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	Professor PhD Ion Onuțu		
2.3. Laboratory / seminar coordinator	Professor PhD Ion Onuțu		
2.4. Project coordinator	-		
2.5. Year of study	1		
2.6. Semester *	2		
2.7. Evaluation type	Exam		
2.8. Course type - formative category **	DS	2.8. Type of subject matter ***	O

* the semester number is in accordance with the curriculum;

** fundamental = DF; domain = DD; speciality = DS; complementary = DC; thoroughgoing = DA; synthesis = DSI.

*** compulsory = C; optional = O; elective = E

3. Total estimated time (teaching hours per semester)

3.1. Number of hours per week	5	of which: 3.2.course	3	3.3. Seminars/laboratories	2	3.4 Project	-
3.4. Total hours from curriculum	70	of which: 3.5.course	42	3.6. Seminars/laboratories	28	3.8 Project	-

3.9. Time distribution	hours
Study of textbook, course support, bibliography and notes	5
Further reading in the library, on online platforms and fieldwork	5
Preparing seminars / laboratories, homework, portfolios and essays	10
Tutoring	5
Examinations	10
Other activities	3

3.10. Total hours of individual study	38
3.11. Total hours per semester	108
3.12. Number of credits	6

4. Prerequisites (where applicable)

4.1. of curriculum	➢ Thermo catalytic Processes ➢ Organic chemistry, Petrochemistry
4.2. of skills	➢ ➢

5. Requirements (where applicable)

5.1. of course	➢ Course room equipped with video projector and screen
5.2. of seminars/laboratory	➢ Laboratory equipped with equipment specific to laboratory work and provided with related infrastucture

6. Specific competences

Professional competences	PC1. Description, analysis and advanced utilization of engineering concepts and fundamental theories in petroleum refining. PC2. Characterization of physical and chemical structural properties, of petroleum products by complex analytic methods. PC3. Equipment, process and plant design. PC4. Real time control of processes and plants in chemical industry. PC5. Modeling, simulation and design of chemical processes.
Cross-curricular competences	TC1. Documentation, information and scientific literature research. TC2. Independent and autonoms achievement of individual professional tasks. TC3. Advanced knowledge of computer, internet and specific chemical engineering software TC4. Management organization and planning of professional teams and organizations.

7. Course objectives (based on the competence grid)

7.1. General objective	➢ The course aims to familiarize students with innovative processes of alternative fuels production
7.2. Specific objectives	➢ Knowledge and identification of physicochemical 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 ➢ Identify and assess the economic aspects and the main aspects of specific emissions from combustion in motor vehicles by introducing alternative/nonconventional fuels

8. Contents

8.1. Course	Time	Teaching methods	Comments
8.1.1. General aspects about motor vehicle types. Progress and trends in the development of economic engines. Non-pollutants fueled with conventional fuels. Current protection legislation	4	Hours of video lectures, written lectures, problem-solving, documenting on the web, exemplification	

8.1.2. Alternative fuels: natural gas and GTL (Gas to Liquid), hydrogen, oxygenated organic compounds (alcohols and ethers), biofuels: bioethanol, vegetable oils, vegetable and animal oils, biodiesel, biokerosene	12	Hours of video lectures, written lectures, problem-solving, documenting on the web, exemplification	
8.1.3. Alternative fuel production technologies: LPG, CNG, GTL; hydrogen production; Technologies for the manufacture of oxygenated organic compounds; Biofuels manufacturing technologies	20	Hours of video lectures, written lectures, problem-solving, documenting on the web, exemplification	
8.1.4. Alternative fuel storage and feeding systems	2		
8.1.5. Pollutant emissions to cars powered by alternative fuels	2		
8.1.6. 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.

8.2. Seminar / laboratory	Time	Teaching methods	Comments
8.2.1. Develop optimal blending of clean engine fuels	10	Consultation of literature and industry data, use of blending software, blending of fuels, identification and use of standardized analysis methods	
8.2.2. Selection and complex analytical characterization of alternative components used in automotive fuel	4	Identifying and using standardized methods, performing of controled experiments, mathematical data processing, discussion and interpretation of the results	
8.2.3. Determination of blending properties of reformulated fuels	10	Identifying and using standardized methods, performing of controled	
8.2.4. Establishing experimental			

correlations of the characteristics of reformulated fuels with the type and ratio of alternative fuel	4	experiments, mathematical data processing, discussion and interpretation of the results	
Bibliography 1. Standarde şi Norme Europene : EN 228, EN 590, EN 589; EN 14214; EN 15376. 2. *PRO/II Reference Manual*. 2014.			
8.3. Project	Time	Teaching methods	Comments
Bibliography			

9. 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.

10. Evaluation

Activity	10.1. Evaluation criteria	10.2. Evaluation methods	10.3. Percentage of final grade
10.4. 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%
10.5. 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%
10.6 Project	-	-	-
10.6. 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.