. LO2 - The student promotes ethical conduct in resource use.
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.

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

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

6.1. General objective	The course aims to familiarize students with innovative processes of alternative fuels production
6.2. Specific objectives	➢ Knowledge and identification of physico-chemical characteristics, specific combustion properties and unconventional fuels production processes ➢ Ability to compare manufacturing technologies and the life cycle of non-conventional fuels with conventional fuels ➢ Performance evaluation and identification of limitations due to the replacement or addition of such components in the MAS and MAC engines

7. Contents

7.1. Course	Time	Teaching methods	Comments
General aspects regarding the involvement of car transport in environmental pollution. Current environmental protection legislation.	4	problem-solving, documenting on the web, exemplification	
Alternative fuels: green and blue hydrogen, oxygenated organic compounds (alcohols and ethers), biofuels: bioethanol, vegetable oils, vegetable and animal oils, biodiesel, biokerosene. Physical-chemical properties.	8		
Alternative fuel production technologies: LPG, CNG, GTL; green and blue hydrogen production; Technologies for the manufacture of oxygenated organic compounds; Biofuels manufacturing technologies	8		
Fuel storage and feeding systems	4		
Pollutant emissions of cars powered by alternative fuels	2		
Economic considerations regarding the use of unconventional fuels	2		

Bibliography

1. Knothe, G., Gerpen, J. V., Krahl, J., *The biodiesel handbook*, AOCS Press, 2005.
2. Speight, J. G., *The refinery of the future*, Elsevier Science, Norwich, N.Y., Oxford, 2011.
3. Singh, A., Rathore, D., *Biohydrogen production: sustainability of current technology and future perspective*, Springer (India), 2017.
4. Twidell, J., Weir, T., *Renewable energy resources*, 2nd Edition, Taylor &Francis, 2007.
5. Hubca, Gh., Lupu, A., Cociaşu, C.A., *Biocombustibili, Biodiesel Bioetanol Sun diesel*, Editura Matrix Rom, Bucuresti, 2008.
6. *** Directive 2009/30/EC of the European Parliament and of the Council of 23 April 2009.
7. Lee. S., Speight, J.G., Loyalka, S.K., *Handbook of alternative fuel technologies*, CRC Press, 2007.

7.2. Seminar / laboratory	Time	Teaching methods	Comments
Synthesis of biodiesel, characterization of the raw materials used	4	Consultation of literature and industry data, identification and use of standardized analysis methods.	
Develop optimal recipes for biodiesel synthesis	4		

Complex analytical techniques for characterization of biodiesel	6	Identifying and using standardized methods, discussion and interpretation of the results.	
Develop optimal synthesis of hydrogen thought steam reforming of bioethanol over different types of catalyst	10		
Establishing experimental graphs correlations between different parameters of the process (temperature, space hour velocity, flow rate) with the hydrogen yield and selectivity.	4		
Bibliography 1. European Standards and Norms: EN 228, EN 590, EN 589; EN 14214; EN 15376.			
7.3 Project	Time	Teaching methods	Comments
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Bibliography			

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 graduates 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 evaluation takes into account the following categories knowledge: Theoretical knowledge evaluated by questions related to topics presented in the course	Written paper	20%
	Theoretical and applied knowledge evaluated through the final examination	Written paper	60%
9.5. Seminar/laboratory	General and detailed knowledge assessed by questions related to the topic and working conditions of the laboratory work	Assessment of laboratory activity; Drawing up the reports and interpreting the results of the experimental part	20%
9.6. Project			
9.7. Minimum performance standard			
Written examination: ➢ For grade 5 it is necessary to obtain a minimum score of 50% for the theoretical knowledge, as well as to prove a minimum level of understanding and solving the applications in the subject (50% minimum) ➢ For grade 10 it is necessary to obtain a maximum score for theoretical knowledge and a complete and			

correct solving of the exam subjects (minimum 95%).

Laboratory activity:

- Note 5 requires a minimum level of 50% for general knowledge as well as a minimum level of understanding and use of laboratory-specific knowledge.
- Note 10 requires a minimum of 90% for laboratory-specific knowledge.

Signature/date	Course coordinator	Laboratory coordinator	Project coordinator

Date of approval in the department	Head of department	Dean

Signature/date	Course coordinator	Laboratory coordinator	Project coordinator
22.09.2025	Assist. Prof.Matei Dănuța	Assist. Prof.Matei Dănuța	

Date of approval in the department	Head of department	Dean
26.09.2025	Associate Professor PhD. Mihaela Neagu	Assistant Professor PhD. Cristina Dusescu – Vasile