COURSE SYLLABUS

1. Program information

1.1. Institution	Petroleum-Gas University of Ploiesti
1.2. Faculty	Faculty of 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 analytic methods in the oil refining industry**		
2.2. Course coordinator	Bondarev Andreea		
2.3. Laboratory / seminar coordinator	Bondarev Andreea		
2.4. Project coordinator	-		
2.5. Year of study	I		
2.6. Semester *	2		
2.7. Evaluation type	V		
2.8. Course type - formative category **	DS	2.8. 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	4	of which: 3.2. course	2	3.3. Seminars/laboratories	2	3.4 Project	-
3.5Total hours from curriculum	56	of which: 3.6. course	28	3.7 Seminars/laboratories	28	3.8 Project	-

3.9 Time distribution	hours
Study of textbook, course support, bibliography and notes	6
Further reading in the library, on online platforms and fieldwork	6
Preparing seminars / laboratories, homework, portfolios and essays	2
Tutoring	-
Examinations	2
Other activities	-

3.10. Total hours of individual study	16
3.11. Total hours per semester	72
3.12. Number of credits	4

4. Prerequisites (where applicable)

4.1. of curriculum	➢ ➢
4.2. of skills	➢ ➢

5. Requirements (where applicable)

5.1. of course	➢ ➢
5.2. of seminars/laboratory	➢ ➢

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 students will develop an understanding on the principles and applications of various analytical methods in the oil refining industry (techniques including chromatography and spectroscopy methods)
7.2. Specific objectives	➢ The student is expected to be able to characterization of physical and chemical structural properties, of petroleum products by complex analytic methods typically employed in chemical research laboratories. ➢ The student is expected to be able to understand and be able to apply the theory and operational principles of spectroscopy and chromatography methods ➢ It will also provide the student with an appreciation of the relative strengths and limitations of different instrumental based analysis methods.

8. Contents

8.1. Course	Time	Teaching methods	Comments
Physico-chemical Methods	4	lecture explication conversation description questioning mind	
Chromatography Methods - Gas chromatography (GC) Methods - High performance liquid chromatography (HPLC) - Mass Spectrometry GC-MS	10	lecture explication conversation description questioning mind	
Spectroscopy methods - Fluorescence Spectroscopy - Infrared spectroscopy - Raman spectroscopy - UV-vis spectroscopy - Atomic absorption spectroscopy - Nuclear Magnetic Resonance spectroscopy	14	lecture explication conversation description questioning mind	
Bibliography 1. Robert M. Silverstein, Francis X. Webster, David J. Kiemle, **Spectrometric Identification of organic compounds**, Wiley, 2005. 2. D. Harvey, **Modern analytical chemistry**, McGraw Hill Higher Education, 2000. 3. Mihai Sonia, Bondarev Andreea, **Modern analytic methods in the oil refining industry, 2019 -** course notes 4. James G. Speight Petroleum Engineering – Downstream - **Analytical Methods And Techniques Applied To Crude Oil And Petroleum Products** 5. Bhanu Prasad Vempatapu, Pankaj K. Kanaujia, **Monitoring petroleum fuel adulteration: a review of analytical methods**, TrAC Trends in Analytical Chemistry, 92, 2017.			
8.2. Seminar / laboratory	Time	Teaching methods	Comments
The Workplace Safety and Health	2	lecture	
Standard Test Method for Density, Relative Density of Crude Petroleum and Liquid Petroleum Products	2	explication conversation experiment	
Standard method (GC) for determination of benzene, toluene, ethylbenzene, xylenes.	4	explication conversation experiment	
Standard method (GC -MS) for determination of gasoline range industrial aromatic adulterants (benzene, toluene, xylenes and total aromatics) in gasoline	4	explication conversation experiment	
Method (HPLC) for determination of mono-, di-, tri- and PAHs in diesel.	4	explication conversation experiment	

Determination of benzene in gasoline samples by FT-IR spectroscopy	2	explication conversation experiment	
Method for determination of triacylglycerols (vegetable oils and fats) in diesel.	4	explication conversation experiment	
The determination of heavy metals in gasoline samples	2	explication conversation experiment	
Determination of polycyclic aromatic hydrocarbon by UV -vis spectroscopy	2	explication conversation experiment	
Determination of sulfur in crude oil (Fluorescence Spectroscopy)	2	explication conversation experiment	
Bibliography 1. Robert M. Silverstein, Francis X. Webster, David J. Kiemle, **Spectrometric Identification of organic compounds**, Wiley, 2005. 2. D. Harvey, **Modern analytical chemistry**, McGraw Hill Higher Education, 2000. 3. Mihai Sonia, Bondarev Andreea, **Modern analytic methods in the oil refining industry, 2019 -** laboratory			
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 ability to describe and explain basic concepts of instrumental analysis to solve problems. -The ability to develop an understanding on principles of analytical techniques.	Written examination	80%

10.5. Seminar / laboratory	-Students will present, analyse and discuss their experiment results in the form of written reports.	Final test	20%
10.6 Project			
10.7. Minimum performance standard			
➢ Upon completion of this course, students must be able to discuss principles of chromatography methods and spectroscopy methods.			