

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 and Environmental Protection Engineering
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	Lubricants and additives		
2.2. Course coordinator	Assoc.Prof.Liana Bogatu		
2.3. Laboratory/seminar coordinator	Assoc.Prof.Liana Bogatu		
2.4. Project coordinator	-		
2.5. Year of study	I		
2.6. Semester *	I		
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 study =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	-
3.5 Total hours from curriculum	70	of which: 3.6.course	42	3.7 Seminars/laboratories	28	3.8 Project	-
3.9 Time distribution							hours
Study of textbook, course support, bibliography and notes							20
Further reading in the library, on online platforms and fieldwork							6
Preparing seminars / laboratories, homework, portfolios and essays							8
Tutoring							2
Examinations							2
Other activities							-
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	<ul style="list-style-type: none"> ➤ Science of Materials ➤ Lube oils Manufacturing Technology ➤ Petroleum Distillation Technology ➤ Thermo-catalytic Processes in Petroleum Industry
4.2. of skills	<ul style="list-style-type: none"> ➤ Knowledge of petroleum products properties ➤ Knowledge of base oils manufacturing ➤ Knowledge of mechanic phenomena of friction, wear, corrosion etc.

5 Requirements (where applicable)

5.1. of course	<ul style="list-style-type: none"> ➤ Standard classroom. ➤ Video projector and screen.
5.2. of seminars/laboratory	<ul style="list-style-type: none"> ➤ Laboratory equipped with modern instruments and equipment for analysis of base oils and lubricating oils. ➤ Base oils, additives

6 Specific competences

Professional competences	<ul style="list-style-type: none"> ➤ 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.
Cross-curricular competences	<ul style="list-style-type: none"> ➤ Documentation, information and scientific literature research in the field. ➤ Independent and autonomous achievement of individual professional tasks, ➤ Team leader skills; demonstration of activity coordination capacity, analytical thinking, adaptability and flexibility, collaboration with team members. ➤ Advanced knowledge of computer, internet and specific chemical engineering software

7 Course objectives (based on the competence grid)

7.1. General objective	<ul style="list-style-type: none"> ➤ The general objective of the discipline is the study of liquid and solid lubricants used in various fields, in concrete applications and specific requirements. In the course are presented general notions of tribology, main characteristics of lubricants, grouped on certain criteria, types of basic oils and main classes of additives, modern requirements and current trends in the manufacture of lubricants. ➤ An important part of the course is dedicated to presenting the main categories of liquid and greasy lubricants, as well as their specific applications.
7.2. Specific objectives	<p>After passing the discipline, students will be able to:</p> <ul style="list-style-type: none"> ➤ analyze and evaluate the physico-chemical characteristics of lubricants; ➤ develop methods to improve the physico-chemical characteristics of lubricants by adding of the appropriate types of additives; ➤ evaluate different type of lubricants, classify them and determine their areas of use.

8 Contents

8.1. Course	Time	Teaching methods	Comments
1. Basic of tribology	9 hours	Interactive and student-centered	
2. Physical and chemical properties of lubricants. The correlation between the applications, specific functions and characteristics of lubricants.	9 hours	Interactive and student-centered	
3. Base oils and additives: representative types, specific chemical structure, correlation between structure and properties.	9 hours	Interactive and student-centered	
4. Types of representative liquid lubricants. Classification, quality standards, formulation and evaluation of the lubricants.	12 hours	Interactive and student-centered	
5. Types of representative of semi-liquid and solid lubricants and specific applications.	3 hours	Interactive and student-centered	
Bibliography			
1. Mang Th., Dresel, W., Lubricants and Lubrication, ISBN 978-3-32670-9, publishing house WILEY-VCH, 2017. 2. Tănăsescu, C., Lubricants Manufacture Technology, Petrol-Gas University publishing house, 2002. 3. Florea, F., Tribology, Universal Cartfil publishing house, Ploiești, 2000. 4. Pavelescu, D., Mușat, M., Tudor, A., Tribology, Didactic and pedagogical publishing house, București, 1977. 5. Popa, St., Dobrescu, C., Petrof, M., Florea, F., Popescu, A., Andronie, Gh., Mineral lubricants for industrial processes, Technical publishing house, București, 1978. 6. Denis, J., Briant, J., Hipeux, J.C., Physico-chimie des lubrifiants, Analyses et Essais, Technip publishing house, Paris, 1997. 7. *** Afton Chemical, Specification handbook 2012.			
8.2. Seminar / laboratory	Time	Teaching methods	Comments
1. Testing and evaluating the physico-chemical characteristics of base oils	8 hours	Interactive and student-centered	
2. Testing and evaluation of the rheological, oxidation resistance and anti-corrosive properties of lubricants.	8 hours	Interactive and student-centered	
3. Testing and assessing the anti-wear and extreme pressure characteristics of lubricants	4 hours	Interactive and student-centered	
4. Characterization of consistent greases	4 hours	Interactive and student-centered	
Assessment of lubricant compliance	4 hours	Interactive and student-centered	
Bibliography			

1. Annual Book of ASTM Standards, Section 5: Petroleum Products, Lubricants, and Fossil Fuels ISBN 978-1-6822-1440-4, 2018.

2. Tănăsescu, C., Cursaru, D., Jugănar, T., Bogatu, L., Lubricants technology- guide for laboratory and numerical applications, Petrol-Gas University publishing house, 2010.

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	Final exam	written test	85%
10.5. Seminar / laboratory	Final exam	Oral test	15%
10.6. Project			
10.7. Minimum performance standard			
<ul style="list-style-type: none"> ➤ All the topics of the exam should be accomplished for reaching at least 5 score. ➤ Laboratory work carried out in full. 			