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 Engineering and Environmental Protection
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	Modern technologies for petroleum refining		
2.2. Course coordinator	Assistant Professor PhD. Eng. Filotti Liviu		
2.3. Laboratory / seminar coordinator	Assistant Professor PhD. Eng. Filotti Liviu		
2.4. Project coordinator	-		
2.5. Year of study	I		
2.6. Semester *	1		
2.7. Evaluation type	Exam		
2.8. Course type - formative category **	DF	2.9. Type of subject matter ***	C

* 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	6	of which: 3.2.course	3	3.3. Seminars/laboratories	3	3.4 Project	-
3.5 Total hours from curriculum	84	of which: 3.6.course	42	3.7 Seminars/laboratories	42	3.8 Project	-

3.9 Time distribution	hour
Study of textbook, course support, bibliography and notes	16
Further reading in the library, on online platforms and fieldwork	16
Preparing seminars / laboratories, homework, portfolios and essays	14
Tutoring	9
Examinations	5
Other activities	-

3.7. Total hours of individual study	60
3.8. Total hours per semester	144
3.9. Number of credits	8

4. Prerequisites (where applicable)

4.1. of curriculum	➢ Knowledge of Chemical Physics ➢ Petroleum Chemistry, Petroleum distillation
4.2. of skills	➢

5. Requirements (where applicable)

5.1. of course	➢ Class equipped with videoprojector and blackboard

5.2. of seminars/laboratory	➢ Class equipped with specialized laboratory equipment and other appropriate teaching materials

6. Specific competences

Professional competences	PC1. Description, analysis and advanced utilization of engineering concepts and fundamental theories in petroleum refining. PC2. Equipment, process and plant design. PC3. Real time control of processes and plants in chemical industry.
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	➢ Basic knowledge of theoretical thermal processes of petroleum processing. Understanding the phenomenons that take place during the thermal processes. ➢ Interpretation of experimental data to establish kinetic parameters for thermal cracking reactions. ➢ Evaluation of the influence of working parameters on the performance of the studied thermal process. ➢ Equalization of the reaction time for politrop reactors with the isothermal reactors with and without constant volume.
7.2. Specific objectives	➢ Comissioning and operating a micro pilot installation that simulates an industrial thermal process. ➢ Compiling experimental data (work parameters, characterization of feedstock and reaction products). ➢ Processing the experimental data (mass balance, kinetic processing, etc.). ➢ Obtaining leadership skills by organizing the experimental activity. ➢ Getting used with teamwork. ➢ Responsbility for the experimental results obtained.

8. Contents

8.1. Course	Time	Teaching methods	Comments
0. Trend in world oil consumption of petroleum products	1		
1. Theoretical basis of thermal processing processes:	5		

1.1 Thermodynamics of thermal processes 1.2 Mechanism of thermal cracking reactions 1.3 Kinetics of thermal cracking reactions		Interactive lecture, Brainstorming	
2. Factors influencing thermal processes: 2.1 Temperature 2.2 Pressure 2.3 Raw material 2.4 Presence of water vapor	4		
3. Industrial application of thermal processes: 3.1 Thermal cracking 3.2 Viscosity reduction 3.3 Coke 3.4 Pyrolysis	8		
4. Catalytic cracking. The industrial process 4.1 Purpose, raw materials, reaction products 4.2 Catalytic cracking catalysts 4.3 Catalytic cracking reaction mechanism 4.4 Kinetics of the catalytic cracking process 4.5 Factors that influence the catalytic cracking process 4.6 The catalytic cracking industrial process 4.7. The resid catalytic cracking	6		
5. Catalytic reforming. The industrial process 5.1 Purpose, raw materials, reaction products 5.2 Catalytic reforming catalysts 5.3 Catalytic reforming reactions 5.4 Kinetics of the catalytic reforming process 5.5 Factors that influence the catalytic reforming process 5.6 The catalytic reforming industrial process	4		
6. Hydrofining. The industrial process 6.1 Purpose, raw materials, reaction products 6.2 Hydrofining catalysts 6.3 Hydrofining reactions 6.4 Factors that influence the hydrofining process 6.5 The hydrofining industrial process	4		
7. Hydrocracking. The industrial process 7.1 Purpose, raw materials, reaction products 7.2 Hydrocracking catalysts 7.3 Hydrocracking reactions 7.4 Factors that influence the hydrocracking process 7.5 The hydrocracking industrial process	3		
8. The gasoline reforming process 8.1 Isomerization of C_5/C_6 fractions 8.2 Alkylationj 8.3 Oligomerization	5		
9. Refining margins and costs	2		
Bibliography 1. Raseev Serge, Thermal and Catalytic Processes in Petroleum refining , Marcel Dekker Inc., 2003 New			

York
2. Reza Sadeghbeigi Fluid Catalytic Cracking Handbook, Gulf Professional Publishing , 2000
3. Rașeev S., Hidrocarbon Conversion, vol I, II, III, Pub. Zecasin, București, 1996-1997
4. Suciu, G., Ionescu, C., Hydrocarbon Processing Engineering, vol.4, Pub. Tehnica, București, 1993
5. Ionescu, C., Ciuparu, D., Dumitrașcu Gh., Pollution and Environmental Protection in Petroleum, Pub. Briliant, 1999

8.2. Seminar / laboratory	Time	Teaching methods	Comments
1. HSEQ regulations.Laboratory work description.	2	Holding thematic courses, followed by analyzes, debates and colloquial discussions.	
2. Pyrolysis of liquid and gaseous fractions: 2.1.Characterisation of raw materials and reaction products 2.2. Establishment of material balance 2.3. Determination of kinetic parameters	5		
3.Coking: 3.1 Characterization of raw materials and reaction products 3.2 Establishment of material balance sheet 3.3 Determination of kinetic parameters	5		
4. Thermal cracking 4.1.Characterisation of raw materials and reaction products 4.2. Establishment of material balance 4.3. Determination of kinetic parameters	5		
5. Reduction of viscosity: 5.1.Characterisation of raw materials and reaction products 5.2. Establishment of material balance 5.3. Determination of kinetic parameters	5		
6. Catalytic cracking: 6.1.Characterization of the raw materials and the reaction products 6.2. Establishment of material balance 6.3. Determination of kinetic parameters	4		
7. Catalytic reforming: 7.1. Characterization of the raw materials and the reaction products 7.2. Establishment of material balance 7.3. Determination of kinetic parameters	4		
8. Hydrofining: 8.1Characterization of the raw materials and the reaction products 8.2. Establishment of material balance 8.3. Determination of kinetic parameters	4		
9. Hydrocracking: 9.1Characterization of the raw materials and the reaction products 9.2. Establishment of material balance 9.3. Determination of kinetic parameters	4		
10. Isomerization : 10.1Characterization of the raw materials and the	4		

reaction products 10.2. Establishment of material balance 10.3. Determination of kinetic parameters			
Bibliography 1.Rosca, P., Ciuparu, D., Borcea, A.,Dragomir, R., Petre, D., Thermo catalytic processes, Laboratory guide, Pub. UPG, 2003.			
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 theoretical knowledge of the topics presented in the course	Written exam	70%
		Cours attendance	10%
10.5. Seminar / laboratory	Attendance and active participation during the laboratory sessions.	Laboratory attendance	20%
10.6 Project			
10.7. Minimum performance standard			

- For Mark 5:
  - Knowledge the processes reaction mechanism;
  - knowledge of the purpose and basic principles of processes;
  - knowledge of working parameters, raw materials and products obtained from processes;

  For Mark 10:
  - Knowledge of kinetics of processes. Kinetic models;
  - Knowledge of the influence of the main factors on the process performance,
  - analysis of reaction systems from processes;
  - Knowledge of the methods of calculating the reaction systems from processes.