Appendix A

MODULE HANDBOOK

Chemical engineering (CHEN) master program, Department of “Petrochemical Technology and Industrial Ecology”.

Course Unit Title	**Modern methods of analysis in the oil industry**
Course Unit Code	**ENG 1210**
Type of Course Unit	Compulsory
Level of Course Unit	1st year CHEN master program
National Credits	-
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	2
Practice (hour/week)	-
Laboratory (hour/week)	1
Year of Study	1
Semester when the course unit is delivered	2
Course Coordinator	Gulnara Sultanova
Name of Lecturer (s)	Gulnara Sultanova
Name of Assistant (s)	-
Mode of Delivery	Face to Face , laboratory
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

The course provides the student with a basic knowledge and understanding of the oil and gas industry, including its history, technical aspects, business model, and impact on society and the environment. The primary emphasis is on operations in exploration, production, transportation, refining, and marketing. At the end of the course, the student should be able to speak in a general way on all aspects of the industry and be familiar with common industry terminology.

Objectives of the Course:

1. Operations of the oil and gas industry across the value chain 2. Relationships and interactions between industry players 3. Importance of oil and gas in the economy 4. Likely future scenarios for the industry		
Learning Outcomes		
At the end of the course the student will be able to		Assessment
1	Provide education that inculcate high ethical and moral standards in its students to serve humanity ii.	1,3,4
2	Perform research activities that incorporate cutting-edge technology and that which is environmentally friendly.	1,2,3,4
3	Demonstrate laboratory and analytical skills, safety awareness and organisational skills	2,3,4
4	The goal is to give students the opportunity to gain insight into a specific topic that is of particular interest to them among the real-world themes studied in this course	3,4
5	Understand and implement professional and ethical standards.	1,3,4
Assessment Methods: 1. Final Exam, 2. Presentation 3.Midterm 4.Quiz		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	4
2	Ability to analyze and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	3
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	5
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	4
5	Ability to develop design and scientific-technological solutions in the field of design, modeling and optimization of refining and petrochemical processes, as well as apply the acquired knowledge to improve the management system of the oil refining industry.	4

6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	3
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modeling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	3
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	5
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	[I] Chap. 2 p-23	Introduction to Petroleum Engineering	
2	[II] Chapter 6 p-89	Geology and Exploration **Laboratory work 1 –Safety rules**	
3	[I] Chap. 6 p-56	Petroleum Analysis	
4	[II] Chapter 4,5.6 p-78	Chemical composition **Laboratory work 2:** Determination of density by aerometer, pycnometer In the laboratory work the following equipment and materials are used: Aerometer, Mohr-Westphal, pycnometer, oil products	

		The objective of laboratory work is to determine the densities of different petroleum products by pycnometer and aerometer.	
5	[I] Chap. 3 p-45	Analysis and sampling	
6	[II] Chapter 4 p-34	Physical properties of petrol **Laboratory work 3 Analysis of gasoline (fraction composition)** In the laboratory work the following equipment and materials are used: Engler device, flask, thermometer, vacuum pump Usually light fractions of oil are distilled up to 300^0C under atmospheric pressure. The boiling temperature of light oil products is determined by the Engler device.	
7	[II] Chap. 4 p-29	Elemental (Ultimate) Analysis of petrol	
8			Midterm
9	[IV] Chapter 6 p-76	Thermal Properties of petrol **Laboratory work 4:** Determination of viscosity In the laboratory work the following equipment and materials are used: • Ubbelohde viscometer The objective of laboratory work is determination of petroleum products viscosity. The Ubbelohde viscometer utilize a glass capillary through which the fluid flows under gravity. The capillary geometry is too small for highly viscous samples.	
10	[II] Chap. 7 67	Density, Specific Gravity, and API gravity of petrol	
11	[III] Chapter 5 p-90	Mass Spectrometry **Laboratory work 5:** Determination of the ignition, combustion, spontaneous temperature	

		In the laboratory work the following equipment and materials are used: kerosene, porcelain bowl, sand bath. The objective of laboratory work is determination of ignition, combustion, spontaneous temperature of petroleum products. The product is poured into the porcelain bowl and placed inside a heater with sand. The thermometer is placed in the center of the product just a little above the bottom of the bowl. The heating rate of the product should be 10^0C per minute. Because the device is open, some of the vapor released from the product is spread out. That's why the product is ignited at high temperatures.	
12	[III] Chapter 6 97	Electrical and Optical Properties	
13	[II] Chapter 5 p-78	Physical Property Methods **Laboratory work 6:**Determination of softening temperature In the laboratory work the following equipment and materials are used: Steel balls-two numbers each of 9.5 mm dia. and weighing 0.05g, Brassrings, thermometer, Bath, Stirrer The *softening point* is defined as the temperature at which the resin flows under a given load on heating.*Softening point* test of bitumen helps in the *determination* of the temperature beyond which the bitumen is softened beyond a pre-specified softness	
14	[II] Chapter 7 p-101	Drilling and Testing	
15	[I] Chapter 5,6,7 p-129	Transportation and Storage **Laboratory work 7.** Determination of water In the laboratory work the following equipment and materials are used: Flask of 500ml capacity, 100 ml graduated cylinder, Electric heater The laboratory work studyTo determine the water content of oil and oil products.	

16			Final

Recommended Sources

TEXTBOOK(S)

1. Guide by Joseph F. Hilyard. The Oil & Gas Industry: A Nontechnical, PennWell Books,2000,509p
2. Mustafa Versan Kok, Introduction to Petroleum Engineering, 1st edition, Dept. of Petroleum & Natural Gas Eng, published by METU, 2000.

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written, Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class	**14**	**3**	**42**
Presentation	1	8	8
Self-study	14	5	70
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	12	12

Final Examination	1	3	3
Preparation for final exam	1	28	28
Total Workload			**180**
Total Workload/30(h)			**180/30**
ECTS Credit of the Course			**6**

Chemical engineering (CHEN) master program, Department of "Petrochemical Technology and Industrial Ecology".

Course Unit Title	**Bioresources**
Course Unit Code	**ENG 3016**
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	2
Practice (hour/week)	1
Year of Study	-

Semester when the course unit is delivered	-
Course Coordinator	Ramil Sadigov
Name of Lecturer (s)	Ramil Sadigov
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

In this course, agricultural and biological resources (bioresources) will be explored as an essential means of supporting a sustainable future for the planet. Efficient and sustainable methods for producing food, fiber, bio-based products, and renewable energy will be presented along with their environmental impact and supply chain considerations. Emphasis will be placed on the Bioresources for a Sustainable Future 2 prospects of plant biomass and algae to serve as renewable raw materials for a sustainable economy. The course will cover topics of global challenges in energy, water, and food security, and the interconnections among the three resources with a systems thinking approach. The course will teach students a holistic approach to dealing with resource management, identifying and utilizing positive interactions and avoiding negative repercussions

Objectives of the Course:

By the end of this course, students will be able to:

1. Assess the benefits, opportunities, and challenges of bioresources in today's economy

2. Understand how nature works regarding the climate, biodiversity and the flow of natural resources, and realize the impact of human activity on the environment

3. Recognize the interactions between energy, water and food and the how their sustainability will safeguard the future of humans and the ecosystem on the planet

4. Understand the variety of technologies currently employed and under development for production of bioenergy and bioproducts from biomass and algae

5. Comprehend the life cycle of products derived from bioresources and the green supply chain 6. Develop critical thinking about the socio-economic aspects of the bioeconomy.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	The research project is intended to foster critical, creative, and practical thinking and to develop effective interpersonal and communication skills	1,3,4
2	Identify and analyse the fundamental physical parameters of an experimental system	1,2,3,4

3	Demonstrate laboratory and analytical skills, safety awareness and organisational skills	2,3,4
4	The goal is to give students the opportunity to gain insight into a specific topic that is of particular interest to them among the real-world themes studied in this course	3,4
5	Understand and implement professional and ethical standards.	1,3,4
Assessment Methods: 1. Final Exam, 2. Presentation 3. Midterm 4. Quiz		

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	4
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	4
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	5
5	Ability to develop design and scientific-technological solutions in the field of design, modeling and optimization of refining and petrochemical processes, as well as apply the acquired knowledge to improve the management system of the oil refining industry.	4
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	4
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modeling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	2
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	4
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4

10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	5
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	[1] Chap. 2 p-14	Natural resource challenges	
2	[II] Chapter 6 p-71	Sustainable water management Seminar : Natural resource challenges	
3	[1] Chap. 7 p-78	Climate change, adaptation, and mitigation	
4	[III] Chapter 4,5.6 p-35	Sustainable forestry Seminar : Climate change, adaptation, and mitigation	
5	[III] Chap. 3 p-34	Biodiversity in the ecosystem	
6	[II] Chapter 4 p-38	Marine bioresources Seminar : Biodiversity in the ecosystem	
7	[II] Chap. 2 p-25	Crop sustainability	
8			Midterm
9	[IV]	Food sustainability	

	Chapter 6 p-67	Seminar : Crop sustainability	
10	[II] Chap. 3 p-56	Biomass and algae for energy	
11	[III] Chapter 5 p-89	Biomass and algae for bioproducts Seminar : Biomass and algae for energy	
12	[III] Chapter 6 p-90	Life cycle analysis and green supply chain	
13	[II] Chapter 5 p-89	Socio-economic aspects of bioresources Seminar : Life cycle analysis and green supply chain	
14	[III] Chapter 7 p-56	Bioresources main properties	
15	[I] Chapter 5,6,7 p-90	Biorenewable Resources Seminar : Bioresources main properties	
16	[I] Chapter 6.7 p-69	Food safety	Final

Recommended Sources

TEXTBOOK(S)

1. Brown Robert C., Biorenewable Resources, John Wiley & Sons Limited, 2010

2. Bert JM DE VERIS, Sustainability Science, Cambridge University Press,
2012

3. Geoffrey Alan Lawrence ,Food Security, Nutrition and Sustainability , Springer, 2010

Assessment		
Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU.

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class	**14**	**3**	**42**
Presentation	1	8	8
Self-study	14	5	70
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	12	12
Final Examination	1	3	3
Preparation for final exam	1	28	28
Total Workload			**180**
Total Workload/30(h)			**180/30**
ECTS Credit of the Course			**6**

Chemical engineering (CHEN) master program, Department of "Petrochemical Technology and Industrial Ecology".

Course Unit Title	Computer design in petroleum refinery.
Course Unit Code	**ENG 3015**
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Aytan Mammadova
Name of Lecturer (s)	Aytan Mammadova
Name of Assistant (s)	-

Mode of Delivery	Face to Face, Seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

Taking a highly pragmatic approach to presenting the principles and applications of chemical engineering, this companion text for students and working professionals offers an easily accessible guide to solving problems using computers. The primer covers the core concepts of chemical engineering, from conservation laws all the way up to chemical kinetics, without heavy stress on theory and is designed to accompany traditional larger core texts. The course presents the basic principles and techniques of chemical engineering processes and helps readers identify typical problems and how to solve them. Focus is on the use of systematic algorithms that employ numerical methods to solve different chemical engineering problems by describing and transforming the information. MATLAB and Excel® are used to solve many examples and the more than 70 real examples throughout the course include computer or hand solutions, or in many cases both.

Objectives of the Course:

-To provide a clear and succinct coverage of the basic principles and computational aspects of chemical engineering.

-To work in a simulated industrial environment, with emphases on teamwork, open-ended problem solving, project-style report writing, and effective oral communications.

- To provide hands-on operating experience with typical chemical engineering equipment and to obtain experience with using computers.

- To provide an understanding of, and practice with, the use of statistics and data interpretation with real experimental data.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	-Understand and correctly implement unit conversions in process calculations. -Understand and apply theoretical knowledge towards problem solving. -Analyze and solve elementary material balances in physical and chemical processes.	1,3,4
2	-Analyze and solve elementary energy balances in reactive and non-reactive processes. -Formulate and solve combined material and energy balances. -Realize the relevance of thermodynamics in process calculations. -Carry out complex process calculations using MS Excel.	1,2,3,4

3	-Formulate and solve simple and moderately complex process calculations associated to industrially prominent chemical processes and technologies. -Conceptualize an integrated methodology that encompasses the knowledge in other subjects (Physical Chemistry, Thermodynamics and Mathematics) and MS Excel for a systematic and structured approach towards chemical process calculations.	2,3,4
4	-Analyze chemical processes through the power of modeling and computation. These include back-calculation methods, inventory losses and revenue related assessment etc	3,4
5	-Learn the application of various thermodynamic laws for the analysis of chemical processes. -Learn the application of the laws of thermodynamics for hydrocarbon (both liquid and gas) characterization, handling, storage and transport.	1,3,4
Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm 4. Quiz		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	4
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	3
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	4
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	5
5	Ability to develop design and scientific-technological solutions in the field of design, modeling and optimization of refining and petrochemical processes, as well as apply the acquired knowledge to improve the management system of the oil refining industry.	4
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	4
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modeling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	1
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research	3

	methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	3
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	4

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

Course Contents

Week	Chapter	Topics	Exam
1	[I, II] Chapter 3,4	Introduction to Subject	
2	[I, II] Chapter 2	An Insight into Chemical Engineering and Process Descriptions of Refinery Processes Seminar: Introduction to Subject	
3	[II] Chapter 3	Introductory Concepts: System of Units, Process Variables, Gas Laws	
4	[II] Chapter 3,4	Basic Principles and Introduction to Calculations: The Two Building Blocks of Chemical Engineering: Unit Operation and Unit Processes Seminar: An Insight into Chemical Engineering and Process Descriptions of Refinery Processes	
5	[I] Chapter 4	Role of Material and Energy Balances, Thermodynamics, and Kinetics: Basic Definitions	
6	[II] Chapter 5	Conversion of Physical Events and Principles to Mathematical Formula Seminar: Basic Principles and Introduction to Calculations:	
7	[I] Chapter 8	Numerical Methods and Chemical Engineering Computations: Basic Definitions and Introductory Remarks	

8			Midterm
9	[II] Chapter 6	Areas and Domain of Numerical Methods Seminar: Role of Material and Energy Balances, Thermodynamics, and Kinetics: Basic Definitions	
10	Book [II] Chapter 7	The Approach to Solve Problems by Computers	
11	[I] Chapter 7	Model Development and Mathematical Formulation Seminar: Conversion of Physical Events and Principles to Mathematical Formula	
12	[I] Chapter 9	Model Development and Mathematical Formulation Applications	
13	[II] Chapter 6	Reaction Kinetics, Chemical Reactors, and Thermodynamics Seminar: The Approach to Solve Problems by Computers	
14	[I] Chapter 5	Fundamentals of Reaction Kinetics	
15	[II] Chapter 7	Applications of Differential Equations Seminar: Model Development and Mathematical Formulation	
16	[II] Chapter 8	Make up Experiment	Final

Recommended Sources

TEXTBOOK

1. Bali N. P. , Narayana Iyengar N. Ch. , Laxmi Publications, Engineering mathematics , 2004, 590 pages

2. Austin D. G., *Chemical Engineering Drawing Symbols* (London: George Godwin), John Wiley & Sons - New York, 2002,104 pages,

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	

Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan Ministry of Education for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	**Number**	**Duration (hour)**	**Total Workload(hour)**
Course duration in class	**14**	**3**	**42**
Presentation	1	12	12
Self-study	14	5	70
Tutorials	14	1	10
Midterm Examination	1	3	3
Preparation for midterm exam	1	14	14
Final Examination	1	3	3
Preparation for final exam	1	28	28
Total Workload			**180**
Total Workload/30(h)			**180/30**
ECTS Credit of the Course			**6**

Chemical engineering (CHEN) master program, Department of “Petrochemical Technology and Industrial Ecology”.

Course Unit Title	**Modern processing technology of lubricants**
Course Unit Code	**ENG 1107**
Type of Course Unit	Compulsory
Level of Course Unit	1st year CHEN master program
National Credits	-
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	2
Practice (hour/week)	-
Laboratory (hour/week)	1
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	AynuraAliyeva
Name of Lecturer (s)	Aynura Aliyeva
Name of Assistant (s)	-
Mode of Delivery	Face to Face , laboratory
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

Almost all modern machines require the use of a lubricant. Power generation in such equipment is achieved by the use of engines that mostly comprise metal parts that move against one another. In many cases, there is metal to metal contact that leads to the generation of friction and heat, which results in wear. The extent of wear in equipment depends upon the degree of the metal-to-metal contact, either due to the equipment design or the nature of the operation However, the parts that are designed to have intimate metal-to-metal contact, such as gears and bearings, wear due to friction is extensive. With respect to the effect of equipment operation on wear, high speed, low-load operation leads to lower wear than slow speed, high-load operation. This is because in the former case there is minimal metal-to-metal contact. A lubricant can be a solid, liquid, or gas, and lubrication is its primary function. The usual objective of the lubrication is to lubricate surfaces to minimize direct metal-to-metal contact and, hence, reduce friction and wear. The course aim is to present comprehensive information regarding the review of lubricant chemistry, technology, selection, and design.

Objectives of the Course:

This course deals with fundamentals of lubrication. It covers the lubricant functions, nature and composition of the lubricants market, concepts of friction, lubrication, viscosity, and wear, lubricant types, and lubricant selection, performance specifications, and composition. A description of the lubricant classes and additives is also provided. Course describes petroleum composition and the oil field and refinery chemicals that are used to facilitate petroleum drilling to extract crude petroleum from beneath the earth's surface and refine it to yield value-added products, such as fuels, lubricant base stocks, and petrochemicals. The course also focuses on many of the refinery processes in some detail to explain the manner in which the hydrocarbon cuts from petroleum with suitable properties for use as lubricant base stocks are obtained. Moreover,non-petroleum lubricant base stocks, the chemistry, manufacture and properties of the chemicals that are used in lubricants as additives, combustion engine lubricants, fuel additives, hydraulic and transmission fluids, industrial lubricants are also discussed.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	understand the fundamentals of lubrication	1,2,3,5
2	understand lubricant functions, nature and composition of the lubricants, concepts of friction, lubrication, viscosity and wear	1,2,3,4
3	explain the chemistry, manufacture and properties of the chemicals that are used in lubricants as additives	1,3.5
4	explain lubricant types and lubricant selection	1, 3
5	understand the main principles of additive technology that is used in petroleum refining and fuels	1,2,3

Assessment Methods: 1. Final Exam, 2. Midterm 3. Presentation, 4. Laboratory 5. Quiz

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	4
2	Ability to analyze and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	3
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	5
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	4
5	Ability to develop design and scientific-technological solutions in the field of design, modeling and optimization of refining and petrochemical processes, as well	4

	as apply the acquired knowledge to improve the management system of the oil refining industry.	
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	3
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modeling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	3
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	5

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

Course Contents

Week	Chapter	Topics	Exam
1	Book I. Chap.[1] p.1	**Lubrication fundamentals** Introduction. Friction and lubrication. Viscosity and wear. Viscosity.	
2	Book I. Chap.[1] p.18	**Lubrication fundamentals** Wear. Types of Lubricants. Lubricant Selection and Specifications. Lubricant composition. **Laboratory work 1. Safety rules**	
3	Book 2. Chap.[1] p.3	**Base oils from petroleum** Introduction. Crude oil selection for base oil manufacture. Base oil manufacturing methods.	
4	Book I. Chap.[2] p.23	**Mineral base oils.** Petroleum composition. Petroleum Refining. Refinery Processes. **Laboratory work 2. Determination of kinematic viscosity of lubricants**	

		In the laboratory work following equipments and materials are used: Viscometer, thermostat, rubber tube, rubber bulb, lubricants. The main objective of laboratory work is to define kinematic viscosity of lubricants.	
5	Book I Chap.[2] p.23	**Mineral base oils.** Refinery Processes. Refinery Process Chemicals. Lubricant Base Stocks. Base Oil Properties.	
6	Book I Chap [3] p.47	**Synthetic Base Stocks** Synthetic Base Stocks. Synthetic Hydrocarbon Polymers. Carboxylate Esters. Other synthetic base stocks. **Laboratory work 3. Treatment of base oils by adsorption method** In the laboratory work following equipments and materials are used: three-necked flask, reflux condenser, stirrer, Buchner funnel, Bunsen flask, refractometer, viscometer, pycnometer, electric heaters, silica gel, base oil distillates (fr. 360-420°C, fr. 420-490°C, fr. above 490°C), ethyl alcohol. The main objective of laboratory work is to study the removal of resinous (asphaltenes) substances from the base oils, the feedstock and the purified product analyze.	
7	Book I Chap [4] p.100	**Lubricant additives.** Desirable Lubricant Properties. Criteria For Suitable Base Stocks. Performance Additives. Stabilizers/Deposit Control Agents. Oxidation Inhibitors.	
8			Midterm
9	Book 2 Chap. [7] p.213	**Dispersants. Detergents.** Introduction to Detergents. **Laboratory work 4. Treatment of base oils by adsorption method** In the laboratory work following equipments and materials are used: three-necked flask, reflux condenser, stirrer, Buchner funnel, Bunsen flask, refractometer, viscometer, pycnometer, electric heaters, silica gel, base oil distillates (fr. 360-420°C, fr. 420-490°C, fr. above 490°C), ethyl alcohol.	

		The main objective of laboratory work is to study the removal of resinous (asphaltenes) substances from the base oils, the feedstock and the purified product analyze.	
10	Book 2 Chap. [6] p.189	**Miscellaneous Additives and Vegetable Oils** Organic Friction Modifiers. Demulsification. Antifoams.	
11	Book 2 Chap. [9] p.293 Book I Chap.[5] p.212	**Formulation of Automotive Lubricants** Passenger Car Engine Oil. Formulation and Functions of a Passenger Car Engine Oil. Combustion engine lubricants. Types of engines and mode of their operation. **Laboratory work 5. Preparation of commercial oils with improved properties.** In the laboratory work following equipments and materials are used: three-necked flask, reflux condenser, stirrer, Buchner funnel, Bunsen flask, technical scales, measuring cylinders 100 ml, refractometer, viscometer, pycnometers, oil distillates (fr. 360-420°C, fr. 420-490°C, fr.above 490°C), ethyl alcohol. The main objective of laboratory work is production of commercial oils by mixing distillate and residual components and introducing additives into them that improve the certain performance properties of commercial oils.	
12	Book I Chap. [6] p.322	**Fuel additives.** Deposit Control Additives/Cleanliness Agents. Fluidizers. Anti-icing Agents. Octane Improvers.	
13	Book 2 Chap. [8] p.239	**Industrial Lubricants** General Aspects of Industrial Lubricants. Compressor Lubricants **Laboratory work 6. Preparation of commercial oils with improved properties (Compounding).** In the laboratory work following equipments and materials are used: three-necked flask, reflux condenser, stirrer, Buchner funnel, Bunsen flask, technical scales, measuring cylinders, refractometer, viscometer, pycnometers, oil distillates (fr.360-420°C, fr. 420-490°C, fr. above 490°C), The main objective of laboratory work is production of commercial oils by mixing distillate, residual components and introducing	

		additives into them that improve the certain performance properties of oils.	
14	Book 2 Chap. [8] p.239 Book I Chap. [9] p.410	**Industrial Lubricants** Lubricants for Refrigerators. Vacuum Pump Lubricants Turbine Lubricants.	
15	Book I Chap. [10] p.443 Book 2 Chap. [14 p.411	**Lubricating greases .** Grease Chemistry. Additives. Desirable Grease Properties. Applications involving lubricating greases. **Laboratory work 7. Preparation of commercial oils with improved properties (Compounding).** In the laboratory work following equipments and materials are used: three-necked flask, reflux condenser, stirrer, Buchner funnel, Bunsen flask, technical scales, measuring cylinders 100 ml, refractometer, viscometer, pycnometers, oil distillates (fr.360-420°C, fr. 420-490°C, fr. above 490°C). The main objective of the laboratory work is production of commercial oils by mixing distillate and residual components and introducing additives into them that improve the certain performance properties of oils.	
16			Final

Recommended Sources

TEXTBOOK

1. Sunggyu Lee, James G.Speight, SudarshanK.Loyalka " *Handbook of alternative fuel technologies*", CRC Press, Taylor and Francis Group 6000 Broken Sound Parkway NW, Suite 300, Boca Raton, 2015,674 p

2. Roy M. Mortier · Malcolm F. Fox · Stefan T. Orszulik " Chemistry and Technology of Lubricants", 576 .p

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	

Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU.

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class	**14**	**3**	**42**
Presentation	1	12	12
Self-study	14	5	70
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	14	14
Final Examination	1	3	3
Preparation for final exam	1	25	25
Total Workload			**180**
Total Workload/30(h)			**180/30**
ECTS Credit of the Course			**6**

Chemical engineering (CHEN) master program, Department of "Petrochemical Technology and Industrial Ecology"

Course Unit Title	**Modern technology of catalytic processes in oil refining**
Course Unit Code	**ENG 1208**
Type of Course Unit	Compulsory
Level of Course Unit	1st year CHEN master program
National Credits	-
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	2
Practice (hour/week)	-
Laboratory (hour/week)	1
Year of Study	1
Semester when the course unit is delivered	2
Course Coordinator	Aynura Aliyeva
Name of Lecturer (s)	Aynura Aliyeva
Name of Assistant (s)	-
Mode of Delivery	Face to Face, laboratory
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

Modern civilisation cannot think of a day without petroleum and petrochemicals. Petroleum fuels, such a gasoline and diesel, are the major fuels for all transportation vehicles. Commodities manufactured from petrochemicals, for example, plastics, rubbers and synthetic fibres derived from petroleum, have become part and parcel of our daily life.Transportation of goods in many parts of the world depend almost completely on petroleum fuels, such as gasoline, jet fuel, diesel fuel, and marine fuel. Apart from the fuels, materials that are necessary for operating the combustion engines of cars, trucks, planes, and trains also come from petroleum. These materials include lubricating oils (motor oils), greases, tires on the wheels of the vehicles, and asphalt to pave the roads for smooth rides in transportation vehicles. All petroleum fuels and many materials are produced by processing of crude oil in petroleum refineries. Petroleum refineries also supply feedstock to the petrochemicals and chemical industry for producing all consumer goods from rubber and plastics (polymers) to cosmetics and medicine. This course addresses basic principles of catalytic processes in oil refining, existing techniques and modern technology of catalytic processes in oil and gas industry, such as catalytic cracking, catalytic reforming, catalytic alkyllation, catalytic isomerization and other processes.

Objectives of the Course:

Course presents an overview of petroleum refinery, oil and gas products, hydrocarbon chemistry, physico-chemical and other properties, fuel product quality, desalting of crude oil, introduction to catalytic processes. Each data; process is presented covering configuration, operating description and conditions, feedstock and catalyst selection, stream yields and properties, the characteristics feedstock, process parameter relationships and their effect on unit performance and yields. The main objective point of this subject is to study and identify oil and oil products obtaining from different destructive processes, their physico-chemical properties, use of oil products in the oil and gas industry, obtaining desirable feedstocks for petrochemical synthesis, obtaining of oil products by different technological methods, significance of these processes in petroleum refining fields.

Learning Outcomes

	At the end of the course the student will be able to	Assessment
1	define the significant properties of crude oil, including density, viscosity, average boiling point, sulfur, and salt content	1,2,4
2	distinguish and evaluate the functions of different refinery processes to control refinery product yield and composition	1,3
3	explain the role of different catalytic processes	1,2,3.5
4	explain major differences between thermal and catalytic processes	1,2,3
5	understand the main principles both primary and secondary processes	1,2,3
6	understand and explain the impact of each process on environment	1,2,3,5

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm 4. Laboratory 5. Quiz

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	4
2	Ability to analyze and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	3

3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	5
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	4
5	Ability to develop design and scientific-technological solutions in the field of design, modeling and optimization of refining and petrochemical processes, as well as apply the acquired knowledge to improve the management system of the oil refining industry.	4
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	3
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modeling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	3
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	5
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	Book I. Chap.1	**Introduction.** Introduction to petroleum refinery. Characterization of crude oil. Composition of crude oil. Hydrocarbon Groups. Complex Hydrocarbons. Non-hydrocarbon constituents. (Sulfur compounds, nitrogen compounds, oxygen compounds,) Unsaturated hydrocarbons. Metallic Constituents	
2	Book I Chap.2	**Petroleum products** Domestic fuels. Liquified petroleum gas. Kerosene. Automotive fuels. Octane number. Diesel fuels. Cetane number. Lubricating oil. Miscellaneous products.	

		Laboratory work 1. Laboratory safety	
3	Book I Chap.2	**Petroleum products** Aviation fuels. Furnace fuels. Lubricating oils. Carbon black feed stock. Bitumen. Lube oil. Petroleum coke.	
4	Book II Chap.14 Book III Chap.4	**Introduction to refining processes.** Dewatering and desalting. Distillation: Atmospheric distillation. Vacuum distillation. **Crude Distillation** Fractionation. Operation of crude distillation units. Crude oil desalting. Vacuum distillation. **Laboratory work 2. Determination of main parameters of petroleum products** In the laboratory work following equipments and materials are used: Viscosimeter, areometer, pycnometer, Abel-Pensky's flash point apparatus, Dean–Stark apparatus, petroleum products. The main objective of laboratory work is to define kinematic viscosity, density, flash point, the amount of water.	
5	Book II Chap.14 Book III Chap.4	**Crude Distillation.** Atmospheric and vacuum distillation: Atmospheric distillation. Vacuum distillation. Equipment. One fold evaporation unit. Two fold evaporation unit. Unit with pre-evaporator. Combinated-atmospheric vacuum unit.	
6	Book IV Chap.4 Book III Chap.6	**Introduction to Refining Processes .** Thermal Processes. Thermal Cracking . Visbreaking. Coking **Thermal cracking and coking.** Introduction. Coke formation. Visbreaking. Coal visbreaker and soaker visbreaker. Process description. Delayed coking. **Laboratory work 3.** Catalytic cracking process In the laboratory work following equipments and materials are used: burette for feeding raw materials, reactor, heater, condenser, receiver, gasometer, flask, thermometer, thermocouple, latr, potentiometer, funnel, gas-water separator, wide vacuum distillate.	

		The main objective of laboratory work is to obtain high octane number of gasoline.	
7	Book III Chap.6	**Thermal cracking and coking.** Fluid coking and Flexicoking processes.	
8			Midterm
9	Book IV Chap.4 Book III Chap.8	**Introduction to Refining Processes .** Catalytic Processes. Catalytic Cracking. Catalysts. **Fluidised catalytic cracking process** Introduction. Role of FCC in the refinery.Feedstock and products. **Laboratory work4.** Catalytic cracking process In the laboratory work following equipments and materials are used: burette for feeding raw materials, reactor, heater, condenser, receiver, gasometer, flask, thermometer, thermocouple, latr, potentiometer, funnel, gas-water separator, wide vacuum distillate. The main objective of laboratory work is to obtain high octane number of gasoline.	
10	Book IV Chap.4 Book III Chap.5	**Introduction to Refining Processes .** Reforming Processes. Catalytic Reforming. Catalysts. **Catalytic reforming and isomerization.** Introduction. Catalytic reforming feedstock. Role of reformer in the refinery. Reforming reactions.	
11	Book IV Chap.4 Book III Chap.5	**Introduction to Refining Processes .** Isomerization Processes. Catalysts **Catalytic reforming and isomerization** Isomerization of light naptha. Isomerization reactions. Isomerization catalyst. Isomerization yield. **Laboratory work 5.** Catalytic cracking process In the laboratory work following equipments and materials are used: burette for feeding raw materials, reactor, heater, condenser, receiver, gasometer, flask, thermometer, thermocouple, latr, potentiometer, funnel, gas-water separator, wide vacuum distillate	

		The main objective of laboratory work is to obtain high octane number of gasoline.	
12	Book IV Chap.4 Book III Chap.10	**Introduction to Refining Processes .** Alkylation Processes. Catalysts **Alkylation.** Introduction. Role of alkylation and polymerization units in the refinery. Alkylation processes.	
13	Book III Chap.7 Book II Chap.22	**Hydroconversion.** Hydrotreating. Objectives of hydrotreating. Role of hydrotreating. Chemistry of hydrotreating. Hydrotreating processes. **Hydrogen production.** Introduction. Processes requiring hydrogen: Hydrotreating and hydrocracking. Feedstocks. Process chemistry. **Laboratory work 6.** Catalytic alkylation process**.** In the laboratory work the following equipments and materials are used: three-necked flask, mixer, funnel, reactor, thermometer, benzene, olefin, sulfuric acid. The main objective of laboratory work is to obtain alkylate.	
14	Book III Chap.7	**Hydroconversion.** Hydrocracking. Role of hydrocracking in the refinery. Feeds and products. Hydrocracking catalysts.	
15	Book III Chap.12	**Clean fuels.** Introduction. Specifications of clean fuels. **Laboratory work 7.** Catalytic alkylation process**.** In the laboratory work the following equipments and materials are used: three-necked flask, mixer, funnel, reactor, thermometer, benzene, olefin, sulfuric acid The main objective of laboratory work is to obtain alkylate.	
16			Final
Recommended Sources **TEXTBOOK**			

1. Uttam Ray Chaudri *Fundamentals of petroleum and petrochemical engineering*., 2011
2. James G. Speight " *The chemistry and technology of petroleum"*, 2006
3. M. A. Fahim, T. A.Alsahhaf, A.,S.Elkilani "Fundamentals of petroleum refining", 2010
4. James G. Speight *Handbook of Petroleum Refining,* 2017, p.727

REFERENCES

I Robert A. Mayers " Hand book of petroleum refining process"

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	10%	
Quiz	10%	
Laboratory	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU.

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class	**14**	**3**	**42**
Presentation	1	8	8
Self-study	14	5	70
Tutorials	14	1	14
Midterm Examination	1	3	3

Preparation for midterm exam	1	12	12
Final Examination	1	3	3
Preparation for final exam	1	28	28
Total Workload			**180**
Total Workload/30(h)			**180/30**
ECTS Credit of the Course			**6**

Chemical engineering (CHEN) program, Department of "Petrochemical Technology and Industrial Ecology".

Course Unit Title	**Non-traditional separation**
Course Unit Code	**ENG 3014**
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Sultanova Gülnarə
Name of Lecturer (s)	Sultanova Gülnarə
Name of Assistant (s)	-
Mode of Delivery	Face to Face, seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

This course advances your learning and experience in experimental aspects of a number of areas of chemical engineering. Both fundamental aspects, such as kinetics and reaction engineering, process control, thermodynamics of separation operations and Mass transfer as well as more applied topics will be covered. The course will not only serve to reinforce fundamental principles of chemical engineering, but also to the application of the technology. The course emphasizes and reinforces topics and principles introduced in lectures through experiential learning with practical work in general. In successfully completing the course you will develop report- writing skills and the ability to critique experimental data and techniques.

Objectives of the Course:

-To work in a simulated industrial environment, with emphases on teamwork, open-ended problem solving, project-style report writing, and effective oral communications.

- To provide hands-on operating experience with typical chemical engineering equipment and to obtain experience with heat transfer, fluid flow, separations, thermodynamics and reacting systems.

- To provide experience with planning and implementing experiments. - To review and practice chemical engineering principles.

- To provide an understanding of, and practice with, the use of statistics and data interpretation with real experimental data.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Introduction: The role of separation in chemical and biochemical industries a. Industrial chemical processes b. b. Basic separation techniques	1,3,4
2	Thermodynamics of separation operations a. Thermodynamics of laws b. Energy, entropy c. Phase equilibria	1,2,3,4
3	Absorption processes a. The differences among physical absorption b. Chemical absorption c. Equipment for vapour-liquid separation	2,3,4

4	Flash distillation. a. Distillation b. Basic method of flash distillation c. c. Binary flash distillation	3,4
5	Adsorption process a. Industrial application of sorption operations b. Sorbents, adsorbents	1,3,4
Assessment Methods: 1. Final Exam, 2. Presentation, 3. Seminars 4. Quiz		
Course's Contribution to Program		
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	4
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	3
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	4
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	5
5	Ability to develop design and scientific-technological solutions in the field of design, modelling and optimization of refining and petrochemical processes, as well as apply the acquired knowledge to improve the management system of the oil refining industry.	4
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	4
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modelling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	1
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	3
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	3

10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.		1
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)			
Course Contents			
Week	Chapter	Topics	Exam
1	[I] Chap.1 p-2	**Separation processes** The role of separation operations in the chemical and biochemical industries. Industrial chemical processes. Basic separation techniques	
2	[I] Chap.1 p-2	**Separation processes** Separation by phase addition, by barriers. Separation by solid agents. Separation factor. **Seminar 1**. Separation processes	
3	[I] Chap.2 p-35	**Thermodynamics of separation operations** Thermodynamic laws. Energy, entropy and availability balances around a separation process.	
4	[I] Chap.2 p-35	**Thermodynamics of separation operations** Vapour-liquid equilibrium. Vapor-liquid equilibrium. Thermodynamic description of vapour-liquid equilibrium. Raoul's laws. **Seminar 2**. Thermodynamics of separation operations	
5	[I] Chap.3 p-85	**Mass transfer** Relationship between mass transfer and phase equilibrium. Concept of equilibrium. Mass transfer	
6	[I] Chap.6 p-206	**Separations by phase addition or creation** The differences among physical absorption, chemical absorption and stripping. **Seminar 3.** Absorption process	
7	[III] Chap.9	**Distillation and stripping** Process distillation and stripping. Batch distillation. Boiling point and equilibrium diagrams. Continuous distillation	
8			Midterm

9	[II] Chap.2 p-13	**Flash distillation** Distillation. Basic methods of flash distillation. **Seminar 4.** Distillation process	
10	[I] Chap.7 p-258	**Distillation of binary mixtures** Binary distillation. Equipment and design consideration. Design and analyses factors.	
11	[III] Chap.10 Book 1 Chap.8	**Extraction** Extraction principles. Extraction process **Liquid-liquid extraction.** Liquid-liquid extraction. Equipment for solvent extraction. Mixer-Settlers. **Seminar 5.** Extraction. Liquid-liquid extraction.	
12	[I] Chap.8 p-299	**Liquid-liquid extraction** Centrifugal extractors. General design considerations. Advantages and disadvantages of different extraction equipment.	
13	[I] Chap.14 p-500	**Membrane separations** Membrane processes. Industrial membrane separation processes. **Seminar 6.** Membrane separations	
14	[I] Chap.14 p-568	**Adsorption process** Industrial application of sorption operations. Sorbents. Adsorbents	
15	[I] Chap.16 p-650	**Leaching and washing** Leaching (liquid-solid extraction). Equipment for leaching. **Seminar 7.** Adsorption process. Leaching and washing	
16			Final

Recommended Sources

TEXTBOOK(S)

1. Seader J.D., Henley E.J., Separation process Principles. Second edition. John Wiley & Sons, New Jersey, 2006

2. Philip C. Wankat, Separation Process Engineering, Third Edition, John Wiley & Sons, 2011
3. Uttam Ray Chaudri, Fundamentals of petroleum and petrochemical engineering, 2011

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU.

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class	**14**	**3**	**42**
Presentation	1	8	8
Self-study	14	5	70
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	12	12
Final Examination	1	3	3
Preparation for final exam	1	28	28
Total Workload			**180**

Total Workload/30(h)	**180/30**
ECTS Credit of the Course	**6**

Chemical engineering (CHEN) master program, Department of "Petrochemical Technology and Industrial Ecology".

Course Unit Title	**3 D design of petroleum refinery**
Course Unit Code	**ENG 3013**
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Aytan Mammadova
Name of Lecturer (s)	Aytan Mammadova
Name of Assistant (s)	-
Mode of Delivery	Face to Face, seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

The development of refining and petro-chemical industries in the country has made it compulsory for the chemical engineers to understand important aspects of petroleum refining and petrochemical technology. Petroleum refining as well as petrochemical industries constitute a major part of chemical sector. Every chemical engineer has to invariably handle the enormous consumption of petroleum products, their diversity and increasing applications. Chemical engineer has to apply the relevant concepts for operating petroleum refinery or petrochemical plant in a smooth and safe manner. Beside this, a chemical engineer must be aware about the various properties of petroleum fractions as well as petrochemicals. Hence, this course has been designed to develop such expertise and skills in A method for drawing consistent process flow diagrams and operator training systems and 3-D graphic process representations are used to train operators and engineers.

Objectives of the Course:

- Overview of the operations of a typical Refinery.

. Petroleum products specification and their relevance to product performance.

Physical and chemical principles involved and how they are utilized in these operations.

Major insights into the technology, economics and major trends of the petroleum refining industry.

To learn How operator training systems and 3-D graphic process representations are

used to train operators and engineers

-to provide an understanding of, the basics of chemical plant design and process economics

- To provide an understanding of, and practice with, the use of statistics and data interpretation with real experimental data.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	an ability to design and conduct experiments, as well as to analyze and interpret data an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability √	1,3,4
2	an ability to function on multidisciplinary teams an ability to identify, formulate, and solve engineering problems an understanding of professional and ethical responsibility an ability to communicate effectively the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	1,2,3,4
3	a recognition of the need for, and an ability to engage in life-long learning a knowledge of contemporary issues an ability to use the techniques, skills, an skills, and modern engineering tools necessary for engineering practice	2,3,4
4	explain waste water treatment using ion exchange systems a.defines ion exchange types. recognises the ion exchange type that they use in experiment c.tells what they know about ion exchange topic. d.does an ion exchange experiment e.calculates the results of experiment	3,4

	f.questions of results of this experiment g.proposes different options for better treatment results.	
5	perform crushing and sieving in a laboratory-scale system and calculate values of physical properties of mixtures. a. Performs size reduction by crushing in a laboratory scale crusher. b.Separates a mixture into its different sized components by using a laboratory scale sieving machine.	1,3,4

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm 4. Quiz

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	4
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	3
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	4
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	5
5	Ability to develop design and scientific-technological solutions in the field of design, modeling and optimization of refining and petrochemical processes, as well as apply the acquired knowledge to improve the management system of the oil refining industry.	4
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	4
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modeling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	1
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	3

9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	3
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	4
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	[I, II] Chapter 3,4	Introduction to Subject	
2	[I] Chapter 4	Composition of Crude Oils and Petroleum Products Seminar: Introduction to Subject	
3	[II] Chapter 5	Characterization of Petroleum and Petroleum Fractions	
4	[II] Chapter 5	Process Descriptions of Refinery Processes Seminar: Composition of Crude Oils and Petroleum Products	
5	[II] Chapter 5	Property Requirements for Refinery Process Models	
6	[II] Chapter3	Atmospheric or Crude Distillation Unit (CDU) Model Development Seminar: Characterization of Petroleum and Petroleum Fractions	
7	[II] Chapter 8	Predictive Modeling of the Fluid Catalytic Cracking (FCC) Process	
8			Midterm
9	[I] Chapter 8	Predictive Modeling of Continuous Catalyst Regeneration (CCR) Reforming Process Model development	

		Seminar: Process Descriptions of Refinery Processes	
10	[II] Chapter 4,9	Chemical Plant Design: Block Flow Diagram (BFD)	
11	[I] Chapter 7	Piping and Instrumentation Diagram (P&ID) Seminar: Chemical Plant Design: Block Flow Diagram (BFD)	
12	[II] Chapter 4	Three-Dimensional Representation of a Process The 3-D Plant Model	
13	Book [II] Chapter 6	Operator and 3-D Immersive Training Simulators Operator Training Simulators (OTS) Seminar: Three-Dimensional Representation of a Process The 3-D Plant Model	
14	[I] Chapter 5	3-D Immersive Training Simulators (ITS) Linking the ITS with an OTS	
15	[II] Chapter 5, 6	Chemical Plant Design and Process Economics Cost and Asset Accounting, Cost Estimation Seminar: 3-D Immersive Training Simulators (ITS) Linking the ITS with an OTS	
16			Final

Recommended Sources

TEXTBOOK

1.Nelson, W.L., Petroleum Refining Engineering, McGraw Hill, 4th edition, New York, New York, 1991, 960 pages,

2. Max S. Peters, Klaus D. Timmerhaus, Plant Design And Economics For Chemical Engineers International Edition New York : McGraw-Hill, - McGraw-Hill chemical engineering series, 1991, 910 pages

Assessment		
Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan Ministry of Education for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	**Number**	**Duration (hour)**	**Total Workload(hour)**
Course duration in class	**14**	**3**	**42**
Presentation	1	12	12
Self-study	14	5	70
Tutorials	10	1	10
Midterm Examination	1	3	3
Preparation for midterm exam	7	2	14
Final Examination	1	3	3
Preparation for final exam	1	28	28
Total Workload			**180**

Total Workload/30(h)	**180/30**
ECTS Credit of the Course	**6**

Chemical engineering (CHEN) master program, Department of "Petrochemical Technology and Industrial Ecology".

Course Unit Title	**Raw materials and products of oil refining industry**
Course Unit Code	**ENG 3019**
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Ramil Sadigov
Name of Lecturer (s)	Ramil Sadigov
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-
Course description: The development of refining and petro-chemical industries in the country has made it compulsory for the chemical engineers to understand important aspects of petroleum refining and petrochemical technology. Petroleum refining as well as petrochemical industries constitute a major part of chemical sector. Every chemical engineer has to invariably handle the enormous consumption of petroleum products, their diversity and increasing applications.	
Objectives of the Course:	

- After successful completion of the course, student will be able to - explain fundamentals of petroleum refinery & various petrochemical plants. - build the flow Sheets of various petrochemicals. - analyse the basic properties of petroleum products. - evaluate various catalytic conversion processes. - adapt the recent developments in area of petroleum refining and petrochemical synthesis. -to provide an understanding of, the basics of chemical plant design and process economics - To provide an understanding of, and practice with, the use of statistics and data interpretation with real experimental data.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	to design and conduct experiments, as well as to analyze and interpret data to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	1,3,4
2	to function on multidisciplinary teams to identify, formulate, and solve engineering problems an understanding of professional and ethical responsibility to communicate effectively the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	1,2,3,4
3	to recognition of the need for, and an ability to engage in life-long learning knowledge of contemporary issues to use the techniques, skills, an skills, and modern engineering tools necessary for engineering practice	2,3,4
4	to explain waste water treatment using ion exchange systems and defines ion exhange types.	3,4

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm, 4. Quiz

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	4

2	Ability to analyze and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	3
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	5
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	4
5	Ability to develop design and scientific-technological solutions in the field of design, modeling and optimization of refining and petrochemical processes, as well as apply the acquired knowledge to improve the management system of the oil refining industry.	4
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	3
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modeling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	3
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	5
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents			
Week	Chapter	Topics	Exam
1	[I,II] Chapter 3,4	Introduction to Subject	
2	[I] Chapter 4	Composition of Crude Oils and Petroleum Products Seminar: Introduction to Subject	

3	[II] Chapter 5	Characterization of Petroleum and Petroleum Fractions	
4	[II] Chapter 5	Processing of petroleum: Atmospheric & Vacuum distillation Seminar: Composition of Crude Oils and Petroleum Products	
5	[II] Chapter 5	Treating operations for crude and refinery products	
6	[II] Chapter3	Thermal & Catalytic Cracking Seminar: Treating operations for crude and refinery products	
7	[II] Chapter 8	Thermodynamics & Kinetics Consideration & Major Engineering Problems for following Petrochemicals	
8			Midterm
9	[I] Chapter 8	Petrochemicals: Petrochemicals Obtained from Methanol, Formaldehyde, Chloromethane Seminar: Thermal & Catalytic Cracking	
10	[II] Chapter 4,6	Petrochemicals : Petrochemicals obtained from Ethylene, Ethanolamine, Ethylene Dichloride, Vinyl Chloride, Ethylene Oxide, etc. Thermodynamics & Kinetics Consideration & Major Engineering Problems for following Petrochemicals	11
11	[I] Chapter 7	Aromatic Petrochemicals: Petrochemicals Obtained from Propylene, ACN, Isopropanol, Seminar: Petrochemicals: Petrochemicals Obtained from Methanol, Formaldehyde, Chloromethane	

12	[II] Chapter 4	Aromatic Petrochemicals: Cunene, BTX Separation, Phenol, Styrene, Phthalic Anhydride etc.	
13	[II] Chapter 6	Polymers: PVC, LDPE, LLDPE, HDPE, Seminar: Petrochemicals: Petrochemicals Obtained from Methanol, Formaldehyde, Chloromethane	13
14	[I] Chapter 5	Polymers: Polypropylene, Polypropylene Co-polymers, Polystyrene, SBR, Polyesters, etc. Linking the ITS with an OTS	
15	[II] Chapter 5, 6	Make Up Experiment Seminar: Polymers: Polypropylene, Polypropylene Co-polymers, Polystyrene, SBR, Polyesters, etc.	
16	[II] Chapter 6	Make up Experiment	Final

Recommended Sources

TEXTBOOK

1. B. K.Bhaskar Rao, Modern Petroleum Refining Processes, Oxford and IBH, 2007 , 208 pages,

2. B.K.Bhaskar Rao, A Text on Petrochemicals, 5th Edition, Khanna Publishers, Delhi, 2004, 398 pages,

Assessment		
Attendance	0%	At least 75% class attendance results is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam

Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan Ministry of Education for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	**Number**	**Duration (hour)**	**Total Workload(hour)**
Course duration in class	**14**	**3**	**42**
Presentation	1	10	10
Self-study	14	5	70
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	10	10
Final Examination	1	3	3
Preparation for final exam	1	28	28
Total Workload			**180**
Total Workload/30(h)			**180/30**
ECTS Credit of the Course			**6**

Chemical engineering (CHEN) master program, Department of “Petrochemical Technology and Industrial Ecology”.

Course Unit Title	**Storage and efficient use of heat**
Course Unit Code	**ENG 3012**
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	6

Theoretical (hour/week)	2
Practice (hour/week)	1
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Sultanova Gulnara
Name of Lecturer (s)	Sultanova Gulnara
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

The course provides the student with a basic knowledge and understanding of the heat and including its history, technical aspects, and impact on society and the environment. This textbook will familiarize learner with the characteristics of Energy Resources, Potential for Production, Consumption, and ready them for compilation of Energy statistics. The book includes 4 units dealing with the above aspects At the end of the course, the student should be able to speak in a general way on all aspects of the industry and be familiar with common industry terminology.

Objectives of the Course:

Fundamental aspects related to energy storage and conversion, with focus on lithium ion batteries, supercapacitors, and fuel cells. Safety aspects, choice of materials, and experimental methods for evaluation and comparison of lithium ion batteries, supercapacitors, and fuel cells. Scientific and technical factors influencing electrochemical energy storage and conversion. Anode and cathode materials. Electrolyte aspects. Laboratory practical including for example analysis of charge- and discharge curves, polarisation, and impedance spectroscopy.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Analyse and evaluate short and long term energy storage	1,3,4
2	Explain and compare the function of batteries, fuel cells and super capacitors,	1,2,3,4
3	Describe and explain the most important scientific and technical factors influencing electrochemical energy storage and conversion,	2,3,4
4	Discuss safety aspects and environmental issues, and motivate the choice of material for lithium ion batteries, supercapacitors, and fuel cells,	3,4
5	Understand and implement professional and ethical standards.	1,3,4

Assessment Methods: 1. Final Exam, 2. Presentation 3. Midterm 4. Quiz		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	4
2	Ability to analyze and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	3
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	5
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	4
5	Ability to develop design and scientific-technological solutions in the field of design, modeling and optimization of refining and petrochemical processes, as well as apply the acquired knowledge to improve the management system of the oil refining industry.	4
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	3
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modeling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	3
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	5
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Wee k	Chapter	Topics	Exam

1	[1] Chap. 1,2 p-33	Introduction to subject	
2	[1] Chapter 3,4 p- 67	Different classes of Energy and different inputs for energy generation Seminar : Introduction to subject	
3	[2] Chap. 3,4 p-56	Different stages of energy storage	
4	[2] Chapter 4,5 p-77	Energy Reserves, Seminar : Different classes of Energy and different inputs for energy generation	
5	[1] Chap. 3,4,5 p-67-89	Energy Efficiency	
6	[2] Chapter 6,7 p-97	Energy commodity balance Seminar : Energy Efficiency	
7	[2] Chap.5,6 p-74	Nuclear energy	
8			Midterm
9	[2] Chapter 6,7,8 p-89	Solar energy, its use and storage Seminar: Nuclear energy	
10	[1] Chap.6 p-79		
11	[2] Chapter 5,6	Energy efficient consumption Seminar : Solar energy, its use and storage	

	p-88		
12	[2] Chapter 7 p-90	Renewable energy sources	
13	[1] Chapter 5	Energy Balance of Each Energy source Seminar : Energy efficient consumption	
14	[2] Chapter 7 p-93	Energy Balance of Each Energy source	
15	[1] Chapter 5,6,7 p-90	Solar power Seminar : Energy Balance of Each Energy source	
16			Final

Recommended Sources

TEXTBOOK(S)

1. Robert A. Huggins, Energy Storage, , Springer,2003. 600 p
2. Ryan O'Hayre et al., Fuel Cell Fundamentals, 2nd Edition, Wiley,2002, 407p

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU.

Course Policies

- Attendance of the course is mandatory.

- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload			
Activities	**Number**	**Duration (hour)**	**Total Workload(hour)**
Course duration in class	**14**	**3**	**42**
Presentation	1	8	8
Self-study	14	5	70
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	12	12
Final Examination	1	3	3
Preparation for final exam	1	18	18
Total Workload			**180**
Total Workload/30(h)			**180/30**
ECTS Credit of the Course			**6**

Chemical engineering (CHEN) master program, Department of “Petrochemical Technology and Industrial Ecology”.

“Technology of petrochemical synthesis” specialization

Course Unit Title	**Modern issues of chemical engineering.**
Course Unit Code	**ENG 1201**
Type of Course Unit	Compulsory
Level of Course Unit	1 st year master program
National Credits	-
Number of ECTS Credits Allocated	4
Theoretical (hour/week)	2
Practice (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	2
Course Coordinator	Ramil Sadiqov
Name of Lecturer (s)	Ramil Sadiqov
Name of Assistant (s)	-
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

Application of cost estimation, energy efficiency, and economic evaluation techniques. Teams analyze an existing facility, identify improvement opportunities, demonstrate the economic consequences, and recommend a course of action.

Objectives of the Course:

Mastery of process and project design principles applied to solving realistic industrial problems.

- Mastery of skills in process and project evaluation and management.
- Familiarity with the profit motive in industry, how it affects business decision-making, and how the chemical engineer fits into this process.
- Familiarity with open-ended project assignments in which students must define the appropriate scope, synthesize a variety of alternatives, design and cost the project, perform an economic evaluation, assess the risk, and make a presentation suitable for a management or other decisionmakers.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	To apply knowledge of mathematics, science, and engineering	1,3,4
2	To apply knowledge of math, science, engineering, and mass transfer principles to solve process and system problems.	1,2,3,4
3	To Design a system, component, equipment or process to meet desired mass transport needs.	2,3,4
4	To Identifying, formulating, and solving engineering and mass transfer problems, including continuous and staged contact equipment, and vapor-liquid equilibrium	3,4
5	To Understand and implement professional and ethical standards.	1,3,4

Assessment Methods: 1. Final Exam, 2. Presentation 3. Midterm 4. Quiz

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	4

2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	3
3	Ability to summarize, formulate, and solve complex problems related to the chemistry, technology, and research of the properties of organic compounds and industrial products based on them.	4
4	Ability to apply modern methods to solve scientific problems and develop new scientific research in the field of synthesis and modification of the properties of organic compounds.	5
5	Ability to develop concepts and scientific-technological solutions in the field of petrochemical and basic organic synthesis.	4
6	Ability to use creativity to develop new and improved methods of utilization of waste of petrochemical and organic synthesis, as well as methods of effective use of renewable energy sources.	4
7	The ability to identify, find and provide the necessary information, as well as to plan and conduct analytical, model and experimental studies of catalytic processes involving organic compounds.	1
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	4
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	3
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	4
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	[I] Chap. I	Introduction to the subject	
2	[II] Chap. I	Optimal design and operation of chemical processes	
3	[IV] Chap. II	Application of new technologies like bioengineering, genetic engineering, microelectronic processing	
4	[III]	Bioengineering and genetic engineering	

	Chap.III		
5	[I] Chap.IV	Microelectronic processing	
6	[IV] Chap.III	Nanotechnology	
7	[III] Chap.IV	Process control in chemical engineering	
8			Midterm
9	[III] Chap.V	Modelling and simulation	
10	Book [I] Chap.V	Systems engineering	
11	[II] Chap V	Advanced materials engineering	
12	[III] Chap. IV	Multifunctional reactions	
13	[III] Chap.I	Water engineering	
14	[II] Chap.III	Mass, momentum and energy balances for multiple systems with multiple reactions.	
15	[I] Chap.VI	Multifunctional reactors and their classification	
16			Final

Recommended Sources

TEXTBOOK(S)

1. Towler, G. and R. Sinnott, Chemical Engineering Design: Principles, Practice and Economics of Plant and Process Design, Butterworth-Heinemann (Elsevier), 2008, 430 pages,
2. Perry, R. H. and D. W. Green, Editors, Chemical Engineer’s Handbook, 8th Ed., McGraw-Hill, 2008, 340 p,
3. Reference: Turton, R., R.C. Bailie, W.B. Whiting and J.A. Shaeiwitz, Analysis Synthesis and Design of Chemical Processes, Prentice-Hall, 1998., 450 pages

4. Said Salaheldeen Elnashaie, Firoozeh Danafar, Hassan Hashemipour Rafsanjani Nanotechnology for Chemical Engineers, Springer. 2005, 390 p,

Authors :

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU.

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	**Number**	**Duration (hour)**	**Total Workload(hour)**
Course duration in class	**14**	**2**	**28**
Presentation	1	5	5
Self-study	14	3	42
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	10	10
Final Examination	1	3	3
Preparation for final exam	1	15	15
Total Workload			**120**

Total Workload/30(h)	**120/30**
ECTS Credit of the Course	**4**

Chemical engineering (CHEN) master program, Department of “Petrochemical Technology and Industrial Ecology”.

“Oil refining technology” specialization

Course Unit Title	**Modern issues of chemical engineering.**
Course Unit Code	**ENG 1201**
Type of Course Unit	Compulsory
Level of Course Unit	1 st year master program
National Credits	-
Number of ECTS Credits Allocated	4
Theoretical (hour/week)	2
Practice (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	2
Course Coordinator	Ramil Sadiqov
Name of Lecturer (s)	Ramil Sadiqov
Name of Assistant (s)	-
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

Application of cost estimation, energy efficiency, and economic evaluation techniques. Teams analyze an existing facility, identify improvement opportunities, demonstrate the economic consequences, and recommend a course of action.

Objectives of the Course:

Mastery of process and project design principles applied to solving realistic industrial problems.

- Mastery of skills in process and project evaluation and management.

• Familiarity with the profit motive in industry, how it affects business decision-making, and how the chemical engineer fits into this process. • Familiarity with open-ended project assignments in which students must define the appropriate scope, synthesize a variety of alternatives, design and cost the project, perform an economic evaluation, assess the risk, and make a presentation suitable for a management or other decisionmakers.		
Learning Outcomes		
At the end of the course the student will be able to		Assessment
1	To apply knowledge of mathematics, science, and engineering	1,3,4
2	To apply knowledge of math, science, engineering, and mass transfer principles to solve process and system problems.	1,2,3,4
3	To Design a system, component, equipment or process to meet desired mass transport needs.	2,3,4
4	To Identifying, formulating, and solving engineering and mass transfer problems, including continuous and staged contact equipment, and vapor-liquid equilibrium	3,4
5	To Understand and implement professional and ethical standards.	1,3,4
Assessment Methods: 1. Final Exam, 2. Presentation 3. Midterm 4. Quiz		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	4
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	5

5	Ability to develop design and scientific-technological solutions in the field of design, modeling and optimization of refining and petrochemical processes, as well as apply the acquired knowledge to improve the management system of the oil refining industry.	4
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	4
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modeling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	2
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	4
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	3
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	4

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

Course Contents

Week	Chapter	Topics	Exam
1	[I] Chap. I	Introduction to the subject	
2	[II] Chap. I	Optimal design and operation of chemical processes	
3	[IV] Chap. II	Application of new technologies like bioengineering, genetic engineering, microelectronic processing	
4	[III] Chap.III	Bioengineering and genetic engineering	
5	[I] Chap.IV	Microelectronic processing	
6	[IV] Chap.III	Nanotechnology	

7	[III] Chap.IV	Process control in chemical engineering	
8			Midterm
9	[III] Chap.V	Modelling and simulation	
10	Book [I] Chap.V	Systems engineering	
11	[II] Chap V	Advanced materials engineering	
12	[III] Chap. IV	Multifunctional reactions	
13	[III] Chap.I	Water engineering	
14	[II] Chap.III	Mass, momentum and energy balances for multiple systems with multiple reactions.	
15	[I] Chap.VI	Multifunctional reactors and their classification	
16			Final

Recommended Sources

TEXTBOOK(S)

5. Towler, G. and R. Sinnott, Chemical Engineering Design: Principles, Practice and Economics of Plant and Process Design, Butterworth-Heinemann (Elsevier), 2008, 430 pages,
6. Perry, R. H. and D. W. Green, Editors, Chemical Engineer's Handbook, 8th Ed., McGraw-Hill, 2008, 340 p,
7. Reference: Turton, R., R.C. Bailie, W.B. Whiting and J.A. Shaeiwitz, Analysis Synthesis and Design of Chemical Processes, Prentice-Hall, 1998., 450 pages
8. Said Salaheldeen Elnashaie, Firoozeh Danafar, Hassan Hashemipour Rafsanjani Nanotechnology for Chemical Engineers, Springer. 2005, 390 p,

Authors :

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU.

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	**Number**	**Duration (hour)**	**Total Workload(hour)**
Course duration in class	**14**	**2**	**28**
Presentation	1	5	5
Self-study	14	3	42
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	10	10
Final Examination	1	3	3
Preparation for final exam	1	15	15
Total Workload			**120**
Total Workload/30(h)			**120/30**
ECTS Credit of the Course			**4**

Chemical engineering (CHEN) master program, Department of "Petrochemical Technology and Industrial Ecology".

"Industrial technology of inorganic substances" specialization

Course Unit Title	**Modern issues of chemical engineering.**
Course Unit Code	**ENG 1201**
Type of Course Unit	Compulsory
Level of Course Unit	1 st year master program
National Credits	-
Number of ECTS Credits Allocated	4
Theoretical (hour/week)	2
Practice (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	2
Course Coordinator	Ramil Sadiqov
Name of Lecturer (s)	Ramil Sadiqov
Name of Assistant (s)	-
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

Application of cost estimation, energy efficiency, and economic evaluation techniques. Teams analyze an existing facility, identify improvement opportunities, demonstrate the economic consequences, and recommend a course of action.

Objectives of the Course:

Mastery of process and project design principles applied to solving realistic industrial problems.

• Mastery of skills in process and project evaluation and management.

• Familiarity with the profit motive in industry, how it affects business decision-making, and how the chemical engineer fits into this process.

• Familiarity with open-ended project assignments in which students must define the appropriate scope, synthesize a variety of alternatives, design and cost the project, perform an economic evaluation, assess the risk, and make a presentation suitable for a management or other decisionmakers.

Learning Outcomes		
At the end of the course the student will be able to		Assessment
1	To apply knowledge of mathematics, science, and engineering	1,3,4
2	To apply knowledge of math, science, engineering, and mass transfer principles to solve process and system problems.	1,2,3,4
3	To Design a system, component, equipment or process to meet desired mass transport needs.	2,3,4
4	To Identifying, formulating, and solving engineering and mass transfer problems, including continuous and staged contact equipment, and vapor-liquid equilibrium	3,4
5	To Understand and implement professional and ethical standards.	1,3,4
Assessment Methods: 1. Final Exam, 2. Presentation 3. Midterm 4. Quiz		

Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	4
2	Ability to analyze and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate and research complex problems regarding with chemistry, technology and research of properties of ceramic, glass and binding composite materials, refractories, inorganic compounds and mineral fertilizers.	4
4	Ability to apply innovative methods based on key principles of nanochemistry and membrane technology to problem-solving of scientific and technological character.	5
5	Ability to develop concepts and scientific-technological solutions in the field of electrochemical technology, processing of mineral raw materials and water treatment.	4
6	Ability to utilize creativity in elaborating new and inventive products, processes and methods of utilization of solid waste in metallurgy and other areas of inorganic substances manufacturing.	4

7	Ability to identify, find, and provide necessary information, as well as, plan and conduct analytical, model and experimental investigations of inorganic substances and composite materials particularly in the field of catalysts and adsorbents synthesis with further studying their activity.	2
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	3
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	2
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	4

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

Course Contents

Week	Chapter	Topics	Exam
1	[I] Chap. I	Introduction to the subject	
2	[II] Chap. I	Optimal design and operation of chemical processes	
3	[IV] Chap. II	Application of new technologies like bioengineering, genetic engineering, microelectronic processing	
4	[III] Chap.III	Bioengineering and genetic engineering	
5	[I] Chap.IV	Microelectronic processing	
6	[IV] Chap.III	Nanotechnology	
7	[III] Chap.IV	Process control in chemical engineering	
8			Midterm
9	[III] Chap.V	Modelling and simulation	

10	Book [I] Chap.V	Systems engineering	
11	[II] Chap V	Advanced materials engineering	
12	[III] Chap. IV	Multifunctional reactions	
13	[III] Chap.I	Water engineering	
14	[II] Chap.III	Mass, momentum and energy balances for multiple systems with multiple reactions.	
15	[I] Chap.VI	Multifunctional reactors and their classification	
16			Final

Recommended Sources

TEXTBOOK(S)

9. Towler, G. and R. Sinnott, Chemical Engineering Design: Principles, Practice and Economics of Plant and Process Design, Butterworth-Heinemann (Elsevier), 2008, 430 pages,

10. Perry, R. H. and D. W. Green, Editors, Chemical Engineer's Handbook, 8th Ed., McGraw-Hill, 2008, 340 p,

11. Reference: Turton, R., R.C. Bailie, W.B. Whiting and J.A. Shaeiwitz, Analysis Synthesis and Design of Chemical Processes, Prentice-Hall, 1998., 450 pages

12. Said Salaheldeen Elnashaie, Firoozeh Danafar, Hassan Hashemipour Rafsanjani Nanotechnology for Chemical Engineers, Springer. 2005, 390 p,

Authors :

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam

Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU.

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	**Number**	**Duration (hour)**	**Total Workload(hour)**
Course duration in class	**14**	**2**	**28**
Presentation	1	5	5
Self-study	14	3	42
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	10	10
Final Examination	1	3	3
Preparation for final exam	1	15	15
Total Workload			**120**
Total Workload/30(h)			**120/30**
ECTS Credit of the Course			**4**

Chemical engineering (CHEN) master program, Department of "Petrochemical Technology and Industrial Ecology".

Course Unit Title	**Project management in the oil refining industry**
Course Unit Code	**ENG 1106**
Type of Course Unit	Compulsory
Level of Course Unit	1 st year CHEN program

National Credits	-
Number of ECTS Credits Allocated	8
Theoretical (hour/week)	2
Practice (hour/week)	2
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	Aytan Mammadova
Name of Lecturer (s)	Aytan Mamamdova
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

Oil production. Surface operations. Characterization and classification of crude oils. Physical properties of oils. Refinery operations; atmospheric and vacuum distillation, treatment processes, catalytic cracking, reforming, alkylation, coking, asphalt production and lubricating oil production. Blending of refinery products. Waste treatment.

Objectives of the Course:

The objective of refining crude oil is to meet the marked demand in the most economical manner. The nature of the market (for example, whether there is strong demand for *motor gasoline* or for *kerosene*) and the relative values of the individual products (their marginal values) largely dictate the mix of refinery processes that are used. The relative values of products differ, with the high value materials typically occurring in the mid-boiling range materials such as motor gasoline, kerosene and diesel fuel. Values are influenced by geographical location, market profile and by the seasons.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Classify Petroleum products specification and their relevance to product performance	1,3
2	Apply chemical and physical engineering principles to analysis of major refinery units.	1,2,4
3	Discuss operations in modern fully integrated refineries and ability to choose a refining route for a crude type and product demand.	2,3

4	Apply Awareness of the environmental regulations and product specifications and their effects on the refining industry as a whole and on individual refinery configuration.	3,4
5	Understand and implement professional and ethical standards.	1,3
Assessment Methods: 1. Final Exam, 2. Presentation 3. Midterm 4. Quiz		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	4
2	Ability to analyze and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	3
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	5
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	4
5	Ability to develop design and scientific-technological solutions in the field of design, modeling and optimization of refining and petrochemical processes, as well as apply the acquired knowledge to improve the management system of the oil refining industry.	4
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	3
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modeling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	3
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	5

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)			
Course Contents			
Week	Chapter	Topics	Exam
1	[I,II] Chapter 3,4	İntroduction to subject Seminar: İntroduction to subject	
2	[I] Chapter 4	Origin of petroleum Seminar: introduction to subject	
3	[II] Chapter 5	Methods of petroleum transportation Seminar: Methods of petroleum transportation	
4	[II] Chapter 6	Geographical Formation Seminar: origin of petroleum	
5	[II] Chapter 5	Petroleum production, well testing, field processing methods and equipment Seminar: Petroleum production, well testing, field processing methods and equipment	
6	[II] Chapter3	Reforming process Seminar : Geographical formation	
7	[II] Chapter 8	Refinery facilities Seminar: Refinery facilities	
8			Midterm
9	[I] Chapter 8	Physical properties of oils. Seminar: Refinery facilities	
10	[II] Chapter 4.	Refinery furnaces Seminar: Refinery furnaces	
11	[I] Chapter 7	Properties and classification of crude oil Seminar: Refinery furnaces	
12	[II] Chapter5	Atmospheric and vacuum distillation Seminar: Atmospheric and vacuum distillation	
13	[II] Chapter 6	Chemical processes found in a refinery Seminar : Atmospheric and vacuum distillation	

14	[I] Chapter 5	Flow diagram of refinery Seminar: Flow diagram of refinery	
15	[II] Chapter 7	List of oil refinery countries Seminar : chemical processes found in oil refinery	
16			Final

Recommended Sources

TEXTBOOK(S)

1. 1. Nelson, W.L., Petroleum Refining Engineering, McGraw Hill, 4th edition, New York, 2001, 650 p
2. 2. Garry, J. H. and Handwrek, G. E., “Petroleum Refining, Technology and Economics”, Marcel-Dekker, 2000, 567 p

Assessment

Attendance	0%	At least 75% class attendance compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU.

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	**Number**	**Duration (hour)**	**Total Workload(hour)**
Course duration in class	**14**	**4**	**56**
Preparation for presentation	1	18	18

Self study	14	6	84
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	25	25
Final Examination	1	3	3
Preparation for final exam	1	35	35
Total Workload			**240**
Total Workload/30(h)			**240/30**
ECTS Credit of the Course			**8**

Chemical engineering (CHEN) master program, Department of “Petrochemical Technology and Industrial Ecology”.

Course Unit Title	**Lubricants and additives**
Course Unit Code	ENG 3018
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	Aynura Aliyeva
Name of Lecturer (s)	Aynura Aliyeva
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar

Language of Instruction	English
Prerequisites	
Recommended Optional Program Components	-

Course description:

Almost all modern machines require the use of a lubricant. Power generation in such equipment is achieved by the use of engines that mostly comprise metal parts that move against one another. In many cases, there is metal to metal contact that leads to the generation of friction and heat, which results in wear. The extent of wear in equipment depends upon the degree of the metal-to-metal contact, either due to the equipment design or the nature of the operation However, the parts that are designed to have intimate metal-to-metal contact, such as gears and bearings, wear due to friction is extensive. With respect to the effect of equipment operation on wear, high speed, low-load operation leads to lower wear than slow speed, high-load operation. This is because in the former case there is minimal metal-to-metal contact. A lubricant can be a solid, liquid, or gas, and lubrication is its primary function. The usual objective of the lubrication is to lubricate surfaces to minimize direct metal-to-metal contact and, hence, reduce friction and wear. The course aim is to present comprehensive information regarding the review of lubricant chemistry, technology, selection, and design.

Objectives of the Course:

This course deals with fundamentals of lubrication. It covers the lubricant functions, nature and composition of the lubricants market, concepts of friction, lubrication, viscosity, and wear, lubricant types, and lubricant selection, performance specifications, and composition. A description of the lubricant classes and additives is also provided. Course describes petroleum composition and the oil field and refinery chemicals that are used to facilitate petroleum drilling to extract crude petroleum from beneath the earth's surface and refine it to yield value-added products, such as fuels, lubricant base stocks, and petrochemicals. The course also focuses on many of the refinery processes in some detail to explain the manner in which the hydrocarbon cuts from petroleum with suitable properties for use as lubricant base stocks are obtained. Moreover,non-petroleum lubricant base stocks, the chemistry, manufacture and properties of the chemicals that are used in lubricants as additives, combustion engine lubricants, fuel additives, hydraulic and transmission fluids, industrial lubricants are also discussed.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	understand the fundamentals of lubrication	1,2,3,4
2	understand lubricant functions, nature and composition of the lubricants, concepts of friction, lubrication, viscosity and wear	1,2,3,4
3	explain the chemistry, manufacture and properties of the chemicals that are used in lubricants as additives	1,3,4
4	explain lubricant types and lubricant selection	1, 3,4
5	understand the main principles of additive technology that is used in petroleum refining and fuels	1,2,3,4

Assessment Methods: 1. Final Exam, 2. Midterm 3. Presentation 4. Quiz		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	4
2	Ability to analyze and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	3
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	5
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	4
5	Ability to develop design and scientific-technological solutions in the field of design, modeling and optimization of refining and petrochemical processes, as well as apply the acquired knowledge to improve the management system of the oil refining industry.	4
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	3
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modeling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	3
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	5
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		
Course Content		

Week	Chapter	Topics	Exam

1	[1] Chap.[1] p.1	**Lubrication fundamentals** Introduction. Friction and lubrication. Viscosity and wear. Viscosity.	
2	[1] Chap.[1] p.1	**Lubrication fundamentals** Wear. Types of Lubricants. Lubricant Selection and Specifications. Lubricant Composition. **Seminar 1.** Lubrication fundamentals	
3	[1] Chap.[2] p.23	**Mineral base oils.** Petroleum composition. Petroleum Refining. Refinery Processes.	
4	[1] Chap.[2] p.23	**Mineral base oils.** Refinery Processes. Refinery Process Chemicals. Lubricant Base Stocks. Base Oil Properties. **Seminar 2.** Mineral base oils.	
5	[1] Chap [3] p.47	**Synthetic and Biological (Natural) Base Stocks** Synthetic Base Stocks. Synthetic Hydrocarbon (SHC) Polymers. Carboxylate Esters. Other synthetic base stocks. Biological (Natural) Base Stocks.	
6	[1] Chap [4] p.100	**Lubricant additives.** Desirable Lubricant Properties. Criteria For Suitable Base Stocks. Performance Additives. Stabilizers/Deposit Control Agents. Oxidation Inhibitors. Dispersants. **Seminar 3.** Synthetic and Biological (Natural) Base Stocks	
7	[1] Chap. [4] p.100	**Lubricant additives.** Dispersants. Detergents. Film-forming Agents.	
8			Midterm
9	[1] Chap. [4] p.100	**Lubricant additives.** Emulsifiers and Demulsifies. Polymeric Additives. Other Additives. Multifunctional Nature of Additives. **Seminar 4**. Lubricant additives.	
10	[1] Chap.[5]	**Combustion engine lubricants**	

	p.212	Types of engines and mode of their operation. Lubricant specifications and classifications. Engine Oil Classification Based on End-use.	
11	[1] Chap. [6] p.322	**Fuel additives.** Deposit Control Additives/Cleanliness Agents. Fluidizers. Anti-icing Agents. Octane Improvers. Lubricity Agents. Cetane Improvers, Diesel Ignition Improvers. Foam Inhibitors. Corrosion Inhibitors. Demulsifies. Oxidation Inhibitors/Stabilizers **Seminar 5. Fuel additives.**	
12	[1] Chap. [7] p.334	**Hydraulic and transmission fluids** Hydraulic Fluids. Tractor Hydraulic Fluids. Industrial Hydraulic Fluids. Oxidation/thermal Stability. Transmission Fluids.	
13	[1] Chap. [9] p.410	**Miscellaneous industrial lubricants** Types of industrial oils. Turbine Lubricants. Compressor and Refrigeration Oils. Compressor Lubricants. Refrigeration Lubricants. **Seminar 6. Miscellaneous industrial lubricants**	
14	[1] Chap. [10] p.443	**Lubricating greases.** Lubricating greases. Lubricating Grease Classification. Lubricating Grease Market. Grease Composition.	
15	[1] Chap. [10] p.443	**Lubricating greases.** Grease Chemistry. Additives. Desirable Grease Properties. Applications involving lubricating greases **Seminar 7. Lubricating greases .**	
16			Final

Recommended Sources

TEXTBOOK

1. Sunggyu Lee, James G.Speight, SudarshanK.Loyalka " *Handbook of alternative fuel technologies"*, CRC Press, Taylor and Francis Group 6000 Broken Sound Parkway NW, Suite 300, Boca Raton, 2015,674 p.

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	

Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan State Oil and Industrial University for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations.

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class	**14**	**3**	**42**
Preparation for presentation	1	8	8
Self study	14	5	70
Tutorials	14	1	10
Midterm Examination	1	3	3
Preparation for midterm exam	1	12	12
Final Examination	1	3	3
Preparation for final exam	1	28	28
Total Workload			**180**
Total Workload/30(h)			**180/30**
ECTS Credit of the Course			**6**

Chemical engineering (CHEN) master program, “Chemistry and inorganic substances technology” department

Course Unit Title	**Modern technologies of processing of mineral raw materials**
Course Unit Code	ENG 1102
Type of Course Unit	Compulsory
Level of Course Unit	1st year of master program
National Credits	-
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	Vagif Baghiyev
Name of Lecturer (s)	Vagif Baghiyev
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	None
Recommended Optional Program Components	-

Course description: During the study of the discipline master students will learn the following aspects: natural raw materials containing useful components, physical and chemical basis of raw materials processing, modern methods of mineral processing, main and auxiliary equipment used in technological schemes, technological schemes of processing of mineral raw materials.
Objectives of the Course: Course main objective is formation at master student of the complete idea about the equipment and main methods of processing of mineral and ore raw materials.
Learning Outcomes

At the end of the course the student will be able to		Assessment
1	demonstrate knowledge about the natural mineral raw material containing useful components, physico-chemical fundamentals of processing of raw materials;	1,2,3,4
2	theoretically justify and make technological schemes for the processing of mineral raw materials;	1,2,3,4
3	evaluate innovative technologies of mineral processing taking into account the complexity of use;	2
4	apply the knowledge to solve typical technological problems associated with the processing of mineral raw materials;	2
5	substantiate and offer basic and auxiliary equipment for mineral processing technology.	1,2,3,4

Assessment Methods: 1. Final Exam, 2. Presentation 3. Midterm 4. Quiz

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate and research complex problems regarding with chemistry, technology and research of properties of ceramic, glass and binding composite materials, refractories, inorganic compounds and mineral fertilizers.	4
4	Ability to apply innovative methods based on key principles of nanochemistry and membrane technology to problem-solving of scientific and technological character.	1
5	Ability to develop concepts and scientific-technological solutions in the field of electrochemical technology, processing of mineral raw materials and water treatment.	5

6	Ability to utilize creativity in elaborating new and inventive products, processes and methods of utilization of solid waste in metallurgy and other areas of inorganic substances manufacturing.	5
7	Ability to identify, find, and provide necessary information, as well as, plan and conduct analytical, model and experimental investigations of inorganic substances and composite materials particularly in the field of catalysts and adsorbents synthesis with further studying their activity.	3
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	4
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	1
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	1
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	[1], p.1-38 Chapter 1 [1], p.30-38 Chapter 2	**Introduction.** Minerals and ores. Mineral processing methods. Efficiency of mineral processing methods. Concentration. **Ore handling.** Removal of harmful materials. Ore transportation. Ore storage. Feeding.	
2	[1], p.90-106 Chapter 4	**Particle size analysis.** Particle size and shape. Sieve analysis. Sub-sieve techniques. **Seminar.** Processing methods of ores and minerals.	
3	[1], p.108-115, Chapter 5 [1], p.118-126 Chapter 6	**Comminution.** Principles of comminution. Comminution theory. Grindability. **Crushers.** Primary crushers. Jaw crushers. Gyratory crushers.	
4	[1], p.126-135 Chapter 6	**Crushers.** Secondary crushers. The cone crusher. The Rhodax crusher. Roll crushers. **Seminar.** Analysis methods of particles.	

5	[1], p.135-143 Chapter 6 [1], p.146-155 Chapter 7	**Crushers.** Impact crushers. Hammer crushers. Rotary breakers. Crushing circuits and control. **Grinding mills.** The motion of a charge in tumbling mill. Tumbling mills.	
6	[1], p.155-165 Chapter 7	**Grinding mills.** Types of mills. Ball mills. Autogenous mills. **Seminar.** Various types of crushers and their principle of operation.	
7	[1], p.165-175 Chapter 7 [1], p.186-196, Chapter 8	**Grinding mills.** Autogenous mills. Vibratory mills. Centrifugal and tower mills. Stirred mills. Grinding circuits. **Industrial screening.** Factors affecting screen performance. Screens. Vibrating screens.	
8			Midterm
9	[1], p.196-202, Chapter 8 [1], p.203-215, Chapter 9	**Industrial screening.** Other screen types. Screening surface. **Seminar.** Grinding mills types and principles of operation. **Classification.** Principles of classification. Free settling. Hindered settling. Types of classifier. Hydraulic classifier. Horizontal current classifier. Hydrocyclones.	
10	[1], p.225-244, Chapter 10	**Gravity concentration.** Principles of gravity concentration. Gravity separators. Jigs. Types of jigs. Pinched sluices and cones. Spiral concentrators and shaking tables. Centrifugal concentrators. **Seminar.** Industrial screening and screens types.	
11	[1], p.246-261, Chapter 11 [1], p.267-286, Chapter 12	**Dens medium separation.** The dens medium. Liquids and suspensions. Separating and gravitational vessels. Centrifugal separators. Dens medium separation circuits. **Froth flotation.** Principles of flotation. Collectors. Frothers, regulators, activators and depressants. The importance of pH and parameters in flotation process.	
12	[1], p.287-344,	**Froth flotation.** The engineering of flotation. Basic flotation circuits. Circuit flexibility. Flotation machines.	

	Chapter 12	**Seminar.** Types of classifiers and concentrators.	
13	[1], p.353-371, Chapter 13 [1], p.373-377, Chapter 14	**Magnetic and electrical separation.** Magnetic separation. Magnetic separator design. Low-intensity magnetic separation. High-intensity magnetic separation. Superconducting separators. Electrical separation. **Ore sorting.** Electronic sorting principles. Circuits of electronic sorting.	
14	[1], p.378-389, Chapter 15	**Dewatering.** Sedimentation. Coagulation and flocculation. Selective flocculation. Gravity sedimentation. High-capacity thickeners. **Seminar**. Froth flotation principles and flotation machines types.	
15	[1], p.389-398, Chapter 15.	**Dewatering.** Centrifugal sedimentation. Filtration. Types of filters. Drying.	
16			Final

Recommended Sources

1. B.A.Wills, T.J.Napier-Munn. Mineral processing technology. An introduction to the practical aspects of ore treatment and mineral recovery. 7-th edition. Elsivier Science & Technology books, 2006, pp.444.

Assessment		
Attendance	0%	At least 75% of class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU Guidelines for Undergraduate Studies

Course Policies			
• Attendance of the course is mandatory. • Late assignments will not be accepted unless an agreement is reached with the lecturer. • Students can use calculators during the exam. • Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations			
ECTS allocated based on Student Workload			
Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class	**14**	**3**	**42**
Presentation	1	16	16
Self-study	14	5	70
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	12	12
Final Examination	1	3	3
Preparation for final exam	1	28	28
Total Workload			**180**
Total Workload/30(h)			**180/30**
ECTS Credit of the Course			**6**

Course Unit Title	**Technology of catalysts and adsorbents**
Course Unit Code	ENG 2101
Type of Course Unit	Compulsory
Level of Course Unit	2nd year of master program
National Credits	-
Number of ECTS Credits Allocated	8
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	1
Year of Study	2
Semester when the course unit is delivered	3
Course Coordinator	Vagif Baghiyev
Name of Lecturer (s)	Vagif Baghiyev
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar, Laboratory
Language of Instruction	English
Prerequisites	None
Recommended Optional Program Components	-

Course description: When studying the discipline, undergraduates will study the following aspects:

ideas about the physical and chemical processes that occur at various stages of the synthesis of carriers, catalysts and adsorbents, the properties of the materials obtained, the state of the active component in massive and supported catalysts, the causes of poisoning, sintering and mechanical destruction of catalysts during their synthesis or operation and ways to increase the stability of the catalysts to the action of these negative factors. technological schemes for their preparation

Objectives of the Course:

The purpose of this discipline is to familiarize oneself with the theoretical foundations and the most significant experimental results accumulated to date in the technology of preparing catalysts and adsorbents, as well as study their properties.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	demonstrate knowledge about the nature of catalysts and adsorbents, physico-chemical fundamentals of the processes occurring when using one or another catalyst	1,2,3,5

2	Demonstrate knowledge of the catalysts and adsorbents used in the production of inorganic substances;	1,2,3,5
3	Demonstrate skills in studying the properties of catalysts and adsorbents in laboratory conditions;	4
4	apply the acquired knowledge to solve typical technological problems associated with the preparation of catalysts	2,4
5	Analyze and compare processes to obtain catalysts and adsorbents;	1,2,3,4,5
Assessment Methods: 1. Final Exam, 2. Presentation 3. Midterm 4. Laboratory 5. Quiz		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate and research complex problems regarding with chemistry, technology and research of properties of ceramic, glass and binding composite materials, refractories, inorganic compounds and mineral fertilizers.	4
4	Ability to apply innovative methods based on key principles of nanochemistry and membrane technology to problem-solving of scientific and technological character.	5
5	Ability to develop concepts and scientific-technological solutions in the field of electrochemical technology, processing of mineral raw materials and water treatment.	3
6	Ability to utilize creativity in elaborating new and inventive products, processes and methods of utilization of solid waste in metallurgy and other areas of inorganic substances manufacturing.	3
7	Ability to identify, find, and provide necessary information, as well as, plan and conduct analytical, model and experimental investigations of inorganic substances and composite materials particularly in the field of catalysts and adsorbents synthesis with further studying their activity.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	4
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	1
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles,	1

	conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.		
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)			
Course Contents			
Week	Chapter	Topics	Exam
1	[1], p.3-10 Chapter 1	Importance and Development of Solid Catalysts. **Laboratory work 1.** Introduction to laboratory safety. *This laboratory work includes an introduction to the instruments and equipment used in the laboratory, as well as a safety briefing.*	
2	[1], p.23-30 Chapter 2	Interfacial Chemistry **Seminar 1.** Catalyst Performance. Factors which Affect the Catalyst Performance	
3	[1], p.33-57 Chapter 3	Electrostatic Adsorption **Laboratory work 2.** Preparation of copper-chromium oxide catalyst by co-deposition. *This work uses the following equipment and materials: a beaker, a porcelain cup, a drying oven, a muffle furnace, magnetic stirrer, dividing funnel, pH-meter, contact thermometer, a solution of copper nitrate, a solution of ammonium chromate.* *The laboratory work consists of co-precipitation of copper and chromium oxides from their aqueous solutions. Then the precipitate is dried and calcined at 700^{0}C.*	
4	[1], p.58-78 Chapter 4	Impregnation and Drying Methods of Impregnation **Seminar 2.** Promoters	
5	[1], p.83-106 Chapter 5	**Sol-Gel Processing.** Physicochemical Basis and Principles of Sol-Gel Processing. Application of Sol-Gel Processing for the Preparation of Solid Catalysts **Laboratory work 2.** Preparation of copper-chromium oxide catalyst by co-deposition. (Continuation) *This work uses the following equipment and materials: a beaker, a porcelain cup, a drying oven, a muffle furnace, magnetic stirrer, dividing funnel, pH-meter, contact thermometer, a solution of copper nitrate, a solution of ammonium chromate.*	

		The laboratory work consists of co-precipitation of copper and chromium oxides from their aqueous solutions. Then the precipitate is dried and calcined at 700^{0}C.	
6	[1], p111-132 Chapter 6	Deposition Precipitation Theory and Practice Mechanistic Studies **Seminar 3.** Inhibitors	
7	[1], p135-141 Chapter 7	**Co-precipitation.** Basic Principles of Precipitation and Nucleation. Raw Materials Process Operation **Laboratory work 3**. Preparation of zinc-calcium oxide catalyst by mixing the starting oxides. *The following equipment and instruments are used in the laboratory work: chemical beaker, porcelain cup, drying cabinet, muffle furnace, zinc oxide, calcium oxide.* *When carrying out laboratory work, calcium and zinc oxides are mixed in an aqueous medium until a homogeneous pulp is obtained. Then the resulting mass is dried and calcined according to the existing procedure.*	
8			Midterm
9	[1], p145-146 Chapter 7	High Metal Nickel/Alumina Catalysts. Copper/Zinc Methanol Catalysts Iron-Based Fischer–Tropsch Catalysts. **Seminar 4.** Catalyst Deactivation and Regeneration	
10	[1], p.173-186 Chapter 7	**Shaping of Solid Catalysts.** Objectives of Catalyst Shaping. Fixed-Bed Reactors – Particle Beds. Pelleting. Granulation Extrusion. Tailoring of the Pore-Size Distribution **Laboratory work 3.** Preparation of zinc-calcium oxide catalyst by mixing the starting oxides. (Continuation) *The following equipment and instruments are used in the laboratory work: chemical beaker, porcelain cup, drying cabinet, muffle furnace, zinc oxide, calcium oxide.* *When carrying out laboratory work, calcium and zinc oxides are mixed in an aqueous medium until a homogeneous pulp is obtained. Then the resulting mass is dried and calcined according to the existing procedure.*	
11	[1], p.187-198 Chapter 8	Fixed-Bed Reactors – Monoliths. Honeycombs. Ceramic Honeycombs.	

		Metallic Honeycombs Catalysts for Moving-Bed Reactors. Catalysts for Fluidized Beds **Seminar 5.** Catalyst Poisoning	
12	[1], p.243-253, Chapter 8	Concepts for Preparation of Zeolite-Based Catalysts. **Laboratory work 4.** Preparation of applied vanadium catalyst by impregnation of a carrier. *In the laboratory work the following equipment and materials are used: porcelain cup, drying cabinet, pipette, muffle furnace, ammonium vanadate, granulated aluminum oxide.* *The course of work consists in applying the required amount of ammonium vanadate on granulated aluminum oxide. Then drying and calcination of obtained catalyst granules according to the existing methodology is carried out.*	
13	[1], p.301-320, Chapter 13	Hydrotreating of Catalysts. Metal Comixing/Coextrusion and Co-precipitation Routes. Impregnation of Metals. Presulfiding as the Last Stage in Hydrotreating Catalyst Preparation **Seminar 6.** Catalyst Shapes and Production of Heterogeneous Catalysts	
14	[1], p.369-388, Chapter 14	Gold Catalysts. Preparations Involving Aqueous Solutions. Anion Adsorption **Laboratory work 5.** Determination of the specific surface of porous adsorbents and solid catalysts by thermal desorption of nitrogen. *A specially designed unit consisting of a monostat, dryer, rheometer, Dewar vessel, U-tube, katharometer, and recorder, as well as nitrogen and helium balloons, is used for the laboratory work.* *The laboratory work is performed as follows. The catalyst or adsorbent sample under study is placed in a stream of nitrogen and helium and then cooled to the temperature of liquid nitrogen. The specific surface of the sample is determined by the amount of nitrogen desorbed during heating.*	
15	[1], p.153-167 Chapter 7	Clusters and Immobilization. The Surface of Common Supports. **Seminar 7.** Catalysis Reactors	
16			Final

Recommended Sources

1. Edited by Krijn P. de Jong Synthesis of Solid Catalysts .2009 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, 2009, pp.423.

2. Jens Hagen .Industrial Catalysis.A Practical Approach WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany,2006, pp.521

Assessment		
Attendance	0%	At least 75% of class attendance is compulsory
Presentation	10%	
Quiz	10%	
Seminars	0%	
Laboratory	10%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU Guidelines for Undergraduate Studies

Course Policies

1. Attendance of the course is mandatory.
2. Late assignments will not be accepted unless an agreement is reached with the lecturer.
3. Students can use calculators during the exam.
4. Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class	**14**	**4**	**56**
Presentation	1	15	15
Self-study	14	7	98
Tutorials	14	1	14

Midterm Examination	1	3	3
Preparation for midterm exam	1	15	15
Final Examination	1	3	3
Preparation for final exam	1	40	30
Total Workload			**240**
Total Workload/30(h)			**240/30**
ECTS Credit of the Course			**8**

Chemical engineering (CHEN) master program, “Chemistry and inorganic substances technology” department

Course Unit Title	**Modern electrochemical technologies**
Course Unit Code	ENG 1103
Type of Course Unit	Compulsory
Level of Course Unit	1^{st} year of master program
National Credits	-
Number of ECTS Credits Allocated	6

Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	Minira Aghahuseynova
Name of Lecturer (s)	Minira Aghahuseynova
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	None
Recommended Optional Program Components	-

Course description: This course provides for the study of the basic aspects of electrochemical processes that occur under the influence of electric current, the basic concepts of technology of electrochemical processes; electrochemical methods for producing coatings on surfaces; fundamentals of electrochemical technologies for producing chemicals; corrosion protection methods, as well as the study of electrochemical current sources.

Objectives of the Course: The purpose of this discipline is to prepare specialists who are able to control the electrochemical processes and properties of substances and materials formed in these processes.

Learning Outcomes

	At the end of the course the student will be able to	Assessment
1	demonstrate knowledge of the basic concepts of electrochemical processes, their fundamental laws and basic methods	1,2,3,4
2	know the basic principles of using modern research methods in the field of technology of electrochemical processes	1,2,3,4
3	to have an idea of current trends and the main directions of research in the development of technology of electrochemical processes and corrosion protection	2
4	apply the acquired knowledge to solve typical technological problems	2
5	apply the basic methods and approaches of conducting theoretical and experimental studies in the field of technology of electrochemical processes and corrosion protection	1,2,3,4

Assessment Methods: 1. Final Exam, 2. Presentation 3. Midterm 4. Quiz

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate and research complex problems regarding with chemistry, technology and research of properties of ceramic, glass and binding composite materials, refractories, inorganic compounds and mineral fertilizers.	5
4	Ability to apply innovative methods based on key principles of nanochemistry and membrane technology to problem-solving of scientific and technological character.	4
5	Ability to develop concepts and scientific-technological solutions in the field of electrochemical technology, processing of mineral raw materials and water treatment.	5
6	Ability to utilize creativity in elaborating new and inventive products, processes and methods of utilization of solid waste in metallurgy and other areas of inorganic substances manufacturing.	4
7	Ability to identify, find, and provide necessary information, as well as, plan and conduct analytical, model and experimental investigations of inorganic substances and composite materials particularly in the field of catalysts and adsorbents synthesis with further studying their activity.	4
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	3
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	1
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	1

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

Course Contents

Week	Chapter	Topics	Exam
1	[1], p.1 -38 Chapter 1 [2], p.7-8 Chapter 1	**Introduction.** Fundamental concepts. **Seminar 1.** Chemical potential of solvent and solute in electrolyte solution	

2	[1], p.38- 58 Chapter 1	**Fundamental concepts**. Continuation	
3	[1], p.60-95 Chapter 2 [2], p.11-13 Chapter 1	**Electrochemical engineering** **Seminar 2.** Chemical.Potential.and.Gibbs.Energy.of.Formation	
4	[1], p.60-171 Chapter 2	**Electrochemical engineering**. Continuation	
5	[1], p.173-209 Chapter 3 [2], p.13-16 Chapter 1	**The chlor-alkali industry** **Seminar 3.** Debye–Hückel Theory of Dilute Electrolyte Solutions	
6	[1], p.210-245 Chapter 4	**The extraction, refining and production of metal.**	
7	[1], p.249-279 Chapter 5 [2], p.16-17, Chapter 1	**Other inorganic electrolytic processes** **Seminar 4.** Calculation of Activity Coefficient Using Debye–Hückel Theory	
8			Midterm
9	[1], p.279-292, Chapter 5 [2], p.17-18, Chapter 1	**Other inorganic electrolytic processes**. Continuation **Seminar 5**. Calculated.and.Observed.Activity.Coefficients	
10	[1], p.331-384, Chapter 7	**Water purification, effluent treatment and recycling of industrial process streams**	
11	[1], p.385-448, Chapter 8	**Metal finishing**. **Seminar 6.** Mean Activity Coefficien .in Concentrated Aqueous Solutions	

	[2], p.18-19, Chapter 1		
12	[1], p.451-479, Chapter 9	**Metals and materials processing**	
13	[1], p.481-541, Chapter 10 [2], p.19-22, Chapter 1	**Corrosion and its control** **Seminar 7.** Speciation in Weak Electrolytes	
14	[1],p.543-595, Chapter 11	**Batteries and cells**	
15	[1], p.596-636, Chapter 12	**Electrochemical sensors and monitoring techniques**	
16			Final

Recommended Sources

1. D. Pletcher, F.C. Walsh Industrial Electrochemistry - Second Edition/Engineering Published ,1990,pp 562
2. Serguei N.Lvov.Introduction to Electrochemical Science and Engineering.CRC Press Taylor & Francis Group 6000 Broken Sound Parkway NW, Suite 300 Boca Raton, 2015, pp.331.

Assessment		
Attendance	0%	At least 75% of class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam

Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU Guidelines for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students can use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	**Number**	**Duration (hour)**	**Total Workload(hour)**
Course duration in class	**14**	**3**	**42**
Presentation	1	10	10
Self-study	14	5	70
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	12	12
Final Examination	1	3	3
Preparation for final exam	1	28	28
Total Workload			**180**
Total Workload/30(h)			**180/30**
ECTS Credit of the Course			**6**

Chemical engineering (CHEN) master program, "Chemistry and inorganic substances technology" department

Course Unit Title	**Innovative technology of inorganic substances**
Course Unit Code	ENG 1202
Type of Course Unit	Compulsory
Level of Course Unit	1st year of master program
National Credits	-
Number of ECTS Credits Allocated	7
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	1
Year of Study	1
Semester when the course unit is delivered	2
Course Coordinator	Minira Aghahuseynova
Name of Lecturer (s)	Minira Aghahuseynova
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar, Laboratory
Language of Instruction	English
Prerequisites	None
Recommended Optional Program Components	-

Course description: This course provides for the study of technological processes for the production of inorganic substances, the theoretical foundations of inorganic synthesis and typical methods for the synthesis of individual classes of substances, the production of metals and alloys.

Objectives of the Course: The main objective of the course is the development in masters of the ability to evaluate and recognize technological and innovative processes for the production of inorganic substances; the ability to synthesize inorganic substances and use these skills in scientific research.

Learning Outcomes

At the end of the course the student will be able to	Assessment

1	perform basic chemical operations, use basic chemical laws, thermodynamic reference data to solve professional problems;	1,2,3,4,5
2	synthesize inorganic compounds, conduct qualitative and quantitative analysis of inorganic compounds using chemical and physico-chemical methods of analysis;	4
3	To analyze and compare technological processes for the production of inorganic substances	1,2,5
4	Know the basic technological methods and modes of processes for the production and processing of inorganic substances.	1,2,3,5
Assessment Methods: 1. Final Exam, 2. Presentation 3. Midterm. 4. Laboratory 5. Quiz		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate and research complex problems regarding with chemistry, technology and research of properties of ceramic, glass and binding composite materials, refractories, inorganic compounds and mineral fertilizers.	5
4	Ability to apply innovative methods based on key principles of nanochemistry and membrane technology to problem-solving of scientific and technological character.	3
5	Ability to develop concepts and scientific-technological solutions in the field of electrochemical technology, processing of mineral raw materials and water treatment.	3
6	Ability to utilize creativity in elaborating new and inventive products, processes and methods of utilization of solid waste in metallurgy and other areas of inorganic substances manufacturing.	3
7	Ability to identify, find, and provide necessary information, as well as, plan and conduct analytical, model and experimental investigations of inorganic substances and composite materials particularly in the field of catalysts and adsorbents synthesis with further studying their activity.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	4
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	2

10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.		1
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)			
Course Contents			
Week	Chapter	Topics	Exam
1	[2], p.1, [5], p.333 Chapter 7	**Introduction**. Innovative Inorganic Synthesis. **Seminar 1.** Transformation of inorganic chemicals in the environment.	
2	[1], p.14 Chapter 1.2	**Hydrogen. Hydrogen production. Economic value. The use of hydrogen. Hydrogen production as a by-product.** **Lab work 1.** Introduction to laboratory safety. *This laboratory work includes an introduction to the instruments and equipment used in the laboratory, as well as a safety briefing.*	
3	[1], p.29 Chapter 1.4 [4], p.175 Chapter 6	**Nitrogen and nitrogen compounds. Ammonia. Economic value. Synthetic ammonia production. Catalysts for the synthesis of ammonia. Production of synthesis gas. Conversion of synthesis gas to ammonia.** **Seminar 2.** Ammonia synthesis reactors.	
4	[1], p.53 Chapter 1.4	**Nitrogen and nitrogen compounds. Nitric acid. Economic value. Basics of nitric acid production. Production of highly concentrated nitric acid. Tail gases from nitric acid production. The use of nitric acid** **Lab.work No. 2.** Analysis of nitric acid. *In this laboratory work the following equipment and materials are used: areometer, thermometer, cylindrical beaker, conical flask, burette, 1n sodium hydroxide solution, nitric acid, methyl red indicator.* *In this work, two methods are used to determine the concentration of nitric acid. According to the first method, the concentration of nitric acid is determined using a areometer. In the second method, the concentration of nitric acid is determined by titrating an aqueous solution of nitric acid with 1n sodium hydroxide solution.*	

5	[1], p.101 Chapter 1.6 [4], p.252 Chapter 8.2	**Sulfur and sulfur compounds. Sulfur. Sulfuric acid. Economic value. Raw materials for the production of sulfuric acid. The use of sulfuric acid. Hydrogen sulfide. Sulfate salts.** **Seminar 3.** SO2 conversion reactor.	
6	[1], p.65 Chapter 1.5	**Phosphorus and its compounds. Phosphorus and inorganic phosphorus compounds. Raw materials. Phosphorus and its compounds. Phosphoric acid. Salts of phosphoric acid.** **Lab.work No. 3.** Obtaining of phosphoric acid. *In the laboratory work the following equipment and materials are used: porcelain cup, chemical beakers, three-neck flask, stirrer, water bath, laboratory transformer, conical flask, burette, fluorapatite, phosphoric acid, sulfuric acid, measuring flask, 0.1n caustic soda solution, methyl orange, phenolphthalein, distilled water, filter paper.* *In the laboratory work phosphoric acid is obtained by extraction method as a result of splitting fluorapatite with sulfuric acid. The process is carried out on a pre-assembled unit. The amount of the obtained phosphoric acid is determined by the content of phosphorus oxide (V) by titration with 0.1N sodium hydroxide solution.*	
7	[1], p.162 Chapter 1.7	**Halogens and halogen compounds. Fluorine. Hydrogen fluoride. Aluminum fluoride. Hydrochloric acid. Hydrogen chloride production. Economic value of hydrogen chloride and hydrochloric acid. Oxygen-chlorine compounds** **Seminar 4.** Urea production.	
8			Midterm
9	[1], p.187 Chapter 2.1	**Phosphorus-containing fertilizers. Economic value. General information. Production of phosphorus fertilizers.** **Superphosphate. Triple superphosphate. Ammonium Phosphates** **Lab.work No. 4.** Obtaining of phosphoric acid. (Continuation) *In the laboratory work the following equipment and materials are used: porcelain cup, chemical beakers, three-neck flask, stirrer, water bath, laboratory transformer, conical flask, burette, fluorapatite, phosphoric acid, sulfuric acid, measuring flask, 0.1n caustic soda solution, methyl orange, phenolphthalein, distilled water, filter paper.*	

		In the laboratory work phosphoric acid is obtained by extraction method as a result of splitting fluorapatite with sulfuric acid. The process is carried out on a pre-assembled unit. The amount of the obtained phosphoric acid is determined by the content of phosphorus oxide (V) by titration with 0.1N sodium hydroxide solution.	
10	[1], p.196 Chapter 2.1 [4], p.185 Chapter 6	**Nitrogen-containing fertilizers. Economic value. General information. Production of nitrogen-containing fertilizers.** **Ammonium sulfate, ammonium nitrate.** **Seminar 5.** Production and properties of nitrogen fertilizers.	
11.	[1], p.205 Chapter 2.3	**Potassium fertilizers. Potassium chloride. Potassium sulfate. Potassium nitrate. The economic importance of potassium fertilizers.** **Lab.work No. 5.** Obtaining simple superphosphate. *In the laboratory work the following equipment and materials are used: porcelain cup, chemical beaker, burette, drying cabinet, mortar, conical flasks, 0.1n solution of caustic soda, sulfuric acid, fluorapatite, methyl orange, phenolphthalein, 10% solution of potassium or sodium oxalate.* *The method consists in obtaining simple superphosphate by splitting fluorapatite with sulphuric acid followed by drying of superphosphate pulp at 100-1100C. The amount of the obtained superphosphate is determined analytically by titration of the resulting mass.*	
12	[1], p.351, Chapter 5.2	**Inorganic fibers. Definitions, production and processing .. Asbestos fibers. Optical fibers.** **Seminar 6.** Inorganic fibers. Mineral fibers Insulation materials.	
13	[1], p.213 Chapter 3.1	**Inorganic fibers. Definitions, production and processing .. Asbestos fibers. Optical fibers.** **Lab.work No. 6.** Obtaining simple superphosphate. (Continuation) *In the laboratory work the following equipment and materials are used: porcelain cup, chemical beaker, burette, drying cabinet, mortar, conical flasks, 0.1n solution of caustic soda, sulfuric acid, fluorapatite, methyl orange, phenolphthalein, 10% solution of potassium or sodium oxalate.* *The method consists in obtaining simple superphosphate by splitting fluorapatite with sulphuric acid followed by drying of*	

		superphosphate pulp at 100-1100C. The amount of the obtained superphosphate is determined analytically by titration of the resulting mass.	
14	[3], p.199, Chapter 12 [1], p.255, Chapter 3.3.	**Aluminum and its compounds. Production and use of aluminum. Economic value.** **Seminar 7.** Chromium compounds. Economic value. Production of chromium compounds.	
15	[1], p.484, Chapter 5.6 [3], p.219, Chapter 12	**General manufacturing processes and properties of metal carbides. Titanium carbide. Zirconium carbide and hafnium carbide.** **Vanadium Carbide Niobium carbide and tantalum carbide, cemented carbides based on tungsten carbide** **Calcium carbide. Economic value. Receipt and application.** **Lab.work No. 7.** Caustification of soda. *The following equipment and materials are used in the laboratory work: three-neck flask, reflux condenser, stirrer, water bath, laboratory transformer, conical flask, thermometer, burette, 5-20% soda solution, caustic lime, 1n hydrochloric acid solution, methyl orange, 10% barium chloride solution, phenolphthalein.* *The laboratory work is carried out in a pre-assembled unit as a result of the interaction of caustic soda and lime. The amount of caustic soda is determined by titration using the existing method.*	
16			Final

Recommended Sources

5. Karl Heinz Büchel, Hans-Heinrich Moretto, Peter Woditsch.Industrial Inorganic Chemistry.Second, Completely Revised Edition. MILEY-VCH, 2000 pp.642.

6. Duncan Gregory.Innovative Inorganic Synthesis.MDPI.2015.pp190.

7. George T.Austin.Shreve's Chemical process industries. McGraW- Hill.Fifth edition. 1984. pp.808

8. Jacob A. Moulijn. Michiel Makkee.Annelies E. Van Diepen. Chemical Process Technology.Second edition.WILEY.2013.pp.552.

9. James Speight. Environmrntal İnorqanic Chemsty for Engineers. Butterworth-Heinemann.2017.pp592.

Assessment		
Attendance	0%	At least 75% of class attendance is compulsory

Presentation	10%	
Quiz	10%	
Seminars	0%	
Laboratory	10%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU Guidelines for Undergraduate Studies

Course Policies

10. Attendance of the course is mandatory.

11. Late assignments will not be accepted unless an agreement is reached with the lecturer.

12. Students can use calculators during the exam.

13. Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class	**14**	**4**	**56**
Presentation	1	16	16
Self-study	14	8	84
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	10	10
Final Examination	1	3	3
Preparation for final exam	1	24	24
Total Workload			210
Total Workload/30(h)			**210/30**
ECTS Credit of the Course			**7**

Chemical engineering (CHEN) master program, “Chemistry and inorganic substances technology” department

Course Unit Title	**Ceramic and glass technology**
Course Unit Code	ENG 1203
Type of Course Unit	Compulsory
Level of Course Unit	1st year of master program
National Credits	-
Number of ECTS Credits Allocated	7
Theoretical (hour/week)	2
Practice (hour/week)	-
Laboratory (hour/week)	1
Year of Study	1
Semester when the course unit is delivered	2
Course Coordinator	Leyla Vazirova
Name of Lecturer (s)	Leyla Vazirova
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Laboratory
Language of Instruction	English
Prerequisites	None
Recommended Optional Program Components	-

Course description: By studying this course, master students will study physico-chemical, mechanical and other properties of ceramic and glass, main processing methods and equipment, and also effects of composition and processing terms on properties of ceramic and glass materials.

Objectives of the Course: The objective of the course is to form knowledge about properties, processing methods, research methods and application areas of ceramic and glass materials.

Learning Outcomes		
At the end of the course the student will be able to		Assessment
1	explain modern approaches to ceramic and glass materials;	1,2,3,4,5
2	substantiate the general principles of chemical processes in ceramic and glass production and to develop a technological scheme of production;	1,2,3,5
3	analysis and evaluate of modern technologies for the production of ceramic and glass;	2
4	understand properties of ceramic and glass materials and areas of their application;	1,2,3,5
5	use various testing methods for studying of structure and properties of ceramic and glass materials.	1,3,4,5
Assessment Methods: 1. Final Exam, 2. Presentation 3. Midterm 4. Laboratory 5. Quiz		

Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate and research complex problems regarding with chemistry, technology and research of properties of ceramic, glass and binding composite materials, refractories, inorganic compounds and mineral fertilizers.	5
4	Ability to apply innovative methods based on key principles of nanochemistry and membrane technology to problem-solving of scientific and technological character.	3
5	Ability to develop concepts and scientific-technological solutions in the field of electrochemical technology, processing of mineral raw materials and water treatment.	3
6	Ability to utilize creativity in elaborating new and inventive products, processes and methods of utilization of solid waste in metallurgy and other areas of inorganic substances manufacturing.	3
7	Ability to identify, find, and provide necessary information, as well as, plan and conduct analytical, model and experimental investigations of inorganic substances and composite materials particularly in the field of catalysts and adsorbents synthesis with further studying their activity.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research	3

	methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	2
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	1

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

Course Contents

Week	Chapter	Topics	Exam
1	[1], p.1-15	**Introduction to ceramic technology.**	
2	[1], Chapter 3, p.20-55	**Milling and equipment.** Purpose of milling and materials. Dry milling. Equipment. Milling media. Mill racks. Blungers. **Laboratory 1.** Introduction to laboratory safety and hazardous materials. *This laboratory work includes an introduction to the instruments and equipment used in the laboratory, as well as a safety briefing.*	
3	[1], Chapter 4, p.56-109	**Slip preparation procedure.** Selection of materials. Fine particle sized slip. Coarse particle slips. Solids recovery. Slip conditioning and storage.	
4	[1], Chapter 5, p.114-133	**Mixing coarse grained materials**. Mixing considerations. Dry mixing and equipment. Wet mixing and equipment. Mix uniformity. **Laboratory 2.** Research of chemical resistance of glass. *In this laboratory work the following equipment and materials are used: conical flask, ball reflux condenser, porcelain mortar, glass funnel, chemical beaker, burette, water bath, distilled water, hydrochloric acid, caustic soda, ethyl alcohol.* *The laboratory work consists in studying the influence of water, hydrochloric acid and alkali on the resistance of inorganic glass when heated. Stability of glass is determined by the difference in mass of the initial glass sample and the mass of this sample after the experiment.*	
5	[1], Chapter 6, p.134-215	**Forming.** Drying a slip. Granulation. Die pressing. Other pressing techniques. Slip casting procedure. Related casting procedure. Extrusion. Drying parts.	

6	[1], Chapter 8, p.230-313	**Firing.** Equipment. Setting practices. Firing procedures. Hot pressing. Hipping. **Laboratory 2.** Research of chemical resistance of glass. (Continuation) *In this laboratory work the following equipment and materials are used: conical flask, ball reflux condenser, porcelain mortar, glass funnel, chemical beaker, burette, water bath, distilled water, hydrochloric acid, caustic soda, ethyl alcohol.* *The laboratory work consists in studying the influence of water, hydrochloric acid and alkali on the resistance of inorganic glass when heated. Stability of glass is determined by the difference in mass of the initial glass sample and the mass of this sample after the experiment.*	
7	[1], Chapter 10, p.333-377	**Effects of processing on properties**. Selection of materials. Effects of pressure and temperature on properties. Effects of temperature on properties. Effects of microstructure on properties.	
8			Midterm
9	[2], Chapter 1, p.1-6 [2], Chapter 2, p.7-25	**Introduction to glass technology**. Definition of glass. The enthalpy/temperature diagram. **Principles of glass formation**. Structural theory of glass formation. Kinetic theories of glass formation. Crystal growth. Determination of glass forming ability and glass stability. **Laboratory 3.** Research of acid resistance of ceramics. *In the laboratory work the following equipment and materials are used: conical flask, ball reflux condenser, sand bath, chemical funnels, rinser, porcelain crucible, muffle furnace, drying cabinet, sulfuric acid, methylorange.* *The laboratory work is to study the effect of sulfuric acid on the acid resistance of ceramics. Acid resistance of ceramic material is determined by the difference between the mass of the initial sample of ceramics and the mass of this sample after acid treatment and calcination.*	
10	[2], Chapter 3, p.26-50	**Glass melting**. Raw materials. Compositional nomenclature. Batch calculations. Mechanism of batch melting. Fining of melts. Homogenizing of melts. Specialized melting methods.	
11	[2], Chapter 4, p.51-71	**Immiscibility/phase separation**. Thermodynamic basis for phase separation. Mechanisms for phase separation. Immiscibility in glass forming systems. Determination of glass forming diagrams. Application of immiscibility diagrams.	

		Laboratory 3. Research of acid resistance of ceramics. (Continuation) *In the laboratory work the following equipment and materials are used: conical flask, ball reflux condenser, sand bath, chemical funnels, rinser, porcelain crucible, muffle furnace, drying cabinet, sulfuric acid, methyl orange.* *The laboratory work is to study the effect of sulfuric acid on the acid resistance of ceramics. Acid resistance of ceramic material is determined by the difference between the mass of the initial sample of ceramics and the mass of this sample after acid treatment and calcination.*	
12	[2], Chapter 5, p.72-109	**Structure of glasses**. Fundamental law of structural models. Elements of structural models for glasses. Structural models for silicate glasses. Structural models for borate glasses. Structural models for germanate glasses. Structural models for phosphate and other inorganic oxide glasses. Halide glasses.	
13	[2], Chapter 6, p.111-137	**Viscosity of glass forming melts**. Viscosity definition and terminology. Viscoelasticity. Viscosity measurement technique. Temperature dependence of viscosity. Compositional dependence of viscosity. Effect of thermal history on viscosity. Effect of phase separation on viscosity. Effect of crystallization on viscosity. **Laboratory 4.** Research of alkali resistance of ceramics. *The following equipment and materials are used in the laboratory work: conical flask, ball reflux condenser, sand bath, chemical funnels, rinser, porcelain crucible, muffle furnace, drying cabinet, 35% caustic soda solution, 1% silver nitrate solution, 10% hydrochloric acid solution.* *The purpose of the laboratory work is to study the effect of caustic soda solution on the alkali-resistance of ceramics. Alkalinity resistance of ceramic material is determined by the difference between the mass of the initial ceramic sample and the mass of this sample after treatment with alkaline solution and calcination.*	
14	[2], Chapter 7, p.138-162 [2], Chapter 9, p.188-200 [2], Chapter 10, p.202-208	**Density and thermal expansion**. Terminology and measurement techniques. Density and molar volume. Thermal expansion behaviour. **Mechanical properties**. Elastic modulus. Hardness. Fracture strength. Fatigue of glasses. Thermal shock. **Optical properties**. Bulk optical properties.	

15	[2], Chapter 13, p.249-260 [2], Chapter 14, p.262-274	**Glass technology**. Classical forming methods. Specialized forming methods. **Composition and properties of commercial glasses**. Vitreous silica. Soda-lime-silica glasses. Borosilicate glasses. Glass fibers. Glass-ceramics. Other commercial glasses. **Laboratory 5.** Determination of density and volume weight of ceramic specimens. *In the laboratory work the following equipment and materials are used: hydrostatic balance (Archimedes balance), analytical balance, chemical beaker, water or appropriate liquid, string to hang the sample, caliper, paraffin.* *Conducting laboratory work is to determine the density of ceramics by weighing samples on hydrostatic balance. Density is determined by the difference of masses of the sample in the air and in the liquid.* *This work also involves determining the volumetric weight of the samples of regular and irregular shape. In the first case, the volumetric weight is determined by measuring the main geometric dimensions of the sample with an accuracy of 0.01 mm, and in the second case by the volume of displaced liquid.*	
16			Final

Recommended Sources

1. A.G.King. Ceramic technology and processing: A practical working guide. 1st edition. William Andrew. 2002. P.533.

2. J.E.Shelby. Introduction to glass science and technology. 2nd edition. The royal society of chemistry. 2005. P.291.

Attendance	0%	At least 75% of class attendance is compulsory
Presentation	10%	
Quiz	10%	
Laboratory	10%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam

Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU Guidelines for Undergraduate Studies

Course Policies

1. Attendance of the course is mandatory.

2. Late assignments will not be accepted unless an agreement is reached with the lecturer.

3. Students can use calculators during the exam.

4. Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class	**14**	**3**	**42**
Presentation	1	16	16
Self-study	14	6	84
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	30	30
Final Examination	1	3	3
Preparation for final exam	1	34	34
Total Workload			**210**
Total Workload/30(h)			**210/30**
ECTS Credit of the Course			**7**

Course Unit Title	**Advanced technologies of binding materials**
Course Unit Code	ENG 1204
Type of Course Unit	Compulsory
Level of Course Unit	1st year of master program
National Credits	-
Number of ECTS Credits Allocated	8
Theoretical (hour/week)	2
Practice(hour/week)	1
Laboratory (hour/week)	1
Year of Study	1
Semester when the course unit is delivered	2
Course Coordinator	Minira Aghahuseynova
Name of Lecturer (s)	Minira Aghahuseynova
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar, Laboratory
Language of Instruction	English
Prerequisites	None
Recommended Optional Program Components	-

Course description In the course of studying the course, the following aspects will be considered: preparation and processing methods of raw materials for the production of cementitious materials, the chemical and mineralogical composition of cementitious materials, thermal processes occurring in the production of cementitious materials, physico-mechanical properties of cementitious materials for their aggregates, innovative methods for producing concrete and cementitious materials .

Objectives of the Course: to teach students the necessary raw materials for the production of materials, production technology, physical and chemical properties and application areas.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	raw materials of the binding industry, knowledge of chemical composition, properties and quality indicators of primary products	1,3
2	knowledge of general principles and technology for the implementation of widespread chemical processes for the production of binders	1,2,3

3	general and specific features of the production processes of inorganic substances	1,2
4	Knowledge of technological scheme and technological mode of production	1,2,3
5	Knowledge of application areas for the designation of different types of binders	1,2,3
6	Be able to obtain binder materials and to study physical and mechanical properties	4
Assessment Methods: 1. Final Exam, 2. Presentation 3. Midterm 4. Laboratory		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate and research complex problems regarding with chemistry, technology and research of properties of ceramic, glass and binding composite materials, refractories, inorganic compounds and mineral fertilizers.	5
4	Ability to apply innovative methods based on key principles of nanochemistry and membrane technology to problem-solving of scientific and technological character.	3
5	Ability to develop concepts and scientific-technological solutions in the field of electrochemical technology, processing of mineral raw materials and water treatment.	3
6	Ability to utilize creativity in elaborating new and inventive products, processes and methods of utilization of solid waste in metallurgy and other areas of inorganic substances manufacturing.	4
7	Ability to identify, find, and provide necessary information, as well as, plan and conduct analytical, model and experimental investigations of inorganic substances and composite materials particularly in the field of catalysts and adsorbents synthesis with further studying their activity.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	4
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	2
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	1

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)			
Course Contents			
Week	Chapter	Topics	Exam
1	[1] Chapter 1 p.1-16 [2], Chapter 1. p.1-10	Introduction. Binders and concrete of yesterday. Characterization of minerals and rocks **Laboratory work** 1. Introduction to laboratory safety. *This laboratory work includes an introduction to the instruments and equipment used in the laboratory, as well as a safety briefing.*	
2	[1] Chapter 2. p.25-27 [2] Chapter 1. p.18-29	Mineral composition and quality of limestone. Lime, raw materials, burning of lime. Lime production, lime properties **Seminar 1.** Introduction to binding materials.	
3	[2] Chapter 1. p.29-39 [1] Chapter 2. p.16-25	Gypsum, special inorganic binders, corrective materials. **Laboratory work** 2. Study of the process of obtaining building lime from carbonate mineral waste. *In this laboratory work the following equipment and materials are used: muffle furnace, porcelain crucible, technical balance, carbonate rock.* *The essence of the work is that carbonate rock is calcined in a muffle furnace. After roasting, the obtained lime is weighed to determine the losses during calcination. These losses are used to determine the grade of the lime.*	
4	[1] Chapter 2. p.27-40 and Chapter 7. p.206-270	Hydraulic binders based on pozzolans, cement and concrete admixtures **Seminar 2.** Lime production and properties.	
5	[1] Chapter 3. pp. 43- 61	The hydraulic binders and concrete industries at the beginning of the twenty-first century. Portland cement - general considerations Composition and petrography of Portland cement clinker. **Laboratory work** 2. Study of the process of obtaining building lime from carbonate mineral waste. (Continuation)	

		In this laboratory work the following equipment and materials are used: muffle furnace, porcelain crucible, technical balance, carbonate rock. *The essence of the work is that carbonate rock is calcined in a muffle furnace. After roasting, the obtained lime is weighed to determine the losses during calcination. These losses are used to determine the grade of the lime.*	
6	[1] Chapter 4. pp. 63- 88	The chemical and phase composition of Portland cement. **Seminar 3.** Gypsum and special inorganic binders.	
77	[2] Chapter 5. pp. 141- 171 [1] Chapter 5. pp. 89- 135	Pyroprocessing and clinker cooling. Production of Portland cement **Laboratory work** 3. Determination of specific surface of binding materials powder. *A specially designed unit consisting of a monostat, dryer, rheometer, Dewar vessel, U-tube, katharometer, and recorder, as well as nitrogen and helium balloons, is used for the laboratory work.* *The laboratory work is performed as follows. The sample of binding material powder under study is placed in a stream of nitrogen and helium and then cooled to the temperature of liquid nitrogen. The specific surface of the sample is determined by the amount of nitrogen desorbed during heating.*	
8			Midterm
9	[2] Chapter 3,4. pp. 73- 139	Fuels commonly in use for clinker production. Alternative fuels and raw materials **Seminar 4.** Portland cement and its production and properties.	
10	[2] Chapter 6. pp. 173- 211	Grinding, storage of Portland cement **Laboratory work** 3. Determination of specific surface of binding materials powder. (Continuation) *A specially designed unit consisting of a monostat, dryer, rheometer, Dewar vessel, U-tube, katharometer, and recorder, as well as nitrogen and helium balloons, is used for the laboratory work.* *The laboratory work is performed as follows. The sample of binding material powder under study is placed in a stream of nitrogen and helium and then cooled to the temperature of*	

		liquid nitrogen. The specific surface of the sample is determined by the amount of nitrogen desorbed during heating.	
11	[2] Chapter 7. pp. 213-226	Composition and properties of Portland cements **Seminar 5.** Fuels used in clinker production.	
12	[1] Chapter 8. p.273-310 [2]. Chapter 7 pp. 226-249	Cementitious materials other than Portland cement. Supplementary cementitious materials, mineral components, Portland cement additions. Slags. Fly ashes. Blended cements. **Laboratory work** 4. Determination of the degree of water absorption of cement concrete samples. The following equipment and materials are required for the laboratory work: analytical scales, drying cabinet, a vessel for the test. The course of this laboratory work is to measure the mass of pre-prepared samples of concrete before and after exposure to water. The mass is determined with an accuracy of 0.001 g. According to the difference in the mass of the samples determine the degree of water absorption by the appropriate methodology.	
13	[1].Chapter 9. 313-327 [2].Chapter 8. pp. 251- 285	Special Portland cements: White Portland, cement Buff, cement Oil, well cements, Shrinkage compensating cements, Regulated set cements, Masonry cement, Air-entrained Portland cements, Low alkali Portland cements, Microcements. Aluminous cements. Calcium sulphoaluminate cements Other types of hydraulic binder. Advances in plant-based quality control practice **Seminar 6.** Other cementitious materials and additives.	
14	[2].Chapter 9. p.287-324 [1].Chapter 10. 331-390	Environmental mitigation and pollution control technologies. The art and science of high-performance concrete. Durability. **Laboratory work** 5. Determination of the basic physical and mechanical properties of concrete. The following equipment is used to carry out this work: computer controlled automatic pressure tester, a set of forms of size 40×40×40 mm and 40×40×160 mm. The essence of the work is that samples of concrete are prepared for testing according to the known methodology. The resulting concrete mass is molded in the above-mentioned forms. After molding and curing samples within 28 days, concrete tests are carried out to determine the compressive strength and the bending strength in accordance with existing standards.	

15	[1].Chapter 11-13 p. 397-440 [2].Chapter 10. p. 352-369	The development of the cement and concrete industries within a sustainable development policy. Cements of yesterday and today, concretes of tomorrow. The ideal Portland cement **Seminar 7.** Special Portland cements.	Final

Recommended Sources:

14. Pierre-Claude Aïtcin. Binders for Durable and Sustainable Concrete/ by Taylor & Francis, 2008. 500p.

15. Anjan Kumar Chatterjee. Cement Production te.cнnology. Principles and practice. 2018 by Taylor & Francis Group, LLC. 440p. (textbook)

Assessment		
Attendance	0%	At least 75% of class attendance is compulsory
Presentation	10%	
Quiz	10%	
Laboratory	10%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU Guidelines for Undergraduate Studies

Course Policies

17. Attendance of the course is mandatory.

18. Late assignments will not be accepted unless an agreement is reached with the lecturer.

19. Students can use calculators during the exam.

20. Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class	**14**	**4**	**56**

Presentation	1	20	20
Self-study	14	5	70
Tutorials	14	2	28
Midterm Examination	1	3	3
Preparation for midterm exam	1	17	17
Final Examination	1	3	3
Preparation for final exam	1	43	43
Total Workload			**240**
Total Workload/30(h)			**240/30**
ECTS Credit of the Course			**8**

Chemical engineering (CHEN) master program, "Chemistry and inorganic substances technology" department

Course Unit Title	**Applied aspects of halurgy**
Course Unit Code	ENG 3002
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	8
Theoretical (hour/week)	2
Practice (hour/week)	2
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Minira Aghahuseynova
Name of Lecturer (s)	Minira Aghahuseynova
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	None
Recommended Optional Program Components	-
Course description: The followings will be studied during the course: physical and chemical analysis of water-salt systems; solar evaporation of salt solutions; brine purification technology and its purpose; equipment in crystallization of halurgic raw materials; general methods of industrial production of salts from halurgic raw materials.	
Objectives of the Course:	

The objective of the course is to give a knowledge about technology of production of industrially important salts from brines and rock salts, resources of salts and their deposits, and about technology of processing of halurgic raw materials.		
Learning Outcomes		
At the end of the course the student will be able to		Assessment
1	evaluate and select the technological schemes of crystallization of salts from solutions and enrichment of natural salts, including in heavy media;	1,2,3,5
2	analyze the advantages and disadvantages of various methods of processing of fossil and lake salt raw materials;	1,2,3,5
3	assess the environmental consequences of the underground dissolution of natural salts, primary enrichment of salts and the necessity for wastewater treatment.	2
Assessment Methods: 1. Final Exam, 2. Presentation 3. Midterm 4. Quiz		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate and research complex problems regarding with chemistry, technology and research of properties of ceramic, glass and binding composite materials, refractories, inorganic compounds and mineral fertilizers.	5
4	Ability to apply innovative methods based on key principles of nanochemistry and membrane technology to problem-solving of scientific and technological character.	3
5	Ability to develop concepts and scientific-technological solutions in the field of electrochemical technology, processing of mineral raw materials and water treatment.	5
6	Ability to utilize creativity in elaborating new and inventive products, processes and methods of utilization of solid waste in metallurgy and other areas of inorganic substances manufacturing.	3
7	Ability to identify, find, and provide necessary information, as well as, plan and conduct analytical, model and experimental investigations of inorganic substances and composite materials particularly in the field of catalysts and adsorbents synthesis with further studying their activity.	4
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research	3

	methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	2
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	1
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	[1], chapter 1, pp. 11-19	**Introduction.** The objectives of halurgy. Role of scientists in development of halurgy in the world. **Seminar.** Halurgy role in science and technology.	
2	[1], chapter 5, pp.60-103	**Main properties of minerals and their solutions**. Salts solubility. Kinetics of minerals solubility. Solution heat of salts and mixing heat of solutions. Volatility of brines and its determination. Vapour pressure of solutions and crystalline hydrates. Viscosity of solutions. Density of solutions and solids. **Seminar.** Main physico-chemical properties of minerals.	
3	[2], chapter 2, pp.4-30	**Principles of hydrochemistry**. Chemical concepts. Physical chemistry applied to natural water. **Seminar.** Hydrochemistry in halurgy.	
4	[2], chapter 3, pp.32-90 [1], chapter 6, pp.111-146	**Chemical processes in water cycle**. Deposition of soluble substances by rain and snow, fog and rime, and by dry deposition. Processes in lakes and water courses. Conditions of natural water formation. Composition of river water. Composition of oceanic water. Composition of sea and lake water. Classification of natural basins. **Seminar.** Chemical processes in natural water cycle.	
5	[3], sodium chloride, pp.1-24	**Production of sodium chloride**. History. Properties formation and occurrence of salt deposits. Mining of rock salt. Production of crude brine by mining methods. Controlled solution mining. Production of sea salt. Production of pure salt by evaporation of brine. Economic aspects. **Seminar.** Sodium chloride production and application.	
6	[4], chapter 1, pp.1-18	**The origin of sodium sulfate and its deposits**. The source of sodium sulfate. Mirabilite. Thenardite. Glauberite.	

	[4], chapter 4, pp.119-220	**Processing.** Current and prior commercial operations. **Seminar.** Sodium sulfate deposits, production and application.	
7			Midterm
8	[4], chapter 4, pp.260-275 [4], chapter 5, pp.289-301	**Processing.** General processing studies. Forming other salts from sodium sulfate. **The uses of sodium sulfate**. Detergents. Textile industry. Kraft pulping process. Glass. Production of other chemicals. **Seminar.** Sodium sulfate deposits, production and application.	
9	[3], sodium carbonates, pp.1-18 [3], magnesium compounds, pp.1-32	**Natural soda and its production**. Sodium carbonate. Properties and minerals. Ammonia-soda process. Other processes. Uses. Sodium hydrogen carbonate. **Magnesium compounds production**. Magnesium carbonate and magnesium chloride properties. Raw materials. Production. Application. Magnesium oxide and hydroxide. Production from magnesite. Production from sea water and brines. Application. Magnesium sulfate. Properties, occurrence, raw materials. Production Application. **Seminar.** Soda deposits, production and application.	
10	[3], bromine, pp. 1-13 [3], iodine and iodine compounds, pp. 1-8	**Extraction of bromine and iodine from sea water and produced waters**. Bromine properties. Bromine production. Steaming-out process. Seawater process. Electrolysis. Bromine from recycle and waste brines. Purification. Bromine application. Iodine properties and occurrence. Iodine production. Iodine application. **Seminar.** Bromine and iodine production.	
11	[5], chapter 4, pp. 304-312 [5], chapter 5, pp. 325-385	**Potash solution mining**. Basic solution mining. **Silvinit, other potash ore processing.** Size reduction. Desliming. Flotation. Electrostatic separation. Heavy media separation. Crystallization circuits. Dewatering, drying. Compaction. Screening. **Seminar.** Potash ores processing.	
12	[5], chapter 6, pp. 403-420. [5], chapter 7, pp. 440-460, 463-486.	**Potash brine processing operations**. Solar evaporation. **Non-chloride products**. Potassium sulfate. Potassium nitrate. Potassium carbonate. Potassium phosphate. **Seminar.** Potassium compounds processing.	

13	[6], part 1, pp. 98-179.	**Lithium production**. Processing. **Seminar.** Lithium production and application.	
14	[6], part 2, pp. 337-378	**Calcium chloride production**. Processing. Michigan dolomitization brines. Bristol and Cadiz lakes. General processing technology. Uses of calcium chloride. **Seminar.** Calcium chloride processing and application.	
15	[7], chapter 8, pp. 333-347, 366-384	**Borates processing**. Borax and kernite. Brine. **Seminar.** Borate compounds obtaining from ores and brines.	
16			Final

Recommended Sources

1. A.B.Zdanovsky. Halurgy. Khimiya. 1972. pp.528.

2. E.Ericsson. Principles and applications of hydrochemistry. Chapman and Hall. 1-st edition. 1985. pp.187.

3. Ullmann's Encyclopediya of industrial chemistry. Wiley Interscience. 2005.

4. D.E.Garrett. Sodium sulfate. Handbook of deposits, processing, properties and use. Academic Press. 2001. pp.365.

5. D.E.Garrett. Potash: deposits, processing, properties and uses. Chapman&Hall. 1996. pp.734.

6. D.E.Garrett. Handbook of lithium and natural calsium chloride. Their deposits, processing, uses and properties. Elsivier. 2004. pp.476.

7. D.E.Garrett. Borates. Handbook of deposits, processing, properties and use. Academic press. 1998. pp.483.

Assessment		
Attendance	0%	At least 75% of class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam

Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU Guidelines for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students can use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	**Number**	**Duration (hour)**	**Total Workload(hour)**
Course duration in class	**14**	**4**	**56**
Presentation	1	16	16
Self-study	14	6	84
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	30	30
Final Examination	1	3	3
Preparation for final exam	1	34	34
Total Workload			**240**
Total Workload/30(h)			**240/30**
ECTS Credit of the Course			**8**

Chemical engineering (CHEN) master program, "Chemistry and inorganic substances technology" department

Course Unit Title	**Membrane technology**
Course Unit Code	ENG 3001
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	8
Theoretical (hour/week)	2
Practice (hour/week)	2
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Vagif Baghiyev
Name of Lecturer (s)	Vagif Baghiyev
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	None
Recommended Optional Program Components	-

Course description: During the course the processes and patterns of microfiltration, ultrafiltration, nanofiltration, dialysis, electrodialysis, reverse osmosis will be studied. In the same time application of ion-exchange and membrane technologies in various industrial processes and in medicine will be discussed.

Objectives of the Course: The main aim of the discipline is to give master student an optimal knowledge about physico-chemical basis of membrane processes, membrane structure, design of membrane processes and application of membranes in science and technology.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	evaluate membrane technologies;	1,2,3,4
2	understand theoretical and methodological basis of membrane technologies for various processes;	1,2,3,4
3	apply membrane technologies in research.	2

Assessment Methods: 1. Final Exam, 2. Presentation 3. Midterm 4. Quiz

Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate and research complex problems regarding with chemistry, technology and research of properties of ceramic, glass and binding composite materials, refractories, inorganic compounds and mineral fertilizers.	4
4	Ability to apply innovative methods based on key principles of nanochemistry and membrane technology to problem-solving of scientific and technological character.	5
5	Ability to develop concepts and scientific-technological solutions in the field of electrochemical technology, processing of mineral raw materials and water treatment.	4
6	Ability to utilize creativity in elaborating new and inventive products, processes and methods of utilization of solid waste in metallurgy and other areas of inorganic substances manufacturing.	4
7	Ability to identify, find, and provide necessary information, as well as, plan and conduct analytical, model and experimental investigations of inorganic substances and composite materials particularly in the field of catalysts and adsorbents synthesis with further studying their activity.	4
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	4
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	2
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	1
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents			
Week	Chapter	Topics	Exam
1	[1], p.1-14, Chapter 1	**Introduction.** Historical development of membranes. Types of membranes. Membrane processes.	

		Seminar. Membrane technology in our life. Types of membranes.	
2	[1], p.15-48, Chapter 2	**Membrane transport theory.** Solution-diffusion model. **Seminar**. Transport processes in membranes.	
3	[1], p.48-84, Chapter 2	**Membrane transport theory.** Structure-permeability relationships in solution-diffusion membranes. Pore-flow membranes. **Seminar**. Solution-diffusion membranes.	
4	[1], p.88-155, Chapter 3	**Membranes and modules.** Isotropic membranes. Anisotropic membranes. Metal membranes and ceramic membranes. Hollow fiber membranes. Membrane modules **Seminar**. Various types of membranes and their modules.	
5	[1], p.161-189, Chapter 4	**Concentration polarization.** Boundary layer film model. Concentration polarization in liquid and gas separation processes. Cross-flow, co-flow and counter-flow. **Seminar.** Concentration polarization applications.	
6	[1], p.191-232, Chapter 5	**Reverse osmosis.** Theoretical background. Membranes and materials. Reverse osmosis membranes categories. Membrane selectivity. Membrane modules. Membrane fouling control. Membrane cleaning. Applications. **Seminar.** Reverse osmosis membranes.	
7			Midterm
8	[1], p.236-272, Chapter 6	**Ultrafiltration.** Characterization of ultrafiltration membranes. Concentration polarization and membranes fouling. Membrane cleaning. Membranes and modules. System design. Application. **Seminar.** Ultrafiltration membranes.	
9	[1], p.275-299, Chapter 7	**Microfiltration.** Background. Types and characterization of membranes. Microfiltration membranes and modules. Process design. Application. **Seminar.** Microfiltration membranes.	
10	[1], p.301-350, Chapter 8	**Gas separation.** Theoretical backgrounds. Membrane materials and structure. Membrane modules. Process design. Applications. **Seminar.** Membranes for gas separation.	
11	[1], p.354-389,	**Pervaporation.** Theoretical background. Membrane materials and modules. Process design. Applications.	

	Chapter 9	**Seminar.** Pervaporation membranes.	
12	[1], p.393-422, Chapter 10	**Ion-exchange membrane processes – Electrodialysis.** Theoretical background. Chemistry of ion-exchange membranes. Transport in electrodialysis membranes. System design. Applications. **Seminar.** Ion-exchange membranes.	
13	[1], p.424-460, Chapter 11	**Carrier facilitated transport.** Coupled transport. Coupled transport membranes. Applications. Facilitated transport. Process designs. Applications. **Seminar.** Coupled and facilitated transport membranes.	
14	[1], p.464-489, Chapter 12	**Medical application of membranes.** Hemodialysis. Blood oxygenators. Controlled drug delivery. **Seminar.** Membrane technologies in medicine.	
15	[1], p.491-519, Chapter 13	**Other membrane processes.** Dialysis. Donnan dialysis and diffusion dialysis. Charge mosaic membranes and piezodialysis. Membrane contactors and membrane distillation. Application of membrane contactors. Membrane reactors. Applications of membrane reactors. **Seminar.** Other membrane processes and applications.	
16			Final

Recommended Sources

1. R.W.Baker. Membrane technology and applications. Second edition. Wiley. 2004. p.538.

Assessment		
Attendance	0%	At least 75% of class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	
Assessment Criteria		

Final grades are determined according to the Academic Regulations of ASOIU Guidelines for Undergraduate Studies			
Course Policies • Attendance of the course is mandatory. • Late assignments will not be accepted unless an agreement is reached with the lecturer. • Students can use calculators during the exam. • Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations			
ECTS allocated based on Student Workload			
Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class	**14**	**4**	**56**
Presentation	1	16	16
Self-study	14	6	84
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	30	30
Final Examination	1	3	3
Preparation for final exam	1	34	34
Total Workload			**240**
Total Workload/30(h)			**240/30**
ECTS Credit of the Course			**8**

Chemical engineering (CHEN) master program, “Chemistry and inorganic substances technology” department

Course Unit Title	**Technologies of processing of industrial waste in metallurgy**
Course Unit Code	ENG 3004
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	8
Theoretical (hour/week)	2
Practice (hour/week)	2
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Leyla Vazirova
Name of Lecturer (s)	Leyla Vazirova
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	None
Recommended Optional Program Components	-

Course description: The following aspects will be studied during the course: theoretical bases and industrial practice of processing of industrial products and wastes of metallurgical productions; factors of allocation of industrial products and industrial wastes in category of technogenic raw materials; research of properties and ways of processing of technogenic raw materials; selection of the equipment for schemes of processing of technogenic raw materials.

<table>
<tr><td colspan="3">Objectives of the Course: The main task of the course is to form a complete idea about sources and types of pyrometallurgical and hydrometallurgical wastes and about ways and technologies of their processing.</td></tr>
<tr><td colspan="3">Learning Outcomes</td></tr>
<tr><td colspan="2">At the end of the course the student will be able to</td><td>Assessment</td></tr>
<tr><td>1</td><td>organize studies of the properties and methods of processing of technogenic raw materials;</td><td>2</td></tr>
<tr><td>2</td><td>argue the choice of equipment for technological schemes of processing of technogenic raw materials;</td><td>1,3,4</td></tr>
<tr><td>3</td><td>search, interpret, analyze and summarize scientific and technical information about the research of properties and development of processes for the processing of technogenic raw materials;</td><td>2</td></tr>
<tr><td>4</td><td>substantiate the choice of optimal methods of processing of technogenic raw materials based on analysis of scientific and technical information and taking into account environmental, social, technical and economic factors.</td><td>1,2,3,4</td></tr>
<tr><td colspan="3">Assessment Methods: 1. Final Exam, 2. Presentation 3. Midterm 4. Quiz</td></tr>
<tr><td colspan="3">Course’s Contribution to Program</td></tr>
<tr><td></td><td></td><td>CL</td></tr>
<tr><td>1</td><td>Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.</td><td>5</td></tr>
<tr><td>2</td><td>Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.</td><td>5</td></tr>
<tr><td>3</td><td>Ability to summarize, formulate and research complex problems regarding with chemistry, technology and research of properties of ceramic, glass and binding composite materials, refractories, inorganic compounds and mineral fertilizers.</td><td>4</td></tr>
<tr><td>4</td><td>Ability to apply innovative methods based on key principles of nanochemistry and membrane technology to problem-solving of scientific and technological character.</td><td>3</td></tr>
<tr><td>5</td><td>Ability to develop concepts and scientific-technological solutions in the field of electrochemical technology, processing of mineral raw materials and water treatment.</td><td>3</td></tr>
<tr><td>6</td><td>Ability to utilize creativity in elaborating new and inventive products, processes and methods of utilization of solid waste in metallurgy and other areas of inorganic substances manufacturing.</td><td>5</td></tr>
<tr><td>7</td><td>Ability to identify, find, and provide necessary information, as well as, plan and conduct analytical, model and experimental investigations of inorganic substances and composite materials particularly in the field of catalysts and adsorbents synthesis with further studying their activity.</td><td>3</td></tr>
</table>

8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	3
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	2
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	1
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	[1], Chapter 1, pp.1-12	**Introduction.** General concepts. Wastes minimization. Waste recycling. Economic incentives for recycling and recourses recovery. **Seminar.** Metallurgical wastes and their utilization problems.	
2	[1], Chapter 2, pp.13-34	**Waste characterization**. Basic principles of spectroscopic techniques. Infrared spectroscopy. Scanning electron microscopy. **Seminar.** Testing methods for metallurgical wastes.	
3	[1], Chapter 3, pp.35-69	**Physical and chemical processes**. Material preparation for physical separation. Comminution. Gravity separation. Magnetic separation. Electrostatic separation. Shredding systems. Adsorptive bubble separation. Separation by picking. **Seminar.** Chemical and physical processes used in processing of metallurgical wastes.	
4	[1], Chapter 4, pp.71-108	**Hydrometallurgical processes**. Selective precipitation. Solvent extraction. Electrochemical processes. Leaching processes. **Seminar.** Hydrometallurgical processes.	
5	[1], Chapter 6, pp.127-165	**Pyrometallurgical processing**. Furnace technology. Burner selection. Smelting furnace. Thermal reactors. Plasma processes. Size enlargement technologies. Pelletization. **Seminar.** Pyrometallurgical processes.	
6	[1], Chapter 7, pp.167-197	**Metal recycling**. Iron and steel. Stainless steel. Copper. **Seminar.** Recycling of ferrous metals.	

7			Midterm
8	[1], Chapter 7, pp.197-235	**Metal recycling.** Lead. Zinc. Aluminum. **Seminar.** Nonferrous metals recycling.	
9	[1], Chapter 7, pp.236-268	**Metal recycling.** Nickel and cobalt. Precious metals. Gallium and indium. Cadmium, mercury and tin. Chromium, molybdenum and tungsten. Magnesium. Rare earth metals. Recovery of alloy from industrial scrap. **Seminar.** Nonferrous metals recycling.	
10	[1], Chapter 8, pp.269-300	**Metallurgical slags, dusts and fumes**. Slags. Flue dust. **Seminar.** Metallurgical slags, dusts and fumes processing.	
11	[1], Chapter 8, pp.301-327	**Metallurgical slags, dusts and fumes**. Flue dust. Metal recovery from fly ash. Recovery metals from picking sludge by smelting reduction. **Seminar.** Metallurgical slags, dusts and fumes processing.	
12	[1], Chapter 9, pp.329-374	**By-products processing and utilization**. Processing and utilization of slug. Processing of dross. Processing of fly ash. Use of mine and mill tailings as backfill. Use tailings as heavy metal adsorbents. Ceramic tiles production from iron ore tailings. “Zero waste process”. **Seminar.** Metallurgical slug, dross and fly ash processing.	
13	[1], Chapter 10, pp.375-457.	**Resources recovery from process wastes**. Mineral process tailings. Metallurgical effluents and residues. Recovery of metal concentrates from wastes sludge. Solid wastes. **Seminar.** Metallurgical processes tailings and their recovery.	
14	[1], Chapter 11, pp.459-481.	**Recycling of water and reagents**. Recycling water. Recycling reagents. **Seminar.** Water treatment in metallurgical processes.	
15	[1], Chapter 12, pp.483-508.	**Emerging new technologies**. Magnetic carrier technologies. Separation by silica-polyamine complexes. Molecular recognition technology. Mesoporous adsorbents. Liquid membrane processes. Nanofiltration. **Seminar.** Advanced technologies application.	
16			Final

Recommended Sources

1. S.Ramachandra Rao. Resource recovery and recycling from metallurgical wastes. Elsevier. First edition. 2006. pp.557.

Assessment		
Attendance	0%	At least 75% of class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU Guidelines for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students can use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class	**14**	**4**	**56**
Presentation	1	16	16
Self-study	14	6	84
Tutorials	14	1	14
Midterm Examination	1	3	3

Preparation for midterm exam	1	30	30
Final Examination	1	3	3
Preparation for final exam	1	34	34
Total Workload			**240**
Total Workload/30(h)			**240/30**
ECTS Credit of the Course			**8**

Chemical engineering (CHEN) master program, "Chemistry and inorganic substances technology" department

Course Unit Title	**Nanochemistry**
Course Unit Code	CHEM 3001
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	8
Theoretical (hour/week)	2
Practice (hour/week)	2
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-

Course Coordinator	Vagif Baghiyev
Name of Lecturer (s)	Vagif Baghiyev
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	None
Recommended Optional Program Components	-

Course description: During the course physical and chemical properties of nanoparticles, nanoclusters and nanomaterials, methods of nanoparticles and nanomaterials obtaining, research methods of nanosystems and application areas of functional nanomaterials in modern fields of science and technology will be studied.

Objectives of the Course: The aim of the discipline is to form at master student complete idea about synthesis methods, research methods and structure of nanoparticles and nanomaterials, and also about application of nanomaterials in science and technology.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	analyze the structure of nanomaterials;	1,2,3,4
2	apply the laws of formation of nanoparticles to develop new nanomaterials;	1,3,4
3	apply the laws of formation of nanocompounds for development of new nanosystems.	2

Assessment Methods: 1. Final Exam, 2. Presentation 3. Midterm 4. Quiz

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate and research complex problems regarding with chemistry, technology and research of properties of ceramic, glass and binding composite materials, refractories, inorganic compounds and mineral fertilizers.	4
4	Ability to apply innovative methods based on key principles of nanochemistry and membrane technology to problem-solving of scientific and technological character.	5

5	Ability to develop concepts and scientific-technological solutions in the field of electrochemical technology, processing of mineral raw materials and water treatment.	4
6	Ability to utilize creativity in elaborating new and inventive products, processes and methods of utilization of solid waste in metallurgy and other areas of inorganic substances manufacturing.	3
7	Ability to identify, find, and provide necessary information, as well as, plan and conduct analytical, model and experimental investigations of inorganic substances and composite materials particularly in the field of catalysts and adsorbents synthesis with further studying their activity.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	4
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	2
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	1

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

Course Contents

Week	Chapter	Topics	Exam
1	[1], p.1-7, Chapter 1	**Introduction.** Survey of the problem and certain definitions. **Seminar.** Nanoparticles and their main definitions.	
2	[1], p.11-27, Chapter 2	**Synthesis and stabilization of nanoparticles.** Chemical reduction. Reactions in micelles, emulsions and dendrimers. Photochemical and radiation-chemical reduction. **Seminar.** Methods of nanoparticles synthesis and stabilization.	
3	[1], p.27-48, Chapter 2	**Synthesis and stabilization of nanoparticles.** Cryochemical synthesis. Physical methods. Particles of various shapes and films. **Seminar.** Cryochemical and physical methods.	
4	[1], p.55-71, Chapter 3	**Solvated metal atom dispersion for making metal nanoparticles.** Experimental technique. Aggregation of metal atoms or reactive molecules in low-temperature matrix/solvents. Examples of useful synthesis. Digestive ripening or “nanomachining”. Rods, wires and stars.	

		Seminar. Metal nanoparticles making.	
5	[1], p.75-86, Chapter 4	**Experimental techniques.** Electron microscopy. Probe microscopy. Diffraction techniques. Miscellaneous techniques. **Seminar.** Experimental technique for nanomaterials research.	
6	[1], p.209-217, Chapter 7 [1], p.221-231, Chapter 8	**Assemblies involving nanoparticles.** Forces between nanoparticles. **Group of Carbon**. Fine particles of carbon and silicon. Fullerenes. Carbon nanotubes. Graphene. **Seminar.** Carbon and silicon containing nanoparticles.	
7			Midterm
8	[1], p.275-295, Chapter 10	**Size effects in nanochemistry.** Melting point. Kinetic peculiarities of chemical processes on the surface of nanoparticles. Thermodynamic features of nanoparticles. Magnetic and electrical/conducting properties of nanoparticles. **Seminar.** Nanochemistry and size effects.	
9	[2], p.486-513, Chapter 4	**Bulk nanostructured materials obtained by powder sintering.** Sintering. Spark plasma sintering. Self-assemble of nanomaterials at macroscopic scales. Fabrication of nanomaterials. 2D and 3D nanomaterials structures. **Seminar.** Obtaining of nanomaterials by sintering of powders.	
10	[2], p.529-546, Chapter 4	**Nanostructured coatings.** Methodology for making superhard nanostructured coatings. Methods of synthesis. **Seminar.** Making of nanocoatings.	
11	[2], p.548-565, Chapter 4	**Dispersion in solids.** Chemical methods. Sol-gel method. Synthesis of doped glass. Physical methods. Ion implantation. Vapour deposition and sputtering methods. **Seminar.** Methods of dispersion in solids.	
12	[2], p.568-588, Chapter 4	**Nanoporous media.** Symthesis of crystalline microporous solids. Synthesis of ordered mesoporous solids. **Seminar.** Synthesis of microporous solid nanomaterials.	

13	[2], p.588-598, Chapter 4 [2], p.596-608, Chapter 4	**Nanoporous media.** Synthesis of ordered mesoporous solids. **Molecular imprinting.** Fundamental considerations. Procedures and methods of molecular imprinting. **Seminar.** Synthesis of mesoporous solid nanomaterials.	
14	[1], p.298-318, Chapter 11	**Nanoparticles of science and technology.** Catalysis on nanoparticles. Oxide reactions. **Seminar.** Nanomaterials applications.	
15	[1], p.318-337, Chapter 11	**Nanoparticles of science and technology.** Semiconductors, sensors and electronic devices. Photochemistry and nanophotonics. Application of carbon nanotubes. Nanochemistry in biology and medicine. **Seminar.** Nanomaterials applications.	
16			Final

Recommended Sources

1. G.B.Sergeev, K.J.Klabunde. Nanochemistry. Second edition. Elsevier. 2013. pp.359.

2. C.Brechignac, P.Houndy, M.Lahmani. Nanomaterials and nanochemistry. Springer. 2007. pp.747.

Assessment		
Attendance	0%	At least 75% of class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU Guidelines for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.

- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students can use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class	**14**	**4**	**56**
Presentation	1	16	16
Self-study	14	6	84
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	30	30
Final Examination	1	3	3
Preparation for final exam	1	34	34
Total Workload			**240**
Total Workload/30(h)			**240/30**
ECTS Credit of the Course			**8**

Chemical engineering (CHEN) master program, "Chemistry and inorganic substances technology" department

Course Unit Title	**Modern technologies of refractories**
Course Unit Code	ENG 3005
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	8
Theoretical (hour/week)	2
Practice (hour/week)	2
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Leyla Vazirova
Name of Lecturer (s)	Leyla Vazirova
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	None
Recommended Optional Program Components	-

Course description: During the study of the discipline master student will learn the following aspects: technologies for production of refractory materials; raw materials for production of refractories; classification of refractories by the mineralogical composition of the raw materials; types and fundamental differences of refractories by purpose; high-temperature processes in metallurgy and equipment protection.

Objectives of the Course: Objective of the course is a training of students in the field of technology of refractory materials, which includes a studying of their physico-chemical properties, testing methods, production methods and application areas depending on chemical composition.

Learning Outcomes

At the end of the course the student will be able to	Assessment

1	explain modern approaches to refractory materials;	1,2,3,4
2	analyze and substantiate the optimal parameters of technological process for producing of refractory materials;	1,3,4
3	depict chemical and schematic diagrams of processes;	1,3,4
4	evaluate raw materials, energy resources and ways of their rational and integrated use;	2
5	understand properties of refractory materials and areas of their application;	1,2,3,4
6	use various testing methods for studying of structure and properties of refractories.	2

Assessment Methods: 1. Final Exam, 2. Presentation 3. Midterm 4. Quiz

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate and research complex problems regarding with chemistry, technology and research of properties of ceramic, glass and binding composite materials, refractories, inorganic compounds and mineral fertilizers.	5
4	Ability to apply innovative methods based on key principles of nanochemistry and membrane technology to problem-solving of scientific and technological character.	3
5	Ability to develop concepts and scientific-technological solutions in the field of electrochemical technology, processing of mineral raw materials and water treatment.	3
6	Ability to utilize creativity in elaborating new and inventive products, processes and methods of utilization of solid waste in metallurgy and other areas of inorganic substances manufacturing.	4
7	Ability to identify, find, and provide necessary information, as well as, plan and conduct analytical, model and experimental investigations of inorganic substances and composite materials particularly in the field of catalysts and adsorbents synthesis with further studying their activity.	4
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	3

9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	2
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	1
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	[1], chapter 1, pp.1-10	**Introduction to refractory**. Definition. Basic property requirements. History of refractory development. **Seminar.** Refractories. Main definitions.	
2	[1], chapter 2, pp.13-21	**Classification of refractories**. Classification based on chemical nature. Classification based on manufacturing method. Physical form and shape. Porosity. **Seminar.** Classification of refractories.	
3	[1], chapter 3, pp.23-50	**Idea of properties**. Physical properties. Mechanical properties. Thermal properties. Thermomechanical properties. Abrasion properties. Corrosion properties. Refractory-specific properties. **Seminar.** Main physico-chemical and mechanical properties of refractory materials.	
4	[1], chapter 4, pp.53-89	**Testing of refractories**. Testing of physical properties. Testing of mechanical properties. Testing of thermal properties. Testing of thermomechanical properties. Testing for corrosion resistance. Testing of abrasion resistance. Testing of thermal shock resistance. **Seminar.** Refractories testing methods.	
5	[2], chapter 13, pp.457-499	**Refractory manufacture**. Solid raw materials. Solid additives. Preparation of solids. Crushing and screening: Grain size distribution. Drying and storage of particulates. Batching. Dry mixing. **Seminar.** Raw materials preparation and dry mixing.	
6	[2], chapter 13, pp.500-544	**Refractory manufacture** Wet mixing. Liquid additives. Sol-gel processing. Forming of masonry and special shapes. Uniaxial dry pressing. Isotactic and hot pressing. Cement casting. Agglomeration for sintered grain. Drying and firing of refractories. **Seminar.** Wet mixing and processing methods of refractories.	

7			Midterm
8	[1], chapter 5, pp.93-110	**Silica refractories**. Raw materials and sources. Manufacturing technique. Action of mineralizer. Classification and properties of silica bricks. Effect of impurities on phase diagram. Main application areas. Silicosis. **Seminar.** Silica refractories properties, manufacturing and application.	
9	[1], chapter 6, pp.113-128	**Alumina refractories**. Raw materials and sources. Manufacturing techniques. Classification and properties. Effect of impurities on phase diagram. Main application areas. **Seminar.** Alumina refractories properties, manufacturing and application.	
10	[1], chapter 7, pp.131-142	**Fireclay refractories**. Raw materials and sources. Grog and its importance. Manufacturing of fireclay refractories. Classification and properties. Application of fireclay bricks. **Seminar.** Fireclay refractories properties, manufacturing and application.	
11	[1], chapter 8, pp.145-162	**Magnesia refractories**. Raw materials and sources. Manufacturing techniques. Effect of lime:silica ratio. Classification and properties. Effect of impurities on phase diagram. Main application areas. **Seminar.** Magnesia refractories properties, manufacturing and application.	
12	[1], chapter 9, pp.165-177	**Dolomite refractories**. Raw materials and sources. Manufacturing process. Classification and properties. Effect of impurities on phase diagram. Main application areas. **Seminar.** Dolomite refractories properties, manufacturing and application.	
13	[1], chapter 10, pp.179-190	**Chromite and MgO-Cr_2O_3 refractories**. Raw materials and sources. Manufacturing technique. Classification and properties. Main application areas. Hazards with chromite containing refractory. **Seminar.** Chromite refractories properties, manufacturing and application.	
14	[1], chapter 11, pp.193-211	**Magnesia-carbon refractories**. Raw materials, binders and additives. Manufacturing technique. Classification and properties. Degradation of MgO-C refractories. Main application areas.	

		Seminar. Magnesia-carbon refractories properties, manufacturing and application.	
15	[1], chapter 12, pp.213-239 [3], chapter 3, pp.44-46	**Special refractories.** Zircon and zirconia refractories. Fused cast refractories. Insulating refractories. Ceramic fibers. Carbon refractories. Silicon carbide refractories. Other non-oxides in refractories. **New developments in refractory field**. **Seminar.** Special refractories properties and application.	
16			Final

Recommended Sources

1. R.Sarkar Refractory technology. Fundamentals and application. Taylor&Francis. 2017. pp.283.

2. S.Caniglia, G.Barna. Handbook of industrial refractories technology. Principles, types, properties and application. William Andew. 1-st edition. 1992. pp.650.

3. A.O.Surendranathan. An introduction to ceramics and refractories. Taylor&Francis. 2015. pp.479.

Assessment		
Attendance	0%	At least 75% of class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU Guidelines for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students can use calculators during the exam.

• Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload			
Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class	**14**	**4**	**56**
Presentation	1	16	16
Self-study	14	6	84
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	30	30
Final Examination	1	3	3
Preparation for final exam	1	34	34
Total Workload			**240**
Total Workload/30(h)			**240/30**
ECTS Credit of the Course			**8**

Chemical engineering (CHEN) master program, “Chemistry and inorganic substances technology” department

Course Unit Title	**Physico-chemical basics of water treatment**
Course Unit Code	ENG 3003
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	8
Theoretical (hour/week)	2
Practice (hour/week)	2
Laboratory (hour/week)	-
Year of Study	-

Semester when the course unit is delivered	-
Course Coordinator	Minira Aghahuseynova
Name of Lecturer (s)	Minira Aghahuseynova
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	None
Recommended Optional Program Components	-

Course description: During the course master student will study main physical and chemical processes that cause corrosion of equipment; basic methods of water treatment and wastewater treatment; principles of design of water treatment systems; innovative methods of water and wastewater treatment.

Objectives of the Course: The goal of the subject is to provide information about water treatment technology for various technological systems, equipment used for water treatment and wastewater treatment, chemicals for water treatment processes and innovative water treatment methods.

Learning Outcomes

	At the end of the course the student will be able to	Assessment
1	analyze the methods and main stages of water treatment;	1,2,3,4
2	compare and choose various methods of water treatment;	1,2,3,4
3	use traditional and innovative water treatment methods in their research.	2

Assessment Methods: 1. Final Exam, 2. Presentation 3. Midterm 4. Quiz

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	3
3	Ability to summarize, formulate and research complex problems regarding with chemistry, technology and research of properties of ceramic, glass and binding composite materials, refractories, inorganic compounds and mineral fertilizers.	3
4	Ability to apply innovative methods based on key principles of nanochemistry and membrane technology to problem-solving of scientific and technological character.	3

5	Ability to develop concepts and scientific-technological solutions in the field of electrochemical technology, processing of mineral raw materials and water treatment.	5
6	Ability to utilize creativity in elaborating new and inventive products, processes and methods of utilization of solid waste in metallurgy and other areas of inorganic substances manufacturing.	5
7	Ability to identify, find, and provide necessary information, as well as, plan and conduct analytical, model and experimental investigations of inorganic substances and composite materials particularly in the field of catalysts and adsorbents synthesis with further studying their activity.	3
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	3
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	2
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	1
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	[1], chapter 1, pp.1-15	**Introduction to water treatment**. Necessity of water treatment. Science of water. Basic chemistry of water treatment. **Seminar.** Importance of water treatment and its basic principles.	
2	[1], chapter 2, pp.16-46	**Water treatment and chemicals for boiler water systems**. General. Boiler problems caused by water. External boiler water treatment. Internal boiler water treatment. **Seminar.** Water treatment in boiler systems.	
3	[1], chapter 2, pp.47-80	**Water treatment and chemicals for boiler water systems**. Internal boiler water treatment. Water treatment for mini-circulation boilers. Preservation of boilers during stoppage. Water quality control for boiler systems. Energy conservation for boilers. **Seminar.** Water treatment in boiler systems and used chemicals.	

4	[1], chapter 3, pp.90-125	**Cooling water treatment**. Outline of cooling water systems. Corrosion and corrosion prevention. Scale and scale prevention. **Seminar.** Water treatment problems in water cooling systems.	
5	[1], chapter 3, pp.126-162	**Cooling water treatment**. Biofouling and its prevention. Case studies of cooling water treatment. Control of cooling water system operation. Energy and water saving operation of cooling water systems. **Seminar.** Control and operation of cooling water systems.	
6	[1], chapter 4, pp.167-200	**Coagulants, flocculants and sludge dewatering agents**. Outline of water, wastewater and sludge treatment. Coagulation and flocculation. Sludge treatment. **Seminar.** Chemicals used in water treatment technology.	
7			Midterm
8	[1], chapter 5, pp.203-235	**Water treatment for air conditioning systems**. Water treatment for water cooling systems. Water treatment of closed recirculating water systems for air conditioning. Water treatment for high temperature water systems in district air conditioning plants. Water treatment for advanced air conditioning systems. Troubles and countermeasures in water and hot water supply systems. Water treatment for humidifiers. Chemical cleaning. **Seminar.** Water treatment technology in air conditioning systems.	
9	[1], chapter 8, pp.292-314	**Water treatment for iron and steelmaking plants**. Outline of iron and steelmaking processes, and the water treatment chemicals. Problems in indirect cooling water systems and their countermeasures. Problems in direct cooling water systems and their countermeasures. Troubles and countermeasures in gas cleaning water systems. Supply water, wastewater and sludge treatments. The other specialty chemicals. **Seminar.** Water treatment in metallurgical industry.	
10	[1], chapter 9, pp.315-355	**Cleaning of plants and equipment**. Purpose of cleaning. Cleaning objects and their scale problems. Cleaning objects and their cleaning methods. Chemical cleaning. Mechanical cleaning. Safety measures for cleaning. **Seminar.** Water treatment problems at cleaning of plants and equipment.	
11	[1], chapter 10, pp.356-394	**Miscellaneous specialty chemicals**. Additives for drinking distilled water. Chemicals for ultra-pure water production systems. Corrosion inhibitors for spot-welding machine cooling	

		water systems. Scale inhibitors for ash cooling water systems in refuse incineration plants. Antifoaming agents. Deodorants. Cleaning agents for water treatment equipment. Synthetic zeolites. **Seminar.** Other special chemicals used in water treatment technology.	
12	[2], chapter 4, pp.67-78	**Membrane bioreactor (MBR) technologies**. Removal of micro-pollutants from wastewater through MBR technologies. General MBR design. General MBR operation parameters. Case study: MBR in treating spent caustic wastewater. **Seminar.** MBR technologies in water treatment.	
13	[2], chapter 5, pp.81-91	**The outlook on future of MBR technologies**. Advanced technology of MBR. Growth of MBR market. **Seminar.** MBR technologies in water and wastewater treatment.	
14	[2], chapter 6, pp.93-106	**Integration of membrane bioreactors with various wastewater treatment systems.** Advanced electrocoagulation and oxidation processes. Anaerobic MBR. Microbial fuel cell. **Seminar.** MBR technologies in water and wastewater treatment.	
15	[2], chapter 8, pp.123-137 [2], chapter 9, pp.141-154	**Application of nonthermal plasma in the treatment of volatile organic compounds (VOC) from wastewater.** Sources of VOCs. VOC treatment methods. Nonthermal plasma application in the treatment of VOCs from wastewater plasma and plasma generation. Mechanism of plasma decomposition of VOCs. Materials and methods. **Removal of color wastewater using low-cost adsorbent:** A comparative study. Color removal technologies in wastewater. Adsorption. Color. Low-cost adsorbents. **Seminar.** Innovative water treatment technologies.	
16			Final

Recommended Sources

1. Water treatment. Kurita water treatment industries LTD. 2-edition. 1999. pp.501.

2. Z.Z.Noor, N.S.Mohammad Sabli. Sustainable water treatment. Innovative technologies. Taylor&Francis. 2017. pp.184.

Assessment		
Attendance	0%	At least 75% of class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU Guidelines for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students can use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class	**14**	**4**	**56**
Presentation	1	16	16
Self-study	14	6	84
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	30	30
Final Examination	1	3	3
Preparation for final exam	1	34	34
Total Workload			**240**
Total Workload/30(h)			**240/30**

ECTS Credit of the Course	**8**

Chemical engineering master program, “Social subjects” department

“Industrial technology of inorganic substances” specialization

Course Unit Title	**Philosophical problems of science and technology**
Course Unit Code	SSC 3001
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	2
Theoretical (hour/week)	1
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	Samadli Ziya
Name of Lecturer (s)	Samadli Ziya
Name of Assistant (s)	-
Mode of Delivery	Face to face
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-
General Course Description:	

Philosophical problems of science and technology considers the history, character of technology, its relation to human values, philosophical assumptions in its development and how it transforms the world. This course surveys a number of recent thinkers on the meaning of technology, its role in our and other societies, and critiques of its effects. Through readings of classic works on Philosophy of Technology as well as investigations of contemporary media reports and representations of technology, the course will engage our thoughts about what technology means to us and the values embedded in it. As technology is increasingly fundamental to our contemporary way of life in all its aspects, this course gets us asking questions about why we do what we do with technology and how it affects us, others around us, and the environment. Required readings typically include collections of essays ranging in reading level from popular journalism to mass-market fiction to historical analyses of technological change and in-depth philosophical investigations of the concept of technology.		
Objectives of the Course: 1. To explain the different levels of philosophical questions ranging from the most general and abstract (What is technology? Is technology determined, autonomous, neutral, etc.?) to very concrete and practical (Should I use wikipedia? Can I use twitter to stage a political action?). 2. To identify common forms of philosophical reasoning, create and evaluate arguments by using the concepts and principles he or she has learned, support his or her judgments with reasons, principles, and arguments, and spell out the complications involved in many common forms of philosophical reasoning. 3. To perceive philosophical concepts and principles as they are at work in our everyday lives and in contemporary issues and events, to learn to philosophize and to question critical issues of the day. 4. To support the student's considered judgments with reasons, principles, and arguments, to identify common forms of philosophical reasoning, identify and evaluate philosophical presuppositions that underlie all forms of thinking, spell out the complications involved in many common forms of philosophical reasoning, and create and evaluate arguments by using the concepts and principles she or he has learned. 5. To reflect and study: recognize philosophical questions, grasp philosophical ideas and arguments, engage in self-reflection and competently think critically in order to become fully integrated.		
Learning Outcomes		
At the end of the course the student will be able to		Assessment
1	analyze and interpret a significant body of primary works in philosophy of technology.	1,2,3,4
2	develop their ability to read, analyze, and write about complex texts.	1,2,3,4
3	demonstrate knowledge of the major questions and traditions in the philosophy of technology.	1,3,4
4	reflect on the socially responsible creation and use of technology, and create a project to further that end.	1,3,4
5	critically analyze and discuss the nature of, value of, and challenges to technology as an intellectual and cultural institution.	1,3,4

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm exam, 4. Quiz		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition ofchemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate and research complex problems regarding with chemistry, technology and research of properties of ceramic, glass and binding composite materials, refractories, inorganic compounds and mineral fertilizers.	4
4	Ability to apply innovative methods based on key principles of nanochemistry and membrane technology to problem-solving of scientific and technological character.	5
5	Ability to develop concepts and scientific-technological solutions in the field of electrochemical technology, processing of mineral raw materials and water treatment.	4
6	Ability to utilize creativity in elaborating new and inventive products, processes and methods of utilization of solid waste in metallurgy and other areas of inorganic substances manufacturing.	3
7	Ability to identify, find, and provide necessary information, as well as, plan and conduct analytical, model and experimental investigations of inorganic substances and composite materials particularly in the field of catalysts and adsorbents synthesis with further studying their activity.	4
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	5
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	3
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents			
Week	Chapter	Topics	Exam
1	[1], Chapter 1, p. 5-43; [2], Chapter 1, p. 9-74;	History of Technology	

3	[1], chapter 2, p. 49-123; [2], Chapter 2, p. 89-183;	Technology and Science	
5	[1], Chapter 3, p. 129-227;	Technology and Philosophy	
7	[1], Chapter 4, p. 233-289;	Technology and Environment	
8			Midterm
9	[1], Chapter 5, p. 295-359; [2], Chapter 5, p. 706;	Technology and Politics	
11	[1], Chapter 6, p. 365-477;	Technology and Ethics	
13	[1], Chapter 7, p. 481-551; [2], Chapter 6, p. 375-495;	Technology and the Future	
16			Final

Recommended Sources:

1. J. K. B. Olsen, S. A. Pedersen and V. F. Hendricks. ***A Companion to the Philosophy of Technology***. © 2009
2. Robert C. Scharff Val Dusek. ***Philosophy of Technology The Technological Condition: An Anthology*** Second Edition John Wiley & Sons, Inc; © 2014

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU for Undergraduate Studies			
Course Policies • Attendance of the course is mandatory. • Late assignments will not be accepted unless an agreement is reached with the lecturer. • Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations			
ECTS allocated based on Student Workload			
Activities	**Number**	**Duration (hour)**	**Total Workload (hour)**
Course duration in class	**14**	**1**	**14**
Presentation	1	5	5
Self-study	14	1,5	21
Tutorials	14	0.5	7
Midterm Examination	1	3	3
Preparation for midterm exam	1	5	5
Final Examination	1	3	3
Preparation for final exam	1	10	10
Total Workload			**60**
Total Workload/30(h)			**60/30**
ECTS Credit of the Course			**2**

Chemical engineering master program, “Social subjects” department

“Oil refining technology” specialization

Course Unit Title	**Philosophical problems of science and technology**
Course Unit Code	SSC 3001
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	2
Theoretical (hour/week)	1
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	Samadli Ziya
Name of Lecturer (s)	Samadli Ziya
Name of Assistant (s)	-
Mode of Delivery	Face to face
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

General Course Description:

Philosophical problems of science and technology considers the history, character of technology, its relation to human values, philosophical assumptions in its development and how it transforms the world. This course surveys a number of recent thinkers on the meaning of technology, its role in our and other societies, and critiques of its effects. Through readings of classic works on Philosophy of

Technology as well as investigations of contemporary media reports and representations of technology, the course will engage our thoughts about what technology means to us and the values embedded in it. As technology is increasingly fundamental to our contemporary way of life in all its aspects, this course gets us asking questions about why we do what we do with technology and how it affects us, others around us, and the environment. Required readings typically include collections of essays ranging in reading level from popular journalism to mass-market fiction to historical analyses of technological change and in-depth philosophical investigations of the concept of technology.

Objectives of the Course:

6. To explain the different levels of philosophical questions ranging from the most general and abstract (What is technology? Is technology determined, autonomous, neutral, etc.?) to very concrete and practical (Should I use wikipedia? Can I use twitter to stage a political action?).
7. To identify common forms of philosophical reasoning, create and evaluate arguments by using the concepts and principles he or she has learned, support his or her judgments with reasons, principles, and arguments, and spell out the complications involved in many common forms of philosophical reasoning.
8. To perceive philosophical concepts and principles as they are at work in our everyday lives and in contemporary issues and events, to learn to philosophize and to question critical issues of the day.
9. To support the student's considered judgments with reasons, principles, and arguments, to identify common forms of philosophical reasoning, identify and evaluate philosophical presuppositions that underlie all forms of thinking, spell out the complications involved in many common forms of philosophical reasoning, and create and evaluate arguments by using the concepts and principles she or he has learned.
10. To reflect and study: recognize philosophical questions, grasp philosophical ideas and arguments, engage in self-reflection and competently think critically in order to become fully integrated.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	analyze and interpret a significant body of primary works in philosophy of technology.	1,2,3,4
2	develop their ability to read, analyze, and write about complex texts.	1,2,3,4
3	demonstrate knowledge of the major questions and traditions in the philosophy of technology.	1,3,4
4	reflect on the socially responsible creation and use of technology, and create a project to further that end.	1,3,4
5	critically analyze and discuss the nature of, value of, and challenges to technology as an intellectual and cultural institution.	1,3,4

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm exam, 4. Quiz

Course's Contribution to Program

		CL

1	Ability to demonstrate well-developed erudition ofchemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	4
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	5
5	Ability to develop design and scientific-technological solutions in the field of design, modeling and optimization of refining and petrochemical processes, as well as apply the acquired knowledge to improve the management system of the oil refining industry.	4
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	3
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modeling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	4
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	5
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	3
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	[1], Chapter 1, p. 5-43; [2], Chapter 1, p. 9-74;	History of Technology	
3	[1], chapter 2, p. 49-123; [2], Chapter 2, p. 89-183;	Technology and Science	

5	[1], Chapter 3, p. 129-227;	Technology and Philosophy	
7	[1], Chapter 4, p. 233-289;	Technology and Environment	
8			Midterm
9	[1], Chapter 5, p. 295-359; [2], Chapter 5, p. 706;	Technology and Politics	
11	[1], Chapter 6, p. 365-477;	Technology and Ethics	
13	[1], Chapter 7, p. 481-551; [2], Chapter 6, p. 375-495;	Technology and the Future	
16			Final

Recommended Sources:

3. J. K. B. Olsen, S. A. Pedersen and V. F. Hendricks. ***A Companion to the Philosophy of Technology***. © 2009
4. Robert C. Scharff Val Dusek. ***Philosophy of Technology The Technological Condition: An Anthology*** Second Edition John Wiley & Sons, Inc; © 2014

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	**Number**	**Duration (hour)**	**Total Workload (hour)**
Course duration in class	**14**	**1**	**14**
Presentation	1	5	5
Self-study	14	1,5	21
Tutorials	14	0.5	7
Midterm Examination	1	3	3
Preparation for midterm exam	1	5	5
Final Examination	1	3	3
Preparation for final exam	1	10	10
Total Workload			**60**
Total Workload/30(h)			**60/30**
ECTS Credit of the Course			**2**

Chemical engineering master program, “Social subjects” department

“Technology of petrochemical synthesis” specialization

Course Unit Title	**Philosophical problems of science and technology**
Course Unit Code	SSC 3001
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	2
Theoretical (hour/week)	1
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	Samadli Ziya
Name of Lecturer (s)	Samadli Ziya
Name of Assistant (s)	-
Mode of Delivery	Face to face
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

General Course Description:

Philosophical problems of science and technology considers the history, character of technology, its relation to human values, philosophical assumptions in its development and how it transforms the world. This course surveys a number of recent thinkers on the meaning of technology, its role in our and other societies, and critiques of its effects. Through readings of classic works on Philosophy of Technology as well as investigations of contemporary media reports and representations of technology, the course will engage our thoughts about what technology means to us and the values embedded in it. As technology is increasingly fundamental to our contemporary way of life in all its aspects, this course

gets us asking questions about why we do what we do with technology and how it affects us, others around us, and the environment. Required readings typically include collections of essays ranging in reading level from popular journalism to mass-market fiction to historical analyses of technological change and in-depth philosophical investigations of the concept of technology.

Objectives of the Course:

11. To explain the different levels of philosophical questions ranging from the most general and abstract (What is technology? Is technology determined, autonomous, neutral, etc.?) to very concrete and practical (Should I use wikipedia? Can I use twitter to stage a political action?).
12. To identify common forms of philosophical reasoning, create and evaluate arguments by using the concepts and principles he or she has learned, support his or her judgments with reasons, principles, and arguments, and spell out the complications involved in many common forms of philosophical reasoning.
13. To perceive philosophical concepts and principles as they are at work in our everyday lives and in contemporary issues and events, to learn to philosophize and to question critical issues of the day.
14. To support the student's considered judgments with reasons, principles, and arguments, to identify common forms of philosophical reasoning, identify and evaluate philosophical presuppositions that underlie all forms of thinking, spell out the complications involved in many common forms of philosophical reasoning, and create and evaluate arguments by using the concepts and principles she or he has learned.
15. To reflect and study: recognize philosophical questions, grasp philosophical ideas and arguments, engage in self-reflection and competently think critically in order to become fully integrated.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	analyze and interpret a significant body of primary works in philosophy of technology.	1,2,3,4
2	develop their ability to read, analyze, and write about complex texts.	1,2,3,4
3	demonstrate knowledge of the major questions and traditions in the philosophy of technology.	1,3,4
4	reflect on the socially responsible creation and use of technology, and create a project to further that end.	1,3,4
5	critically analyze and discuss the nature of, value of, and challenges to technology as an intellectual and cultural institution.	1,3,4

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm exam, 4. Quiz

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition ofchemistry, mathematical-scientific and engineering principles of chemical engineering.	5

2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate, and solve complex problems related to the chemistry, technology, and research of the properties of organic compounds and industrial products based on them.	4
4	Ability to apply modern methods to solve scientific problems and develop new scientific research in the field of synthesis and modification of the properties of organic compounds.	5
5	Ability to develop concepts and scientific-technological solutions in the field of petrochemical and basic organic synthesis.	4
6	Ability to use creativity to develop new and improved methods of utilization of waste of petrochemical and organic synthesis, as well as methods of effective use of renewable energy sources.	3
7	The ability to identify, find and provide the necessary information, as well as to plan and conduct analytical, model and experimental studies of catalytic processes involving organic compounds.	4
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	5
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	3

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

Course Contents

Week	Chapter	Topics	Exam
1	[1], Chapter 1, p. 5-43; [2], Chapter 1, p. 9-74;	History of Technology	
3	[1], chapter 2, p. 49-123; [2], Chapter 2, p. 89-183;	Technology and Science	
5	[1], Chapter 3, p. 129-227;	Technology and Philosophy	

7	[1], Chapter 4, p. 233-289;	Technology and Environment	
8			Midterm
9	[1], Chapter 5, p. 295-359; [2], Chapter 5, p. 706;	Technology and Politics	
11	[1], Chapter 6, p. 365-477;	Technology and Ethics	
13	[1], Chapter 7, p. 481-551; [2], Chapter 6, p. 375-495;	Technology and the Future	
16			Final

Recommended Sources:

5. J. K. B. Olsen, S. A. Pedersen and V. F. Hendricks. ***A Companion to the Philosophy of Technology***. © 2009
6. Robert C. Scharff Val Dusek. ***Philosophy of Technology The Technological Condition: An Anthology*** Second Edition John Wiley & Sons, Inc; © 2014

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.

• Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations			
ECTS allocated based on Student Workload			
Activities	**Number**	**Duration (hour)**	**Total Workload (hour)**
Course duration in class	**14**	**1**	**14**
Presentation	1	5	5
Self-study	14	1,5	21
Tutorials	14	0.5	7
Midterm Examination	1	3	3
Preparation for midterm exam	1	5	5
Final Examination	1	3	3
Preparation for final exam	1	10	10
Total Workload			**60**
Total Workload/30(h)			**60/30**
ECTS Credit of the Course			**2**

Chemical engineering master program, "Foreign language-2" department

"Industrial technology of inorganic substances" specialization

Course Unit Title	**Foreign language**
Course Unit Code	ENGL 1101
Type of Course Unit	Compulsory
Level of Course Unit	1st year master program
National Credits	-
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	-
Practice (hour/week)	3
Laboratory (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	Verdiyeva Saida
Name of Lecturer (s)	Verdiyeva Saida
Name of Assistant (s)	-
Mode of Delivery	Seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

This course is designed for master degree students studying at the department of Chemical Technology. A Master program in English subject is based on knowledge previously attained from basic level courses and involves a deepening of the student's understanding in the chosen subject area as well as a development of the student's skills and general knowledge. It will give students an opportunity to master key concepts in chemical engineering and technology, and learn how research questions are formulated. The major goal of this course is to guide students to achieve a basic understanding of authentic texts on their subject discipline, understand how to formulate a scientific approach to explaining problems and solving them.

This module focuses on the skills required for lectures, tutorials, research, reading and written assignments in English. It includes conversations, texts for analyses, discussions, project works, and so on. These activities

reinforce and consolidate four main skills of language: listening, speaking, reading and writing. The course offers students tasks and exercises to update their English language, develop their confidence in using the language, and expand their vocabulary and range of expressions.

At the end of the course they are expected to do an oral presentation.

Objectives of the Course:

This course is aimed to introduce English for academic and professional purposes in order to enable the students to use it in their future professional life

- to teach basic scientific terms;
- to equip students with communication skills;
- to use general and professional language in discussions and talks;
- to expand students' scientific reading and thinking skills;
- provide opportunities for students to work in teams;
- develop students' critical and rhetorical thinking.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	work with authentic text material with the aim at collecting information;	2,3,4
2	read fluently and understand any text dealt with science and technology;	2,3,4
3	use scientific vocabulary;	1,2,3,4
4	use chief derivatives of scientific words and the most important expressions used in scientific texts;	1,2,3,4
5	use professional language in discussions and talks;	3
6	work cooperatively in teams and small groups;	3
7	read, write, present and evaluate chemical reports;	3

8	carry out project work on particular topics covered through the module;	3

Assessment Methods: 1. Final Exam, 2.Midterm exam, 3.Presentation, 4.Quiz

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyze and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate and research complex problems regarding with chemistry, technology and research of properties of ceramic, glass and binding composite materials, refractories, inorganic compounds and mineral fertilizers.	4
4	Ability to apply innovative methods based on key principles of nanochemistry and membrane technology to problem-solving of scientific and technological character.	5
5	Ability to develop concepts and scientific-technological solutions in the field of electrochemical technology, processing of mineral raw materials and water treatment.	4
6	Ability to utilize creativity in elaborating new and inventive products, processes and methods of utilization of solid waste in metallurgy and other areas of inorganic substances manufacturing.	3
7	Ability to identify, find, and provide necessary information, as well as, plan and conduct analytical, model and experimental investigations of inorganic substances and composite materials particularly in the field of catalysts and adsorbents synthesis with further studying their activity.	4
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	5
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	5

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)			
Week	**Chapter**	**Topics**	**Exam**
1	[1] Unit 1	Why do we choose postgraduate studies? Motivation to enter the postgraduate studies.	
1	[1] Unit 2	Postgraduate programs and research degrees. Postgraduate course mastering.	
2	[1] Unit 3	Types of postgraduate programs.	
3	[2] Unit 1	Engineering career. What is engineering?	
3	[2] Unit 1	What do engineers do? Choosing a Major.	
4	[2] Unit 1	Professional language development	
5	[2] Unit 1	Creativity in Engineering. Speaking activities.	
5	[2] Unit 2	Engineering Education.	
6	[2] Unit 2	Postgraduate studying: “Another discovery channel”.	
7	[2] Unit 2	Professional language development	
7	[2] Unit 2	Speaking. Project work: ”Why did I choose this university?”	
8			Midterm
9	[2] Unit 3	White Space. Are you good for this job?	
9	[2]	Reading: 21-st century engineers moving at internet time	

	Unit 3		
10	[2] Unit 3	Competencies for the entrepreneurial engineer.	
11	[2] Unit 3	Professional language development. Exercises	
11	Textbook 2 Unit 3	Speaking: professional abilities.	
12	[1] Unit 5	Listening Skills. Listening to directions. Listening to extract information.	
13	[1] Unit 5	Confusing fact and opinion. Distinguishing between fact and opinion.	
13	[1] Unit 6	Making a speech. What is speech?	
14	[1] Unit 6	Gathering and organizing Information.	
15	[1] Unit 6	Speech practicing and revising	
15		Revision	
16			Final

Recommended Sources:

1.G.G.Gubina, English Language Master's and PhD Study Guide, Yaroslavl, 2010

2.T.S. Petrovskaya, I.E. Rymanova, A.V. Makarovskikh, English for Chemical Engineers Tomsk Polytechnic University Publishing House, 2012

3. Jill S. Tietjen; Kristy A. Schloss; Carol J. Carter; Joyce Bishop; Sarah Lyman Kravits, Keys to Engineering Success, Prentice Hall; 1 edition , 2000

Supplementary Course Material:

1.Dr.Ashleigh,J.Fletcher; Chemistry for Chemical Engineers bookboon.com.2012

2.О.И. Сафроненко, Ж. И. Макарова, М. В. Малащенко, Английский язык для магистров и аспирантов

естественных факультетов университетов. Москва, Высшая школа, 2005

3.http://chemistry.about.com/old/healthsafety/a/aa080104a.htm

4. http://chemistry.about.com/library/weeklyblsafetyquiz.htm

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Test Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU for Postgraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload (hour)
Course duration in class	**14**	**3**	**42**
Presentation	1	10	10
Self-study	14	5	70
Tutorials	14	2	28
Midterm Examination	1	3	3
Preparation for midterm exam	1	10	10
Final Examination	1	3	3
Preparation for final exam	1	15	15
Total Workload			**180**
Total Workload/30(h)			**180/30**

ECTS Credit of the Course	**6**

Chemical engineering master program, “Foreign language-2” department

“Oil refining technology” specialization

Course Unit Title	**Foreign language**
Course Unit Code	ENGL 1101
Type of Course Unit	Compulsory
Level of Course Unit	1st year master program
National Credits	-
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	-
Practice (hour/week)	3
Laboratory (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	Verdiyeva Saida
Name of Lecturer (s)	Verdiyeva Saida
Name of Assistant (s)	-
Mode of Delivery	Seminar
Language of Instruction	English
Prerequisites	-

Recommended Optional Program Components	-

Course description:

This course is designed for master degree students studying at the department of Chemical Technology. A Master program in English subject is based on knowledge previously attained from basic level courses and involves a deepening of the student's understanding in the chosen subject area as well as a development of the student's skills and general knowledge. It will give students an opportunity to master key concepts in chemical engineering and technology, and learn how research questions are formulated. The major goal of this course is to guide students to achieve a basic understanding of authentic texts on their subject discipline, understand how to formulate a scientific approach to explaining problems and solving them.

This module focuses on the skills required for lectures, tutorials, research, reading and written assignments in English. It includes conversations, texts for analyses, discussions, project works, and so on. These activities

reinforce and consolidate four main skills of language: listening, speaking, reading and writing. The course offers students tasks and exercises to update their English language, develop their confidence in using the language, and expand their vocabulary and range of expressions.

At the end of the course they are expected to do an oral presentation.

Objectives of the Course:

This course is aimed to introduce English for academic and professional purposes in order to enable the students to use it in their future professional life

- to teach basic scientific terms;
- to equip students with communication skills;
- to use general and professional language in discussions and talks;
- to expand students' scientific reading and thinking skills;
- provide opportunities for students to work in teams;
- develop students' critical and rhetorical thinking.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	work with authentic text material with the aim at collecting information;	2,3,4
2	read fluently and understand any text dealt with science and technology;	2,3,4
3	use scientific vocabulary;	1,2,3,4

4	use chief derivatives of scientific words and the most important expressions used in scientific texts;	1,2,3,4
5	use professional language in discussions and talks;	3
6	work cooperatively in teams and small groups;	3
7	read, write, present and evaluate chemical reports;	3
8	carry out project work on particular topics covered through the module;	3
Assessment Methods: 1. Final Exam, 2.Midterm exam, 3.Presentation, 4.Quiz		

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	4
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	5
5	Ability to develop design and scientific-technological solutions in the field of design, modeling and optimization of refining and petrochemical processes, as well as apply the acquired knowledge to improve the management system of the oil refining industry.	4
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	3

7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modeling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	4
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	5
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	5
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Week	**Chapter**	**Topics**	**Exam**
1	[1] Unit 1	Why do we choose postgraduate studies? Motivation to enter the postgraduate studies.	
1	[1] Unit 2	Postgraduate programs and research degrees. Postgraduate course mastering.	
2	[1] Unit 3	Types of postgraduate programs.	
3	[2] Unit 1	Engineering career. What is engineering?	
3	[2] Unit 1	What do engineers do? Choosing a Major.	
4	[2] Unit 1	Professional language development	
5	[2] Unit 1	Creativity in Engineering. Speaking activities.	
5	[2] Unit 2	Engineering Education.	

6	[2] Unit 2	Postgraduate studying: “Another discovery channel”.	
7	[2] Unit 2	Professional language development	
7	[2] Unit 2	Speaking. Project work: ”Why did I choose this university?”	
8			Midterm
9	[2] Unit 3	White Space. Are you good for this job?	
9	[2] Unit 3	Reading: 21-st century engineers moving at internet time	
10	[2] Unit 3	Competencies for the entrepreneurial engineer.	
11	[2] Unit 3	Professional language development. Exercises	
11	Textboo k 2 Unit 3	Speaking: professional abilities.	
12	[1] Unit 5	Listening Skills. Listening to directions. Listening to extract information.	
13	[1] Unit 5	Confusing fact and opinion. Distinguishing between fact and opinion.	
13	[1] Unit 6	Making a speech. What is speech?	
14	[1] Unit 6	Gathering and organizing Information.	
15	[1] Unit 6	Speech practicing and revising	
15		Revision	
16			Final

Recommended Sources:

1.G.G.Gubina, English Language Master's and PhD Study Guide, Yaroslavl, 2010

2.T.S. Petrovskaya, I.E. Rymanova, A.V. Makarovskikh, English for Chemical Engineers Tomsk Polytechnic University Publishing House, 2012

3. Jill S. Tietjen; Kristy A. Schloss; Carol J. Carter; Joyce Bishop; Sarah Lyman Kravits, Keys to Engineering Success, Prentice Hall; 1 edition , 2000

Supplementary Course Material:

1.Dr.Ashleigh,J.Fletcher; Chemistry for Chemical Engineers bookboon.com.2012

2.О.И. Сафроненко, Ж. И. Макарова, М. В. Малащенко, Английский язык для магистров и аспирантов

естественных факультетов университетов. Москва, Высшая школа, 2005

3.http://chemistry.about.com/old/healthsafety/a/aa080104a.htm

4. http://chemistry.about.com/library/weeklyblsafetyquiz.htm

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Test Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU for Postgraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload (hour)
Course duration in class	**14**	**3**	**42**
Presentation	1	10	10
Self-study	14	5	70
Tutorials	14	2	28
Midterm Examination	1	3	3
Preparation for midterm exam	1	10	10
Final Examination	1	3	3
Preparation for final exam	1	15	15
Total Workload			**180**
Total Workload/30(h)			**180/30**
ECTS Credit of the Course			**6**

Chemical engineering master program, "Foreign language-2" department

"Technology of petrochemical synthesis" specialization

Course Unit Title	**Foreign language**

Course Unit Code	ENGL 1101
Type of Course Unit	Compulsory
Level of Course Unit	1st year master program
National Credits	-
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	-
Practice (hour/week)	3
Laboratory (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	Verdiyeva Saida
Name of Lecturer (s)	Verdiyeva Saida
Name of Assistant (s)	-
Mode of Delivery	Seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

This course is designed for master degree students studying at the department of Chemical Technology. A Master program in English subject is based on knowledge previously attained from basic level courses and involves a deepening of the student's understanding in the chosen subject area as well as a development of the student's skills and general knowledge. It will give students an opportunity to master key concepts in chemical engineering and technology, and learn how research questions are formulated. The major goal of this course is to guide students to achieve a basic understanding of authentic texts on their subject discipline, understand how to formulate a scientific approach to explaining problems and solving them.

This module focuses on the skills required for lectures, tutorials, research, reading and written assignments in English. It includes conversations, texts for analyses, discussions, project works, and so on. These activities

reinforce and consolidate four main skills of language: listening, speaking, reading and writing. The course offers students tasks and exercises to update their English language, develop their confidence in using the language, and expand their vocabulary and range of expressions.

At the end of the course they are expected to do an oral presentation.

Objectives of the Course:

This course is aimed to introduce English for academic and professional purposes in order to enable the students to use it in their future professional life

- to teach basic scientific terms;
- to equip students with communication skills;
- to use general and professional language in discussions and talks;
- to expand students' scientific reading and thinking skills;
- provide opportunities for students to work in teams;
- develop students' critical and rhetorical thinking.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	work with authentic text material with the aim at collecting information;	2,3,4
2	read fluently and understand any text dealt with science and technology;	2,3,4
3	use scientific vocabulary;	1,2,3,4
4	use chief derivatives of scientific words and the most important expressions used in scientific texts;	1,2,3,4
5	use professional language in discussions and talks;	3
6	work cooperatively in teams and small groups;	3
7	read, write, present and evaluate chemical reports;	3
8	carry out project work on particular topics covered through the module;	3

Assessment Methods: 1. Final Exam, 2.Midterm exam, 3.Presentation, 4.Quiz

Course's Contribution to Program

		CL

1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate, and solve complex problems related to the chemistry, technology, and research of the properties of organic compounds and industrial products based on them.	4
4	Ability to apply modern methods to solve scientific problems and develop new scientific research in the field of synthesis and modification of the properties of organic compounds.	5
5	Ability to develop concepts and scientific-technological solutions in the field of petrochemical and basic organic synthesis.	4
6	Ability to use creativity to develop new and improved methods of utilization of waste of petrochemical and organic synthesis, as well as methods of effective use of renewable energy sources.	3
7	The ability to identify, find and provide the necessary information, as well as to plan and conduct analytical, model and experimental studies of catalytic processes involving organic compounds.	4
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	5
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	5

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

Week	**Chapter**	**Topics**	**Exam**
1	[1] Unit 1	Why do we choose postgraduate studies? Motivation to enter the postgraduate studies.	
1	[1] Unit 2	Postgraduate programs and research degrees. Postgraduate course mastering.	

2	[1] Unit 3	Types of postgraduate programs.	
3	[2] Unit 1	Engineering career. What is engineering?	
3	[2] Unit 1	What do engineers do? Choosing a Major.	
4	[2] Unit 1	Professional language development	
5	[2] Unit 1	Creativity in Engineering. Speaking activities.	
5	[2] Unit 2	Engineering Education.	
6	[2] Unit 2	Postgraduate studying: “Another discovery channel”.	
7	[2] Unit 2	Professional language development	
7	[2] Unit 2	Speaking. Project work: ”Why did I choose this university?”	
8			Midterm
9	[2] Unit 3	White Space. Are you good for this job?	
9	[2] Unit 3	Reading: 21-st century engineers moving at internet time	
10	[2] Unit 3	Competencies for the entrepreneurial engineer.	
11	[2] Unit 3	Professional language development. Exercises	
11	Textbook 2 Unit 3	Speaking: professional abilities.	

12	[1] Unit 5	Listening Skills. Listening to directions. Listening to extract information.	
13	[1] Unit 5	Confusing fact and opinion. Distinguishing between fact and opinion.	
13	[1] Unit 6	Making a speech. What is speech?	
14	[1] Unit 6	Gathering and organizing Information.	
15	[1] Unit 6	Speech practicing and revising	
15		Revision	
16			Final

Recommended Sources:

1.G.G.Gubina, English Language Master's and PhD Study Guide, Yaroslavl, 2010

2.T.S. Petrovskaya, I.E. Rymanova, A.V. Makarovskikh, English for Chemical Engineers Tomsk Polytechnic University Publishing House, 2012

3. Jill S. Tietjen; Kristy A. Schloss; Carol J. Carter; Joyce Bishop; Sarah Lyman Kravits, Keys to Engineering Success, Prentice Hall; 1 edition , 2000

Supplementary Course Material:

1.Dr.Ashleigh,J.Fletcher; Chemistry for Chemical Engineers bookboon.com.2012

2.О.И. Сафроненко, Ж. И. Макарова, М. В. Малащенко, Английский язык для магистров и аспирантов

естественных факультетов университетов. Москва, Высшая школа, 2005

3.http://chemistry.about.com/old/healthsafety/a/aa080104a.htm

4. http://chemistry.about.com/library/weeklyblsafetyquiz.htm

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	

Midterm Exam	20%	Written Exam
Final Exam	50%	Test Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU for Postgraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload (hour)
Course duration in class	**14**	**3**	**42**
Presentation	1	10	10
Self-study	14	5	70
Tutorials	14	2	28
Midterm Examination	1	3	3
Preparation for midterm exam	1	10	10
Final Examination	1	3	3
Preparation for final exam	1	15	15
Total Workload			**180**
Total Workload/30(h)			**180/30**
ECTS Credit of the Course			**6**

Chemical engineering master program, “Social disciplines” department

“Industrial technology of inorganic substances” specialization

Course Unit Title	**Pedagogy of high school**
Course Unit Code	PED 1201
Type of Course Unit	Compulsory
Level of Course Unit	1st year master program
National Credits	-
Number of ECTS Credits Allocated	4
Theoretical (hour/week)	2
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	2
Course Coordinator	Nasibova Sevinj
Name of Lecturer (s)	Nasibova Sevinj
Name of Assistant (s)	-
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-
Course description:	

Higher education pedagogy is a branch, a section of general pedagogy, and more specifically, professional pedagogy, studying patterns, carrying out theoretical substantiation, developing principles, technologies for the upbringing and education of a person, focused on a concrete-professional sphere of reality.
Objectives of the Course: The main goal and objectives of the higher education pedagogy course are to form the foundations of the professional and pedagogical culture of a higher school teacher, master the theoretical foundations of modern pedagogical science and form readiness for the creative solution of professional tasks.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Analyze of the current state and forecasting the development of higher education	1,2,3,4
2	Study the history of the development of higher education	1,2,3,4
3	Develop of theoretical and methodological foundations of higher professional education	1,2,3,4
4	Identify regularity of higher education	1,3,4
5	Determine the content of higher education	1,3,4
6	Develop of educational standards, new methods and forms of education	1,3,4

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm exam, 4. Quiz

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate and research complex problems regarding with chemistry, technology and research of properties of ceramic, glass and binding composite materials, refractories, inorganic compounds and mineral fertilizers.	4
4	Ability to apply innovative methods based on key principles of nanochemistry and membrane technology to problem-solving of scientific and technological character.	5
5	Ability to develop concepts and scientific-technological solutions in the field of electrochemical technology, processing of mineral raw materials and water treatment.	4

6	Ability to utilize creativity in elaborating new and inventive products, processes and methods of utilization of solid waste in metallurgy and other areas of inorganic substances manufacturing.	3
7	Ability to identify, find, and provide necessary information, as well as, plan and conduct analytical, model and experimental investigations of inorganic substances and composite materials particularly in the field of catalysts and adsorbents synthesis with further studying their activity.	4
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	5
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	3

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

Course Contents

Week	Chapter	Topics	Exam
1	[1] Chapter 1	Framing the Context of Higher Education	
2	[1] Chapter 2	The Capability Approach and Higher Education	
3	[1] Chapter 3	Core Ideas from the Capability Approach	
4	[1] Chapter 4	Pedagogy and Capabilities	
5	[1] Chapter 5	Learning and capabilities	
6	[1] Chapter 6	Widening Participation and Capabilities	
7	[1] Chapter 7	Capabilities for a Higher Education List	

8			Midterm
9	[1] Chapter 8	Change in Higher Education.	
10	[1] Chapter 9	Pedagogy, Capabilities and a Criterion of Justice	
11	[1] Chapter 10	Making sense of teacher professionalism	
12	[1] Chapter 11	Challenges for professionalism within twenty-first-century learning environments	
13	[1] Chapter 11	Making sense of pedagogy	
14	[1] Chapter 12	The application of educational theory	
15	WEB	Research work in high school. Master's dissertation. Rules for the granting of academic degrees and titles	
16			Final

Recommended Sources:

1. Walker M. Higher Education Pedagogies. A Capabilities Approach. New-York, 2006, 164 pages.
2. Waring M., Evans C. Understanding Pedagogy. Developing a critical approach to teaching and learning. New-York, 2015, 259 pages.
3. Site of Ministry of Education of Azerbaijan Republic: https://edu.gov.az/en/page/466
4. Game-based learning for postgraduates: an empirical study of an educational game to teach research skills // Higher Education Pedagogy. 2019, Vol. 4, No. 1, pp.80–104.

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	

Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	**Number**	**Duration (hour)**	**Total Workload (hour)**
Course duration in class	**14**	**2**	**28**
Presentation	1	10	10
Self-study	14	3	42
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	10	10
Final Examination	1	3	3
Preparation for final exam	1	10	10
Total Workload			**120**
Total Workload/30(h)			**120/30**
ECTS Credit of the Course			**4**

Chemical engineering master program, "Social disciplines" department

"Oil refining technology" specialization

Course Unit Title	**Pedagogy of high school**
Course Unit Code	PED 1201
Type of Course Unit	Compulsory
Level of Course Unit	1st year master program
National Credits	-
Number of ECTS Credits Allocated	4
Theoretical (hour/week)	2
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	2
Course Coordinator	Nasibova Sevinj
Name of Lecturer (s)	Nasibova Sevinj
Name of Assistant (s)	-
Mode of Delivery	Face to Face

Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

Higher education pedagogy is a branch, a section of general pedagogy, and more specifically, professional pedagogy, studying patterns, carrying out theoretical substantiation, developing principles, technologies for the upbringing and education of a person, focused on a concrete-professional sphere of reality.

Objectives of the Course:

The main goal and objectives of the higher education pedagogy course are to form the foundations of the professional and pedagogical culture of a higher school teacher, master the theoretical foundations of modern pedagogical science and form readiness for the creative solution of professional tasks.

Learning Outcomes

	At the end of the course the student will be able to	Assessment
1	Analyze of the current state and forecasting the development of higher education	1,2,3,4
2	Study the history of the development of higher education	1,2,3,4
3	Develop of theoretical and methodological foundations of higher professional education	1,2,3,4
4	Identify regularity of higher education	1,3,4
5	Determine the content of higher education	1,3,4
6	Develop of educational standards, new methods and forms of education	1,3,4

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm exam, 4. Quiz

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	4

4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	5
5	Ability to develop design and scientific-technological solutions in the field of design, modeling and optimization of refining and petrochemical processes, as well as apply the acquired knowledge to improve the management system of the oil refining industry.	4
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	3
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modeling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	4
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	5
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	3
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	[1] Chapter 1	Framing the Context of Higher Education	
2	[1] Chapter 2	The Capability Approach and Higher Education	
3	[1] Chapter 3	Core Ideas from the Capability Approach	
4	[1] Chapter 4	Pedagogy and Capabilities	
5	[1] Chapter 5	Learning and capabilities	

6	[1] Chapter 6	Widening Participation and Capabilities	
7	[1] Chapter 7	Capabilities for a Higher Education List	
8			Midterm
9	[1] Chapter 8	Change in Higher Education.	
10	[1] Chapter 9	Pedagogy, Capabilities and a Criterion of Justice	
11	[1] Chapter 10	Making sense of teacher professionalism	
12	[1] Chapter 11	Challenges for professionalism within twenty-first-century learning environments	
13	[1] Chapter 11	Making sense of pedagogy	
14	[1] Chapter 12	The application of educational theory	
15	WEB	Research work in high school. Master's dissertation. Rules for the granting of academic degrees and titles	
16			Final

Recommended Sources:

5. Walker M. Higher Education Pedagogies. A Capabilities Approach. New-York, 2006, 164 pages.
6. Waring M., Evans C. Understanding Pedagogy. Developing a critical approach to teaching and learning. New-York, 2015, 259 pages.
7. Site of Ministry of Education of Azerbaijan Republic: https://edu.gov.az/en/page/466
8. Game-based learning for postgraduates: an empirical study of an educational game to teach research skills // Higher Education Pedagogy. 2019, Vol. 4, No. 1, pp.80–104.

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	**Number**	**Duration (hour)**	**Total Workload (hour)**
Course duration in class	**14**	**2**	**28**
Presentation	1	10	10
Self-study	14	3	42
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	10	10
Final Examination	1	3	3
Preparation for final exam	1	10	10
Total Workload			**120**
Total Workload/30(h)			**120/30**
ECTS Credit of the Course			**4**

Chemical engineering master program, “Social disciplines” department

“Technology of petrochemical synthesis” specialization

Course Unit Title	**Pedagogy of high school**
Course Unit Code	PED 1201
Type of Course Unit	Compulsory
Level of Course Unit	1st year master program

National Credits	-
Number of ECTS Credits Allocated	4
Theoretical (hour/week)	2
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	2
Course Coordinator	Nasibova Sevinj
Name of Lecturer (s)	Nasibova Sevinj
Name of Assistant (s)	-
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

Higher education pedagogy is a branch, a section of general pedagogy, and more specifically, professional pedagogy, studying patterns, carrying out theoretical substantiation, developing principles, technologies for the upbringing and education of a person, focused on a concrete-professional sphere of reality.

Objectives of the Course:

The main goal and objectives of the higher education pedagogy course are to form the foundations of the professional and pedagogical culture of a higher school teacher, master the theoretical foundations of modern pedagogical science and form readiness for the creative solution of professional tasks.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Analyze of the current state and forecasting the development of higher education	1,2,3,4
2	Study the history of the development of higher education	1,2,3,4
3	Develop of theoretical and methodological foundations of higher professional education	1,2,3,4
4	Identify regularity of higher education	1,3,4
5	Determine the content of higher education	1,3,4

6	Develop of educational standards, new methods and forms of education	1,3,4
Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm exam, 4. Quiz		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate, and solve complex problems related to the chemistry, technology, and research of the properties of organic compounds and industrial products based on them.	4
4	Ability to apply modern methods to solve scientific problems and develop new scientific research in the field of synthesis and modification of the properties of organic compounds.	5
5	Ability to develop concepts and scientific-technological solutions in the field of petrochemical and basic organic synthesis.	4
6	Ability to use creativity to develop new and improved methods of utilization of waste of petrochemical and organic synthesis, as well as methods of effective use of renewable energy sources.	3
7	The ability to identify, find and provide the necessary information, as well as to plan and conduct analytical, model and experimental studies of catalytic processes involving organic compounds.	4
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	5
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	3
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	[1]	Framing the Context of Higher Education	

	Chapter 1		
2	[1] Chapter 2	The Capability Approach and Higher Education	
3	[1] Chapter 3	Core Ideas from the Capability Approach	
4	[1] Chapter 4	Pedagogy and Capabilities	
5	[1] Chapter 5	Learning and capabilities	
6	[1] Chapter 6	Widening Participation and Capabilities	
7	[1] Chapter 7	Capabilities for a Higher Education List	
8			Midterm
9	[1] Chapter 8	Change in Higher Education.	
10	[1] Chapter 9	Pedagogy, Capabilities and a Criterion of Justice	
11	[1] Chapter 10	Making sense of teacher professionalism	
12	[1] Chapter 11	Challenges for professionalism within twenty-first-century learning environments	
13	[1] Chapter 11	Making sense of pedagogy	
14	[1] Chapter 12	The application of educational theory	
15	WEB	Research work in high school. Master's dissertation. Rules for the granting of academic degrees and titles	

16			Final

Recommended Sources:

9. Walker M. Higher Education Pedagogies. A Capabilities Approach. New-York, 2006, 164 pages.
10. Waring M., Evans C. Understanding Pedagogy. Developing a critical approach to teaching and learning. New-York, 2015, 259 pages.
11. Site of Ministry of Education of Azerbaijan Republic: https://edu.gov.az/en/page/466
12. Game-based learning for postgraduates: an empirical study of an educational game to teach research skills // Higher Education Pedagogy. 2019, Vol. 4, No. 1, pp.80–104.

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	**Number**	**Duration (hour)**	**Total Workload (hour)**
Course duration in class	**14**	**2**	**28**
Presentation	1	10	10
Self-study	14	3	42
Tutorials	14	1	14

Midterm Examination	1	3	3
Preparation for midterm exam	1	10	10
Final Examination	1	3	3
Preparation for final exam	1	10	10
Total Workload			**120**
Total Workload/30(h)			**120/30**
ECTS Credit of the Course			**4**

Chemical engineering (CHEN) master program, "Technology of organic substances and high molecular compounds" department

Course Unit Title		**Catalysis and organocatalysis**

CourseUnit Code	ENG 1205
Type of Course Unit	Compulsory
Level of Course Unit	1st year CHEN master program
National Credits	-
Number of ECTS Credits Allocated	8
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	1
Year of Study	1
Semester when the course unit is delivered	2
Course Coordinator	Narmina Guliyeva
Name of Lecturer (s)	Narmina Guliyeva
Name of Assistant (s)	-
Mode of Delivery	Face to Face, laboratory, seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

It is currently not possible to imagine organic synthesis without catalysts. In organic chemistry, the term organocatalysis (the term “organic” and “catalyst”) refers to a form of catalysis in which the rate of a chemical reaction is increased by using an organic catalyst called an “organocatalyst,” consisting of carbon, hydrogen, sulfur and other non-metallic elements contained in organic compounds

Objectives of the Course:

- The formation and development of catalysis;

- the role and importance of the catalyst in the basic organic and petrochemical synthesis;

- the main types of catalytic processes;

- main indicators characterizing the catalyst;

- different types of raw materials used for the preparation of various catalysts.

Learning Outcomes		
At the end of the course the student will be able to		Assessment
1	- distinguish between different types of raw materials used for the preparation of various catalysts.	1, 3, 5
2	- selection of a suitable catalyst for high-tech processes;	1, 2, 3, 4, 5
3	- development of a catalyst for each catalytic process;	1, 2, 3, 5
4	- Proper use of the catalyst to increase life expectancy.	1, 3, 4, 5
5	- conclusion of the catalyst from the process	1, 3, 4, 5
Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm, 4. Laboratory, 5. Quiz		

Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate, and solve complex problems related to the chemistry, technology, and research of the properties of organic compounds and industrial products based on them.	5
4	Ability to apply modern methods to solve scientific problems and develop new scientific research in the field of synthesis and modification of the properties of organic compounds.	5
5	Ability to develop concepts and scientific-technological solutions in the field of petrochemical and basic organic synthesis.	5
6	Ability to use creativity to develop new and improved methods of utilization of waste of petrochemical and organic synthesis, as well as methods of effective use of renewable energy sources.	5
7	The ability to identify, find and provide the necessary information, as well as to plan and conduct analytical, model and experimental studies of catalytic processes involving organic compounds.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5

9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	4
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

CourseContents

Week	Chapter	Topics	Exam
1	p.1-29 [1]	Noncovalent Organocatalysis Based on Hydrogen Bonding: Elucidation of Reaction Paths by Computational Methods. **Sem:** Noncovalent Organocatalysis Based on Hydrogen Bonding: Elucidation of Reaction Paths by Computational Methods	
2	p.29-77 [1]	Enamine Catalysis. **Lab: Preparation of a zeolite-containing catalyst by co-precipitation** In the laboratory work the following equipment and material are used: *sump, mixer, molding column, spray dryer, specific installation (consist of pH meter, electrodes, magnetic valve, containers with sulfuric acid, liquid glass solution, aluminum sulfate solution, an aqueous suspension of zeolite, thermometer, regulator, mixer, electromagnetic stirrer), sulfuric acid, aluminum oxide, zeolite U, silicate block.* *The laboratory work will explain how to prepare the zeolite catalyst by the co-precipitation method. The preparation of liquid glass solutions. How to perform the sol-gel method synthesis. The preparation of alumina sulfate. pH control over processes. Determining the volume of taken samples.*	
3	p.77-145 [1]	Carbene Catalysts. **Sem:** Enamine Catalysis Carbene Catalysts	
4	p.145-201 [1]	Bronsted Base Catalysts	

		Lab: Preparation of aluminum-cobalt-molybdenum catalyst by impregnation method In the laboratory work the following equipment and material are used: ammonium paramolybdate, cobalt nitrate, nitric acid, ammonium hydroxide, aluminum hydroxide, sodium hydroxide, sodium aluminate, screw presses. Prepare a certain amount of Al-Co-Mo-O catalyst with a carrier content of Al_2O_3-84% by weight and a ratio of Co/Mo =1/3. The synthesis of catalysts by impregnation with the application of the active component to the carrier.	
5	p.201-233 [1]	Chiral Ketone and Iminium Catalysts for Olefin Epoxidation. **Sem:** Chiral Ketone and Iminium Catalysts for Olefin Epoxidation.	
6	p.233-281 [1]	Amine, Alcohol and Phosphine Catalysts for Acyl Transfer Reactions. **Lab: Determination of the mechanical strength of catalysts** In the laboratory work the following equipment and material are used: *lever device (consist of counterweight, knife, granule, stand, cargo) weights, tested catalyst pellet.* *During the process, the solid catalyst located in the reactor is exposed to increased pressure, high temperature and its fluctuations, the effect of water vapor and air during pneumatic transportation, as well as the dynamic action of the passing raw materials to test it mechanical strength.*	
7			Midterm
8	p.281-349 [1]	Secondary and Primary Amine Catalysts for Iminium Catalysis. **Sem:** Secondary and Primary Amine Catalysts for Iminium Catalysis	

9	p.349-385 [1]	Lewis Acid Organocatalysts **Lab: Determination of mechanical wear of granular catalyst** In the laboratory work the following equipment and material are used: *tested catalyst, sieves, rheometer, airlift device (consist of impact plate, grid, inner tube, outer tube, nozzle)* *The catalyst sample is tested for mechanical wear resistance in airlift device. The catalyst is partially destroyed due to the friction of the granules with each other and against the walls of the device. Residues then weighted and then strength is determined by given formula.*	
10	p.395-457 [1]	Chiral Brønsted Acids for Asymmetric Organocatalysis. **Sem:** Lewis Acid Organocatalysts	
11	p.33-75 [2]	Heterogeneous Catalytic Processes **Lab: Determination of the activity index of an aluminosilicate catalyst** In the laboratory work the following equipment and material are used: *reactor (consist of funnel, three–way tap, outlet tube, burette, capillary, tee, straight tap, rheometer, reactor, tubular furnace, refrigerator, receiver, manometer, gasometer), deflegmator, test catalyst.* *The laboratory work designed to allow students to independently determine the activity index of catalyst on the given installation. The determination of the activity index of the catalyst is carried out with 2 parallel experiments with the reference raw material – a long dash of kerosene–gas oil fraction of naphthenic base with boiling range of 240-300 0C.*	
12	p.76-133 [2]	Physical Chemistry, Elementary Kinetics **Sem:** Elementary Kinetics	
13	p. 134-160 [2]	The State of the Working Catalyst	

		Lab: Determination of the activity index of an aluminosilicate catalyst In the laboratory work the following equipment and material are used: *reactor (consist of funnel, three–way tap, outlet tube, burette, capillary, tee, straight tap, rheometer, reactor, tubular furnace, refrigerator, receiver, manometer, gasometer), deflegmator, test catalyst.* *The laboratory work designed to allow students to independently determine the activity index of catalyst on the given installation. The determination of the activity index of the catalyst is carried out with 2 parallel experiments with the reference raw material – a long dash of kerosene–gas oil fraction of naphthenic base with boiling range of 240-300 0C.*	
14	p.161-182 [2]	Advanced Kinetics: Breakdown of Mean Field Approximation **Sem:** Breakdown of Mean Field Approximation	
15	p. 183-222 [2]	Molecular Heterogeneous Catalysis ***Lab: Determination of the amount of copper in the trigger catalyst*** In the laboratory work the following equipment and material are used: *analytical scales, flask, potassium hydroxide solution, concentrated nitric acid, ammonia solution, sulfuric acid, potassium iodide, sodium hyposulfite, starch.* *The amount of the active component in the catalysts of the oxidative chlorination process should have an optimal value. a necessary condition is to take the exact amount of copper chloride. The iodometric method is used to determine the amount of Cu+ in the catalyst.*	
16			Final

Recommended Sources

TEXTBOOK(S)

1. List, Benjamin, Asymmetric Organocatalysis Editors: (Ed.) Publisher: Springer, 2009, p. 467 2. Rutger A. van Santen, Modern Heterogeneous Catalysis: An Introduction Editor(s): Publisher:Wiley VCH, 2017, p. 573

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	10%	
Quiz	10%	
Seminar	0%	
Laboratory	10%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan State Oil and Industry University for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Work load (hour)
Course duration in class	**14**	**4**	**56**
Preparation for Presentation	1	22	22
Tutorials	14	2	28
Self –study	14	6	84
Midterm Examination	1	3	3
Preparation for midterm exam	1	20	20
Final Examination	1	3	3

Preparation for final exam	1	24	24
Total Workload			**240**
Total Work load/30(h)			**240/30**
ECTS Credit of the Course			**8**

Chemical engineering (CHEN) master program, "Technology of organic substances and high molecular compounds" department

Course Unit Title	**Additives and plasticizers**
CourseUnitCode	ENG 1206
Type of Course Unit	Compulsory
Level of Course Unit	1 st year master program
National Credits	-
Number of ECTS Credits Allocated	8
Theoretical (hour/week)	2
Practice (hour/week)	2
Laboratory (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	2
Course Coordinator	Narmina Guliyeva
Name of Lecturer (s)	Narmina Guliyeva
Name of Assistant (s)	-
Mode of Delivery	Face to Face, seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

Additives are substance added to something in small quantities to improve or preserve it.

Many foods contain chemical additives. Plasticizers or dispersants are additives that reduce ductility or reduce the viscosity of the material. These are substances that are added to change their physical properties. These are either low volatility liquids or solids. They reduce the attraction between the polymer chains to make them more flexible.

Objectives of the Course:

- the correct selection of additives for the production of high-quality oils and fuels;

- the ability to use additives when creating waste-free processes.

- the formation and development of additives;

- the role and importance of additives in the production of high-quality fats and fuels;

- main types of additives;

- the main indicators characterizing the composition of additives;

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	- distinguish the main indicators characterizing the composition of the additives;	1, 3, 4
2	- know the various types of raw materials used to prepare various additive packages.	1, 2, 3, 4
3	- selection of appropriate additives for the production of high-quality fats and fuels;	1, 2, 3, 4
4	- preparation of additive packages for each process;	1, 3, 4
5	- the correct use of high-quality oils and fuels to increase their service life.	1, 3, 4

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm, 4. Quiz

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate, and solve complex problems related to the chemistry, technology, and research of the properties of organic compounds and industrial products based on them.	5

4	Ability to apply modern methods to solve scientific problems and develop new scientific research in the field of synthesis and modification of the properties of organic compounds.	5
5	Ability to develop concepts and scientific-technological solutions in the field of petrochemical and basic organic synthesis.	5
6	Ability to use creativity to develop new and improved methods of utilization of waste of petrochemical and organic synthesis, as well as methods of effective use of renewable energy sources.	5
7	The ability to identify, find and provide the necessary information, as well as to plan and conduct analytical, model and experimental studies of catalytic processes involving organic compounds.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	4

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

CourseContents

Week	Chapter	Topics	Exam
1	p.1-9 [1]	Overview of polymers, additives, and processing Sem; Overview of polymers, additives, and processing	
2	p.9-13 [1]	Compounding overview Sem: Overview of polymers, additives, and processing	
3	p.19-26 [1]	Extraction and analysis Sem; Extraction and analysis	
4	p.27-53 [1]	Crosslinking compounds/accelerators Sem: Extraction and analysis	
5	p.53-73 [1]	Stabilizers Sem; Stabilizers	
6	p.73-219 [1]	Antioxidants	

		Sem: Stabilizers Antioxidants	
7	p.231-247 [1]	Flame Retardants Sem; Flame Retardants	
8			Midterm
9	p.247-389 [1]	Plasticizers Sem: Plasticizers	
10	p.389-405 [1]	Other compounds of interest Sem Other compounds of interest	
11	p.405-415 [1]	Practical applications of investigative analyses Sem: Practical applications of investigative analyses	
12	p.415-423 [1]	Performance and exposure issues with organic additives Sem; Performance and exposure issues with organic additives	
13	p.425-432 [1]	Polymers for electrical equipment applications Sem: organic additives Sem; Polymers for electrical equipment applications Sem: organic additives	
14	p.432-439 [1]	Questioned analytical procedures Sem Questioned analytical procedures	
15	p.439-607 [1]	Chromatograms Sem: Questioned analytical procedures	
16			Final

RecommendedSources

TEXTBOOK(S)

1. Michael Bolgar, Jack Hubball, Joseph Groeger, Susan Meronek, Handbook for the chemical analysis of plastic and polymer additives, Second edition, , Publisher CRC Press,2015 p.654

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	

Quiz	10%	
Seminar	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan State Oil and Industry University for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Work load (hour)
Course duration in class	**14**	**4**	**56**
Preparation for Presentation	1	17	17
Tutorials	14	2	28
Self –study	14	6	84
Midterm Examination	1	3	3
Preparation for midterm exam	1	18	18
Final Examination	1	3	3
Preparation for final exam	1	31	31
Total Workload			**240**
Total Work load/30(h)			**240/30**
ECTS Credit of the Course			**8**

Chemical engineering (CHEN) master program, “Technology of organic substances and high molecular compounds” department

Course Unit Title	**Total synthesis and synthesis planning**
Course Unit Code	ENG 1104
Type of Course Unit	Compulsory
Level of Course Unit	1 st year of master program
National Credits	-
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	2
Practice (hour/week)	-
Laboratory (hour/week)	1
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	Narmina Guliyeva
Name of Lecturer (s)	Narmina Guliyeva
Name of Assistant (s)	-
Mode of Delivery	Face to Face, laboratory
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

Organic synthesis is a special branch of chemical synthesis and is concerned with the intentional construction of organic compounds. Organic molecules are often more complex than inorganic compounds, and their synthesis has developed into one of the most important branches of organic chemistry.

Objectives of the Course:

- to study new production processes of hydrocarbon compounds;

- to study theoretical knowledge for the production of hydrocarbon raw materials;

- to study new processes of organic oxygen compounds;

- to study new processes for the production of alkilaromatic compounds.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	- hydrocarbon production processes;	1, 3, 4, 5
2	- processes for the production of organic oxygen compounds;	1, 2, 3, 4, 5
3	- processes for the production of alkyl aromatic compounds;	2, 3, 4, 5
4	- the main features of the process of catalytic pyrolysis of hydrocarbons;	3, 4, 5
5	- Introduction of new processes in the oil refining and petrochemical industries.	1, 3, 5
Assessment Methods: 1. Final Exam, 2. Presentation, 3.Midterm, 4 Laboratory, 5. Quiz		

Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate, and solve complex problems related to the chemistry, technology, and research of the properties of organic compounds and industrial products based on them.	5
4	Ability to apply modern methods to solve scientific problems and develop new scientific research in the field of synthesis and modification of the properties of organic compounds.	5
5	Ability to develop concepts and scientific-technological solutions in the field of petrochemical and basic organic synthesis.	5
6	Ability to use creativity to develop new and improved methods of utilization of waste of petrochemical and organic synthesis, as well as methods of effective use of renewable energy sources.	5
7	The ability to identify, find and provide the necessary information, as well as to plan and conduct analytical, model and experimental studies of catalytic processes involving organic compounds.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4

10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	4

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

Course Contents

Week	Chapter	Topics	Exam
1	p. 1-26 [1]	Synthetic design	
2	p.31-47 [1]	Stereochemical considerations in planning syntheses **Laboratory work.** Low-temperature oxidative chlorination of toluene For laboratory work, the following equipment and materials are required: a mechanical stirrer, a thermometer, an addition funnel, a three-necked flask, a chromatograph, hydrochloric acid, toluene, hydrogen peroxide, an adsorbent, anion exchangers, and an apparatus suitable for this kind of reaction. Laboratory work will allow students to independently carry out the reaction of toluene chlorination.	
3	p.58-82 [1]	The concept of protecting functional goups	
4	p.88-97 [1]	Functional group transformations: oxidation and reduction **Laboratory work.** Low-temperature oxidative chlorination of toluene For laboratory work, the following equipment and materials are required: a mechanical stirrer, a thermometer, an addition funnel, a three-necked flask, a chromatograph, hydrochloric acid, toluene, hydrogen peroxide, an adsorbent, anion exchangers, and an apparatus suitable for this kind of reaction. Laboratory work will allow students to independently carry out the reaction of toluene chlorination.	

5	p.98-112 [1]	Oxidative procedures to carboxylic acids	
6	p.115-124	Diastereoselective reductions of cyclic ketones **Laboratory work**. Low-temperature oxidative chlorination of toluene For laboratory work, the following equipment and materials are required: a mechanical stirrer, a thermometer, an addition funnel, a three-necked flask, a chromatograph, hydrochloric acid, toluene, hydrogen peroxide, an adsorbent, anion exchangers, and an apparatus suitable for this kind of reaction. Laboratory work will allow students to independently carry out the reaction of toluene chlorination.	
7			Midterm
8	p.139-193 [1]	Functional group transformations: The chemistry of carbon-carbon π-bonds and related reactions **Laboratory work**. Alkylation of aromatic hydrocarbons with alcohols in the presence of sulfuric acid For laboratory work, the following equipment and materials are required: benzene, butyl alcohol, sulfuric acid, round-bottomed and three-necked flasks, Liebig refrigerator, stirrer, dropping funnel, separating funnel, fractional distillation device, receivers. Laboratory work will allow students to independently carry out the reaction of alkylation of the benzene ring using alcohols and sulfuric acid. The work will explain the mechanism and theory of the reaction and teach students how to carry out such organic syntheses efficiently.	
9	p.213-231 [1]	Formation of carbon-carbon single bonds via enolate anions	
10	p.234-260 [1]	Stereochemistry of cyclic ketone alkylation	

		Laboratory work. Alkylation of aromatic hydrocarbons with alcohols in the presence of sulfuric acid For laboratory work, the following equipment and materials are required: benzene, butyl alcohol, sulfuric acid, round-bottomed and three-necked flasks, Liebig refrigerator, stirrer, dropping funnel, separating funnel, fractional distillation device, receivers. Laboratory work will allow students to independently carry out the reaction of alkylation of the benzene ring using alcohols and sulfuric acid. The work will explain the mechanism and theory of the reaction and teach students how to carry out such organic syntheses efficiently.	
11	p.273-297 [1]	Formation of carbon-carbon bonds via organometallic reagents	
12	p.298-322 [1]	Organochromium reagents **Laboratory work.** Dehydration of Isopropyl Alcohol For laboratory work, the following equipment and materials are required: isopropyl, distilled water, catalyst. Laboratory work will allow students to independently carry out the reaction of alcohol dehydration in order to obtain alkenes. During the procedures, students will study the kinetics of dehydration reactions. They will better understand such reactions and study the mechanisms and theory of the process.	
13	p.359-396 [1]	Formation of carbon-carbon π-bonds	
14	p.412-443 [1]	Syntheses of carbocyclic systems **Laboratory work.** Dehydration of Isopropyl Alcohol For laboratory work, the following equipment and materials are required: isopropyl, distilled water, catalyst.	

		Laboratory work will allow students to independently carry out the reaction of alcohol dehydration in order to obtain alkenes. During the procedures, students will study the kinetics of dehydration reactions. They will better understand such reactions and study the mechanisms and theory of the process.	
15	p.443-469 [1]	The art of synthesis	
16			Final

Recommended Sources

TEXTBOOK(S)

1. George S. Zweifel, Michael H. Nantz, Peter Somfai Modern Organic Synthesis: An Introduction, 2nd Edition, Publisher: W. H. Freeman, 2006,

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	10%	
Quiz	10%	
Laboratory	10%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan Ministry of Education for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)

Course duration in class	**14**	**3**	**42**
Tutorials	14	2	28
Presentation	1	16	16
Self-study	14	3	42
Midterm Examination	1	3	3
Preparation for midterm exam	1	22	22
Final Examination	1	3	3
Preparation for final exam	1	24	24
Total Workload			**180**
Total Workload/30(h)			**180/30**
ECTS Credit of the Course			**6**

Chemical engineering (CHEN) master program, “Technology of organic substances and high molecular compounds” department

Course Unit Title	**The using of wastes of petrochemical synthesis**
CourseUnitCode	ENG 2102
Type of Course Unit	2 nd year CHEN master program
Level of Course Unit	2
National Credits	-
Number of ECTS Credits Allocated	8
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	1
Year of Study	2
Semester when the course unit is delivered	3
Course Coordinator	Narmina Guliyeva
Name of Lecturer (s)	Narmina Guliyeva
Name of Assistant (s)	-
Mode of Delivery	Face to Face, laboratory, seminar
Language of Instruction	English
Prerequisites	-

Recommended Optional Programme Components	-

Course description:

Modern state of waste production of petrochemical synthesis. Classification of industrial wastes. Production, consumption waste, by-products and secondary sources of raw materials.

The concept of waste-free production. Causes of production wastes. Creating waste-free or low-waste manufacturing processes. Saving waste and environmental protection with waste recycling.

Objectives of the Course:

- acquaintance with waste of petrochemical synthesis industry,

- acquaintance with gas, liquid and solid fuels and by-products of the petrochemical synthesis industry,

- to teach methods of reduction of production waste of petrochemical synthesis;

- to teach methods of processing of waste products of petrochemical synthesis.

Learning Outcomes

At the end of the course the student will be able to		**Assessment**
1	- be able to work with waste petrochemical synthesis,	1, 3, 5
2	- be able to handle and apply in the laboratory with liquid and solid fuels and by-products of petrochemical synthesis,	1, 2, 3, 5
3	- consider plans to reduce production waste of petrochemical synthesis;	1, 2, 3, 4, 5
4	- own methods of processing petrochemical synthesis waste.	1, 3, 4, 5
5	- know the safety conditions for working with waste	1, 3, 4, 5

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm, 4.Laboratory, 5. Quiz

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate, and solve complex problems related to the chemistry, technology, and research of the properties of organic compounds and industrial products based on them.	5

4	Ability to apply modern methods to solve scientific problems and develop new scientific research in the field of synthesis and modification of the properties of organic compounds.	5
5	Ability to develop concepts and scientific-technological solutions in the field of petrochemical and basic organic synthesis.	5
6	Ability to use creativity to develop new and improved methods of utilization of waste of petrochemical and organic synthesis, as well as methods of effective use of renewable energy sources.	5
7	The ability to identify, find and provide the necessary information, as well as to plan and conduct analytical, model and experimental studies of catalytic processes involving organic compounds.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	4
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents			
Week	Chapter	Topics	Exam
1	p.1-20 [1]	Introduction to the petroleum industry Sem: Petroleum industry	
2	p.20-30 [1]	Wastes from exploration, development and production **Laboratory work.** Dehydration of triple butyl alcohol **The laboratory work will utilize the following equipment and materials:** *triple butyl alcohol, distilled water, catalyst, device for dehydration (consists of electromechanical dosing device, evaporator, reactor, small inverter oven, photoelectric regulator, potentiometer, refrigerant gas – evaporator, Mariott bowl, measuring cylinder, receiver), stopwatch, chromatograph, kinetic device* *During laboratory work, students will investigate the process of vapor-phase dehydration of triple butyl*	

		alcohol on the catalyst NaX containing zeolite and the effect of the amount of water contained in trimethylcarbinol on the course of dehydration, extract the kinetic regularity of the process and determine the speed constant and activation energy. The results of the carried experiments will be transferred into the table. Based on the results obtained, the speed constant and activation energy will be calculated according to the given equations.	
3	p.30-72 [1]	Wastes from hydrocarbon processing Sem: Wastes from exploration, development and production	
4	p.72-84 [1]	Estimation of oil-spill volume **Laboratory work.** Dehydration of triple butyl alcohol **The laboratory work will utilize the following equipment and materials:** *triple butyl alcohol, distilled water, catalyst, device for dehydration (consists of electromechanical dosing device, evaporator, reactor, small inverter oven, photoelectric regulator, potentiometer, refrigerant gas – evaporator, Mariott bowl, measuring cylinder, receiver), stopwatch, chromatograph, kinetic device* *During laboratory work, students will investigate the process of vapor-phase dehydration of triple butyl alcohol on the catalyst NaX containing zeolite and the effect of the amount of water contained in trimethylcarbinol on the course of dehydration, extract the kinetic regularity of the process and determine the speed constant and activation energy. The results of the carried experiments will be transferred into the table. Based on the results obtained, the speed constant and activation energy will be calculated according to the given equations.*	
5	p.85-116 [1]	Environmental impacts of the petroleum Industry, protection options and regulations Sem: Environmental impacts of the petroleum industry, protection options and regulations	
6	p.117-148 [1]	Oil-spill response	

		Laboratory work. Dehydration of triple butyl alcohol **The laboratory work will utilize the following equipment and materials:** *triple butyl alcohol, distilled water, catalyst, device for dehydration (consists of electromechanical dosing device, evaporator, reactor, small inverter oven, photoelectric regulator, potentiometer, refrigerant gas – evaporator, Mariott bowl, measuring cylinder, receiver), stopwatch, chromatograph, kinetic device* *During laboratory work, students will investigate the process of vapor-phase dehydration of triple butyl alcohol on the catalyst NaX containing zeolite and the effect of the amount of water contained in trimethylcarbinol on the course of dehydration, extract the kinetic regularity of the process and determine the speed constant and activation energy. The results of the carried experiments will be transferred into the table. Based on the results obtained, the speed constant and activation energy will be calculated according to the given equations.*	
7			Midterm
8	p.149-185 [1]	Control and treatment of air emissions **5** Sem: Oil-spill response	

9	p.186-200 [1]	Wastewater characterization **Laboratory work.** Dehydrochlorination of chloroethanes to chloroethylenes The laboratory work will utilize the following equipment and materials: *1,1,2,2-tetrachlorethane, potassium iodide aqueous solution, 0,1 N potassium hydroxide solution, 0,1 N sodium thiosulfate solution, the device for dehydrochlorination of chloroethanes (consist of electro-mechanical dosing device, monostat, rheometer, oxygen or air evaporator, reactor, condenser, capacity, Mariott bowl.* *During laboratory work, students will study the dehydrochlorination reaction of 1,1,2,2 - tetrachloroethane to trichloroethylene (or tetrachloroethylene of pentachloroethane), the oxidative dehydrochlorination reaction of 1,1,2,2 - tetrachloroethane to trichloroethylene or tetrachloroethylene (or tetrachloroethylene of pentachloroethane), comply the material balance of the process and check its elements (C, Cl), determine the chloroethane conversion, output, and selectivity of target product and additive products, construct the technological scheme of flow process (block - scheme) and dependency graphs of technological parameters of indicators of the process. They also will obtain a better insight into the theory and procedures behind the work and try to apply gained knowledge to perform experiments efficiently.*	
10	p.200-205 [1]	Continuous stirred tank bioreactor Sem: Continuous stirred tank bioreactor	
11	p.206-209 [1]	Rotating biological contactors **Laboratory work.** Dehydrochlorination of chloroethanes to chloroethylenes The laboratory work will utilize the following equipment and materials: *1,1,2,2-tetrachlorethane, potassium iodide aqueous solution, 0,1 N potassium hydroxide solution, 0,1 N sodium thiosulfate solution, the device for dehydrochlorination of chloroethanes (consist of electro-mechanical dosing device, monostat, rheometer, oxygen or air evaporator, reactor, condenser, capacity, Mariott bowl.*	

		During laboratory work, students will study the dehydrochlorination reaction of 1,1,2,2 - tetrachloroethane to trichloroethylene (or tetrachloroethylene of pentachloroethane), the oxidative dehydrochlorination reaction of 1,1,2,2 - tetrachloroethane to trichloroethylene or tetrachloroethylene (or tetrachloroethylene of pentachloroethane), comply the material balance of the process and check its elements (C, Cl), determine the chloroethane conversion, output, and selectivity of target product and additive products, construct the technological scheme of flow process (block - scheme) and dependency graphs of technological parameters of indicators of the process. They also will obtain a better insight into the theory and procedures behind the work and try to apply gained knowledge to perform experiments efficiently.	
12	p.209-248 [1]	Tertiary treatment or polishing Sem: Rotating biological contactors	
13	p.248-270 [1]	Oily wastewater treatment plants **Laboratory work.** Dehydrochlorination of chloroethanes to chloroethylenes The laboratory work will utilize the following equipment and materials: *1,1,2,2-tetrachlorethane, potassium iodide aqueous solution, 0,1 N potassium hydroxide solution, 0,1 N sodium thiosulfate solution, the device for dehydrochlorination of chloroethanes (consist of electro-mechanical dosing device, monostat, rheometer, oxygen or air evaporator, reactor, condenser, capacity, Mariott bowl.* *During laboratory work, students will study the dehydrochlorination reaction of 1,1,2,2 - tetrachloroethane to trichloroethylene (or tetrachloroethylene of pentachloroethane), the oxidative dehydrochlorination reaction of 1,1,2,2 - tetrachloroethane to trichloroethylene or tetrachloroethylene (or tetrachloroethylene of pentachloroethane), comply the material balance of the process and check its elements (C, Cl), determine the chloroethane conversion, output, and selectivity of target product and additive products, construct the technological scheme of flow process (block - scheme) and dependency graphs of technological parameters of indicators of the process. They also will obtain a*	

		better insight into the theory and procedures behind the work and try to apply gained knowledge to perform experiments efficiently.	
14	p.276-280 [1]	Solvent Extraction Sem: Oily wastewater treatment plants	
15	p.280-289 [1]	Centrifugation **Laboratory work.** Dehydrochlorination of chloroethanes to chloroethylenes The laboratory work will utilize the following equipment and materials: *1,1,2,2-tetrachlorethane, potassium iodide aqueous solution, 0,1 N potassium hydroxide solution, 0,1 N sodium thiosulfate solution, the device for dehydrochlorination of chloroethanes (consist of electro-mechanical dosing device, monostat, rheometer, oxygen or air evaporator, reactor, condenser, capacity, Mariott bowl.* *During laboratory work, students will study the dehydrochlorination reaction of 1,1,2,2 - tetrachloroethane to trichloroethylene (or tetrachloroethylene of pentachloroethane), the oxidative dehydrochlorination reaction of 1,1,2,2 - tetrachloroethane to trichloroethylene or tetrachloroethylene (or tetrachloroethylene of pentachloroethane), comply the material balance of the process and check its elements (C, Cl), determine the chloroethane conversion, output, and selectivity of target product and additive products, construct the technological scheme of flow process (block - scheme) and dependency graphs of technological parameters of indicators of the process. They also will obtain a better insight into the theory and procedures behind the work and try to apply gained knowledge to perform experiments efficiently.*	
16			Final

Recommended Sources

TEXTBOOK(S)

1. Shahryar Jafarinejad, Petroleum Waste Treatment and Pollution Control.

Butterworth-Heinemann, 2017, p. 378

Assessment

Attendance	0%	At least 75% class attendance is compulsory

Presentation	10%	
Quiz	10%	
Seminar	0%	
Laboratory	10%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan State Oil and Industry University for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	**Number**	**Duration (hour)**	**Total Work load (hour)**
Course duration in class	14	4	56
Presentation	1	36	36
Tutorials	14	1	14
Self –study	14	5	70
Midterm Examination	1	3	3
Preparation for midterm exam	1	19	19
Final Examination	1	3	3
Preparation for final exam	1	39	39
Total Workload			**240**
Total Work load/30(h)			**240/30**
ECTS Credit of the Course			**8**

Chemical engineering (CHEN) master program, “Technology of organic substances and high molecular compounds” department

Course Unit Title	**Petroleum and Petrochemical Processes**
CourseUnitCode	ENG 3006
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	8
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	1
Year of Study	1
Semester when the course unit is delivered	-
Course Coordinator	Narmina Guliyeva
Name of Lecturer (s)	Narmina Guliyeva
Name of Assistant (s)	-
Mode of Delivery	Face to Face, laboratory, seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

Petroleum and Petrochemical Processes

The scope of the course module is to enable students to understand the principal processes involved in petroleum processing, in the interface between petroleum refining and a petrochemical plant and in major petrochemical operations. This includes: Basics of crude oil chemistry, Distillation of crude oil, Catalytic conversion and upgrading processes, Thermal conversion and upgrading processes, Production and managing hydrogen, Basic Petrochemical Processes.

Objectives of the Course:

- to give students the opportunity to understand the basic processes associated with oil refining, on the border between oil refining and a petrochemical plant, as well as in basic petrochemical operations. - basics of chemistry of crude oil, distillation of crude oil, - processes of catalytic conversion and modernization, - processes of thermal conversion and modernization, production and management of hydrogen, basic petrochemical processes.		
Learning Outcomes		
At the end of the course the student will be able to		Assessment
1	- must know the composition of oil	1, 3, 5
2	- the basics of chemistry of crude oil, distillation of crude oil,	1, 2, 3, 4, 5
3	- processes of catalytic conversion and modernization,	1, 2, 3, 4, 5
4	- production and control of hydrogen	1, 3, 4, 5
5	- basic petrochemical processes.	1, 3, 5
Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm, 4. Laboratory, 5. Quiz		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate, and solve complex problems related to the chemistry, technology, and research of the properties of organic compounds and industrial products based on them.	5
4	Ability to apply modern methods to solve scientific problems and develop new scientific research in the field of synthesis and modification of the properties of organic compounds.	5
5	Ability to develop concepts and scientific-technological solutions in the field of petrochemical and basic organic synthesis.	5
6	Ability to use creativity to develop new and improved methods of utilization of waste of petrochemical and organic synthesis, as well as methods of effective use of renewable energy sources.	5

7	The ability to identify, find and provide the necessary information, as well as to plan and conduct analytical, model and experimental studies of catalytic processes involving organic compounds.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	4

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

CourseContents

Week	Chapter	Topics	Exam
1	p.1-26 [1]	Primary raw materials for petrochemicals Sem; Primary raw materials for petrochemicals	
2	p.29-48 [1]	Hydrocarbon intermediates **Laboratory work.** Preparation of ethylbenzene hydroperoxide via oxidation of ethylbenzene The laboratory work will utilize the following equipment and materials: *rectified technical ethanol, ethylbenzene, molybdenum, sodium hydroxide, hydrochloric acid, hydrazine sulfate, sulfuric acid, fenamic acid, sodium carbonate, ammonium metavanadate, distilled water, glacial acetic acid, potassium iodide, soluble starch, sodium thiosulfate, sodium chloride, magnesium chloride, potassium hydroxide, methyl orange; bromocresol green, methyl red; n-hexane, conical flasks, graduated cylinders, graduated pipettes, burette, analytical weights, stopwatch, separatory funnel, electric heater, water bath, dropper, thermometer, installation for ethylbenzene oxidation, installation for dissolving sodium hydroxide in ethylbenzne.* *During laboratory work, students will study the synthesis of ethylbenzene hydroperoxide via oxidation with oxygen from the air in presence of a catalyst (salt, hydroxides of metals of permanent and varying valence state) and how the conditions of reaction affect the composition of oxidation products. Students should carry out the*	

		calculation of the mass fraction of organic hydroperoxides (X, %) and do the statistical analysis by the end of the work.	
3	p.49-107 [1]	Crude oil processing and production of hydrocarbon Intermediates Sem; Crude oil processing and production of hydrocarbon Intermediates	
4	p.111-133 [1]	Nonhydrocarbon intermediates **Laboratory work.** Preparation of ethylbenzene hydroperoxide via oxidation of ethylbenzene The laboratory work will utilize the following equipment and materials: *rectified technical ethanol, ethylbenzene, molybdenum, sodium hydroxide, hydrochloric acid, hydrazine sulfate, sulfuric acid, fenamic acid, sodium carbonate, ammonium metavanadate, distilled water, glacial acetic acid, potassium iodide, soluble starch, sodium thiosulfate, sodium chloride, magnesium chloride, potassium hydroxide, methyl orange; bromocresol green, methyl red; n-hexane, conical flasks, graduated cylinders, graduated pipettes, burette, analytical weights, stopwatch, separatory funnel, electric heater, water bath, dropper, thermometer, installation for ethylbenzene oxidation, installation for dissolving sodium hydroxide in ethylbenzne.* *During laboratory work, students will study the synthesis of ethylbenzene hydroperoxide via oxidation with oxygen from the air in presence of a catalyst (salt, hydroxides of metals of permanent and varying valence state) and how the conditions of reaction affect the composition of oxidation products. Students should carry out the calculation of the mass fraction of organic hydroperoxides (X, %) and do the statistical analysis by the end of the work.*	
5	p.135-167 [1]	Chemicals based on methane Sem; Chemicals based on methane	
6	p.169-186 [1]	Ethane and higher paraffins-based chemicals **Laboratory work.** Preparation of ethylbenzene hydroperoxide via oxidation of ethylbenzene The laboratory work will utilize the following equipment and materials: *rectified technical ethanol, ethylbenzene, molybdenum, sodium hydroxide, hydrochloric acid,*	

		hydrazine sulfate, sulfuric acid, fenamic acid, sodium carbonate, ammonium metavanadate, distilled water, glacial acetic acid, potassium iodide, soluble starch, sodium thiosulfate, sodium chloride, magnesium chloride, potassium hydroxide, methyl orange; bromocresol green, methyl red; n-hexane, conical flasks, graduated cylinders, graduated pipettes, burette, analytical weights, stopwatch, separatory funnel, electric heater, water bath, dropper, thermometer, installation for ethylbenzene oxidation, installation for dissolving sodium hydroxide in ethylbenzne. *During laboratory work, students will study the synthesis of ethylbenzene hydroperoxide via oxidation with oxygen from the air in presence of a catalyst (salt, hydroxides of metals of permanent and varying valence state) and how the conditions of reaction affect the composition of oxidation products. Students should carry out the calculation of the mass fraction of organic hydroperoxides (X, %) and do the statistical analysis by the end of the work.*	
7			Midterm
8	p.188-211 [1]	Chemicals based on ethylene **Laboratory work.** Effects of inhibitors on oxidation process of ethylbenzene The laboratory work will utilize the following equipment and materials: *rectified technical ethanol, ethylbenzene, molybdenum, sodium hydroxide, hydrochloric acid, hydrazine sulfate, sulfuric acid, fenamic acid, sodium carbonate, ammonium metavanadate, distilled water, glacial acetic acid, potassium iodide, soluble starch, sodium thiosulfate, sodium chloride, magnesium chloride, potassium hydroxide, methyl orange; bromocresol green, methyl red; n-hexane, conical flasks, graduated cylinders, graduated pipettes, burette, analytical weights, stopwatch, separatory funnel, electric heater, water bath, dropper, thermometer, inhibitors (monooxypropylated amine, dioxypropylated amine, Novantox, 6PPD, polyoxypropylated amine).* *During laboratory work, students will study the effects of various inhibitors on the oxidation process of ethylbenzene and conduct comparative analysis. Students should carry out the calculation of the mass fraction of organic hydroperoxides (X, %) and do the statistical analysis by the end of the work.*	

9	p.213-236 [1]	Chemicals based on propylene Sem; Chemicals based on propylene	
10	p.238-260 [1]	C_4 olefins and diolefins-based chemicals **Laboratory work.** Effects of inhibitors on oxidation process of ethylbenzene The laboratory work will utilize the following equipment and materials: *rectified technical ethanol, ethylbenzene, molybdenum, sodium hydroxide, hydrochloric acid, hydrazine sulfate, sulfuric acid, fenamic acid, sodium carbonate, ammonium metavanadate, distilled water, glacial acetic acid, potassium iodide, soluble starch, sodium thiosulfate, sodium chloride, magnesium chloride, potassium hydroxide, methyl orange; bromocresol green, methyl red; n-hexane, conical flasks, graduated cylinders, graduated pipettes, burette, analytical weights, stopwatch, separatory funnel, electric heater, water bath, dropper, thermometer, inhibitors (monooxypropylated amine, dioxypropylated amine, Novantox, 6PPD, polyoxypropylated amine).* *During laboratory work, students will study the effects of various inhibitors on the oxidation process of ethylbenzene and conduct comparative analysis. Students should carry out the calculation of the mass fraction of organic hydroperoxides (X, %) and do the statistical analysis by the end of the work.*	
11	p.262-299 [1]	Chemicals based on benzene, toluene and xylenes Sem; Chemicals based on benzene, toluene and xylenes	
12	p.301-321 [1]	Polymerization **Laboratory work.** Inhibition of radical and anionic reaction in example of styrene polymerization The laboratory work will utilize the following equipment and materials: *ethylbenzene, styrene, inhibitors (monooxypropylated amine, dioxypropylated amine, Novantox, 6PPD, polyoxypropylated amine), conical flasks, graduated cylinders, graduated pipettes, analytical weights, stopwatch, thermometer, thermostat, stand, installation for polymerization.* *During laboratory work, students will study the kinetics of radical and ionic polymerization, the effects of various inhibitors on the polymerization process of styrene, and explain the main aspects of radical and ionic*	

		polymerization. Students should plot the graph of h=h(t) dependency and find out the value of dh/dt which allows to calculate the speed of reaction via the given formula and do the statistical analysis by the end of the work.	
13	p.323-350 [1]	Synthetic petroleum-based polymers Sem; Synthetic petroleum-based polymers	
14	p.350-358 [1]	Synthetic Rubber **Laboratory work.** Inhibition of radical and anionic reaction in example of styrene polymerization The laboratory work will utilize the following equipment and materials: *ethylbenzene, styrene, inhibitors (monooxypropylated amine, dioxypropylated amine, Novantox, 6PPD, polyoxypropylated amine), conical flasks, graduated cylinders, graduated pipettes, analytical weights, stopwatch, thermometer, thermostat, stand , installation for polymerization.* *During laboratory work, students will study the kinetics of radical and ionic polymerization, the effects of various inhibitors on the polymerization process of styrene, and explain the main aspects of radical and ionic polymerization. Students should plot the graph of h=h(t) dependency and find out the value of dh/dt which allows to calculate the speed of reaction via the given formula and do the statistical analysis by the end of the work.*	
15	p.359-371 [1]	Synthetic Fibers Sem; Synthetic Fibers	
16			Final

Recommended Sources

TEXTBOOK (S)

1. Sami Matar, Ph.D. Lewis F. Hatch, Chemistry of Petrochemical Processes 2nd., , Publisher Gulf professional publishing, 2001, p.405

Assessment

Attendance	0%	At least 75 % class attendance is compulsory
Presentation	10%	
Quiz	10%	
Seminar	0%	

Laboratory	10%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan State Oil and Industry University for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Work load (hour)
Course duration in class	**14**	**4**	**56**
Presentation	1	26	26
Tutorials	14	2	28
Self –study	14	4	56
Midterm Examination	1	3	3
Preparation for midterm exam	1	34	34
Final Examination	1	3	3
Preparation for final exam	1	34	34
Total Workload			**240**
Total Work load/30(h)			**240/30**
ECTS Credit of the Course			**8**

Chemical engineering (CHEN) master program, “Technology of organic substances and high molecular compounds” department

Course Unit Title	**Organization of scientific-research works**
CourseUnitCode	ENG 3007
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	8
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	1
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Narmina Guliyeva
Name of Lecturer (s)	Narmina Guliyeva
Name of Assistant (s)	-
Mode of Delivery	Face to Face, laboratory, seminar

Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

Conducting research and presenting results. Primary documents, types of documents. The structure of the article. Preparation of the report. Select titles and titles. Deposit of manuscripts. Preparation of illustrative materials.

Objectives of the Course:

The development of the chemical industry is primarily characterized by the level of organization of scientific research work. Therefore, the problem of increasing the efficiency of the organization of research works is considered one of the most important issues of the national economy. The purpose of the course "Organization of scientific research":

- organizational and technical aspects of research;

- Statistical analysis and evaluation of experimental results;

- Describe the experimental results with the help of mathematical models;

- statistical methods of practice planning and equipment provision of experience;

- processing of experimental results and working with specific literature;

- compiling research results and writing the manuscript, work on the report

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	- conduct an analysis of scientific literature;	1, 3, 5
2	- statistical analysis and evaluation of experimental results;	1, 2 ,3, 4, 5
3	- describe the results of the experiment using mathematical models;	1, 2, 3, 4, 5
4	- statistical methods for planning practice and providing equipment experience;	1, 3, 4, 5
5	- processing of experimental results and work with special literature;	1, 3, 5

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm, 4. Laboratory, 5. Quiz

Course's Contribution to Program

		CL

1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate, and solve complex problems related to the chemistry, technology, and research of the properties of organic compounds and industrial products based on them.	5
4	Ability to apply modern methods to solve scientific problems and develop new scientific research in the field of synthesis and modification of the properties of organic compounds.	5
5	Ability to develop concepts and scientific-technological solutions in the field of petrochemical and basic organic synthesis.	5
6	Ability to use creativity to develop new and improved methods of utilization of waste of petrochemical and organic synthesis, as well as methods of effective use of renewable energy sources.	5
7	The ability to identify, find and provide the necessary information, as well as to plan and conduct analytical, model and experimental studies of catalytic processes involving organic compounds.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	4
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	p.26-50 [1]	The choice and statement of a research problem Sem : The choice and statement of a research problem	
2	p.51-79 [1]	Searching the literature	

		Laboratory work 1. *Feedstock (monomer) purification for synthesis and property determination (with a density of n_D^20)* *The laboratory work will utilize the following equipment and materials: styrene, 10%-basic solution, separatory funnel, beaker, graduated cylinder, litmus paper, desiccator.* *During laboratory work, students will conduct the purification of styrene to prepare it for further polymerization. Work will provide them with insight into the process and explain the various aspects of feedstock treatment before the polymerization process. They will calculate the yield of purified styrene (in grams and %), determine the density of purified styrene, and construct a table with collected data from the process.*	
3	p.80-88 [1]	Elementary scientific method Sem : Separation and justification of the stages of research work	
4	p.89-120 [1]	Analysis and Synthesis **Laboratory work 2.** *Block polymerization of styrene* *The laboratory work will utilize the following equipment and materials: styrene (purified), graduated cylinder, ampoule, soldering torch, thermal cabinet.* *During laboratory work, students will conduct the synthesis of polystyrene by bulk polymerization and study the aspects of such method of polymerization. They will calculate the yield of obtained polymer (in grams and %), check its solubility in various organic solvents, determine its molecular mass and construct a table with collected data from the process.*	
5	p.121-207 [1]	The design of experiments Sem : Organization and technical side of research	
6	p.208-359 [1]	The design of apparatus. The execution of experiments **Laboratory work 3.** *Polymerization of styrene in solution*	

		The laboratory work will utilize the following equipment and materials: distillated styrene (monomer), benzoyl peroxide, benzene, methanol, three-neck flask, reverse refrigerator, thermometer, mixer, lamp, motor, electric heater, water bath. *During laboratory work, students will conduct the synthesis of polystyrene by solution polymerization and study the aspects of such a method of polymerization. They will calculate the yield of obtained polymer (in grams and %), determine its viscosity and molecular mass, and construct a table with collected data from the process.*	
7			Midterm
8	p.424-469 [1]	Classification, sampling and measurement **Laboratory work 3.** *Polymerization of styrene in solution* *The laboratory work will utilize the following equipment and materials: distillated styrene (monomer), benzoyl peroxide, benzene, methanol, three-neck flask, reverse refrigerator, thermometer, mixer, lamp, motor, electric heater, water bath.* *During laboratory work, students will conduct the synthesis of polystyrene by solution polymerization and study the aspects of such a method of polymerization. They will calculate the yield of obtained polymer (in grams and %), determine its viscosity and molecular mass, and construct a table with collected data from the process.*	
9	p.424-469 [1]	Classification, sampling and measurement Sem : Technical support for experiments	
10	p.470-615 [1]	The analysis of experimental data **Laboratory work 4.** *Determination of solubility of the polymer* *The laboratory work will utilize the following equipment and materials: organic solvents (alcohols, ketones, etc.), graduated pipette, test tubes.* *During laboratory work, students will conduct qualitative and quantitative tests to find out the solubility of the polymer and get insight into the procedures carried out in tests. They will use a wide*	

		range of solvents and settlers and collect the data based on results.	
11	p.616-725 [1]	Errors of measurement Sem : Analysis of experimental results. Assessment of the importance of results	
12	p.726-792 [1]	Probability, randomness and logic **Laboratory work 4.** *Determination of solubility of the polymer* *The laboratory work will utilize the following equipment and materials: organic solvents (alcohols, ketones, etc.), graduated pipette, test tubes.* *During laboratory work, students will conduct qualitative and quantitative tests to find out the solubility of the polymer and get insight into the procedures carried out in tests. They will use a wide range of solvents and settlers and collect the data based on results.*	
13	p.793-864 [1]	Mathematical work Sem : Work with literature.. Preparation and compilation of experimental results. Manuscript and Report Work	
14	p.865-916 [1]	Numerical computations **Laboratory work 5.** *Determination of the degree of swelling of the polymer* *The laboratory work will utilize the following equipment and materials: tested polymers, solvents, analytical weights.* *During laboratory work, students will conduct tests to find out the degree of swelling of the high molecular compounds and study the methods and theory of the swelling process. They will use a wide range of solvents, and based on results and given equations derive the results. Gathered data will be put in the table and compared to one another.*	
15	p.917-944 [1]	Reporting the results of research Sem : Work with literature.. Preparation and compilation of experimental results. Manuscript and Report Work	
16			Final

Recommended Sources

TEXTBOOK (S)

3. An Introduction to Scientific Research Revised, Subsequent Edition

by E. Bright Wilson Jr., 1991, p. 983

Assessment

Attendance	0%	At least 75 % class attendance is compulsory
Presentation	10%	
Quiz	10%	
Seminar	0%	
Laboratory	10%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan State Oil and Industry University for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Work load (hour)
Course duration in class	**14**	**4**	**56**
Presentation	1	10	10
Tutorials	14	2	28
Self –study	14	5	70
Midterm Examination	1	3	3
Preparation for midterm exam	1	36	36

Final Examination	1	3	3
Preparation for final exam	1	34	34
Total Workload			**240**
Total Work load/30(h)			**240/30**
ECTS Credit of the Course			**8**

Chemical engineering (CHEN) master program, “Technology of organic substances and high molecular compounds” department

Course Unit Title	**Molecular and Heterogeneous Catalysis**
CourseUnitCode	ENG 3008
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	8
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	1
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Narmina Guliyeva

Name of Lecturer (s)	Narmina Guliyeva
Name of Assistant (s)	-
Mode of Delivery	Face to Face, laboratory, seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

It is currently not possible to imagine organic synthesis without catalysts. In organic chemistry, the term organocatalysis (the term “organic” and “catalyst”) refers to a form of catalysis in which the rate of a chemical reaction is increased by using an organic catalyst called an “organocatalyst,” consisting of carbon, hydrogen, sulfur and other non-metallic elements contained in organic compounds

Objectives of the Course:

The formation and development of catalysis;

- the role and importance of the catalyst in the basic organic and petrochemical synthesis;

- the main types of catalytic processes;

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	- distinguish between different types of raw materials used for the preparation of various catalysts.	1, 3, 5
2	- selection of a suitable catalyst for high-tech processes;	1, 2, 3, 4, 5
3	- development of a catalyst for each catalytic process;	1, 2, 3, 4, 5
4	- Proper use of the catalyst to increase life expectancy.	1, 3, 4, 5
5	- conclusion of the catalyst from the process	1, 3, 5

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm, 4 Laboratory, 5. Quiz

Course’s Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5

2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate, and solve complex problems related to the chemistry, technology, and research of the properties of organic compounds and industrial products based on them.	5
4	Ability to apply modern methods to solve scientific problems and develop new scientific research in the field of synthesis and modification of the properties of organic compounds.	5
5	Ability to develop concepts and scientific-technological solutions in the field of petrochemical and basic organic synthesis.	5
6	Ability to use creativity to develop new and improved methods of utilization of waste of petrochemical and organic synthesis, as well as methods of effective use of renewable energy sources.	5
7	The ability to identify, find and provide the necessary information, as well as to plan and conduct analytical, model and experimental studies of catalytic processes involving organic compounds.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	4
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

CourseContents

Week	Chapter	Topics	Exam
1	p.3-12 [1]	Heterogeneous catalysis Sam; Heterogeneous catalysis	
2	p. 15-26 [1]	Heterogeneous catalytic processes **Laboratory work 1.** Catalytic decomposition of the hydrogen peroxide The laboratory work will utilize the following equipment and materials: *hydrogen peroxide* 30%, *potassium permanganate, BAU active coal, cuprum*	

		oxide (II), zinc oxide, distilled water, gas burette, conic flasks, graduated cylinders, graduated pipettes, stopwatch, thermometer, installation for catalytic decomposition of hydrogen peroxide. *During laboratory work, students will determine the decomposition speed of the hydrogen peroxide of a given concentration in the presence of homogeneous and heterogeneous catalysts. Work will provide the students with sufficient theoretic aspects of the laboratory work and explain the procedures of the following experiments. Students should plot the graph of decomposition speed dependency on time and carry out statistical analysis by the end of the work.*	
3	p.27-34 [1]	Oligomerization and polymerization catalysis Sem; Oligomerization and polymerization catalysis	
4	p. 35-45 [1]	Polymerization: surface coordination complex catalyst **Laboratory work 1.** Catalytic decomposition of the hydrogen peroxide The laboratory work will utilize the following equipment and materials: *hydrogen peroxide* 30*%, potassium permanganate, BAU active coal, cuprum oxide (II), zinc oxide, distilled water, gas burette, conic flasks, graduated cylinders, graduated pipettes, stopwatch, thermometer, installation for catalytic decomposition of hydrogen peroxide.* *During laboratory work, students will determine the decomposition speed of the hydrogen peroxide of a given concentration in the presence of homogeneous and heterogeneous catalysts. Work will provide the students with sufficient theoretic aspects of the laboratory work and explain the procedures of the following experiments. Students should plot the graph of decomposition speed dependency on time and carry out statistical analysis by the end of the work.*	
5	p.59-70 [1]	Physical chemistry, elementary kinetics Sem; Physical chemistry, elementary kinetics	
6	p.71-110 [1]	Elementary Catalytic Reaction Kinetics	

		Laboratory work 2. Comparison of the homogeneous and heterogeneous catalyst and determination of dissolved and all of molybdenum The laboratory work will utilize the following equipment and materials: *hydrogen peroxide 30%, isopropyl alcohol, molybdenum, sodium hydroxide, muriatic acid, hydrazine sulfate, sulfuric acid, fenamic acid, sodium carbonate, ammonium metavanadate, activated coal pellets, distilled water, potassium dichromate, conic flasks, graduated cylinders, graduated pipettes, burette, analytical weights, stopwatch, electric heater, water bath, thermometer, dropper.* *During laboratory work, students will study the methodology of synthesis of complex molybdenum catalyst, investigate the possibility of dissolved molybdenum extraction from solution via sorption on activated coal, and check the effect of sorption on the initial amount of molybdenum. Work will provide the students with sufficient theoretic aspects of the laboratory work and explain the procedures of the following experiments. Students should carry out the calculation of the mass percentage of dissolved and all of the molybdenum, plot the graph of mass percentage dependency on time and do the statistical analysis by the end of the work.*	
7			Midterm
8	p.113-139 [1]	The state of the working catalyst **Laboratory work 2.** Comparison of the homogeneous and heterogeneous catalyst and determination of dissolved and all of molybdenum The laboratory work will utilize the following equipment and materials: *hydrogen peroxide 30%, isopropyl alcohol, molybdenum, sodium hydroxide, muriatic acid, hydrazine sulfate, sulfuric acid, fenamic acid, sodium carbonate, ammonium metavanadate, activated coal pellets, distilled water, potassium dichromate, conic flasks, graduated cylinders, graduated pipettes, burette, analytical weights, stopwatch, electric heater, water bath, thermometer, dropper.* *During laboratory work, students will study the methodology of synthesis of complex molybdenum catalyst, investigate the possibility of dissolved*	

		molybdenum extraction from solution via sorption on activated coal, and check the effect of sorption on the initial amount of molybdenum. Work will provide the students with sufficient theoretic aspects of the laboratory work and explain the procedures of the following experiments. Students should carry out the calculation of the mass percentage of dissolved and all of the molybdenum, plot the graph of mass percentage dependency on time and do the statistical analysis by the end of the work.	
9	p.145-165 [1]	Advanced kinetics: breakdown of mean field approximation Sem; Advanced kinetics: breakdown of mean field approximation	
10	p.167-199 [1]	Molecular heterogeneous catalysis **Laboratory work 2.** Comparison of the homogeneous and heterogeneous catalyst and determination of dissolved and all of molybdenum The laboratory work will utilize the following equipment and materials: *hydrogen peroxide 30%, isopropyl alcohol, molybdenum, sodium hydroxide, muriatic acid, hydrazine sulfate, sulfuric acid, fenamic acid, sodium carbonate, ammonium metavanadate, activated coal pellets, distilled water, potassium dichromate, conic flasks, graduated cylinders, graduated pipettes, burette, analytical weights, stopwatch, electric heater, water bath, thermometer, dropper.* *During laboratory work, students will study the methodology of synthesis of complex molybdenum catalyst, investigate the possibility of dissolved molybdenum extraction from solution via sorption on activated coal, and check the effect of sorption on the initial amount of molybdenum. Work will provide the students with sufficient theoretic aspects of the laboratory work and explain the procedures of the following experiments. Students should carry out the calculation of the mass percentage of dissolved and all of the molybdenum, plot the graph of mass percentage dependency on time and do the statistical analysis by the end of the work.*	
11	p.209-281 [1]	Chemical bonding and reactivity of transition metal surfaces	

		Sem; Chemical bonding and reactivity of transition metal surfaces	
12	p.293-337 [1]	Mechanisms of transition metal catalyzed reactions **Laboratory work 3.** Preparation of complex molybdenum catalyst via epoxidation and determination of its activity The laboratory work will utilize the following equipment and materials: *rectified technical ethanol, ethylbenzene hydroperoxide, molybdenum, sodium hydroxide, hydrochloric acid, hydrazine sulfate, sulfuric acid, fenamic acid, sodium carbonate, ammonium metavanadate, distilled water, glacial acetic acid, potassium iodide, soluble starch, sodium thiosulfate, sodium chloride, magnesium chloride, potassium hydroxide, methyl orange; bromocresol green, methyl red; n-hexane, conical flasks, graduated cylinders, graduated pipettes, burette, analytical weights, stopwatch, separatory funnel, electric heater, water bath, dropper, thermometer, installation for complex molybdenum catalyst synthesis.* *During laboratory work, students will study the methodology of synthesis of complex molybdenum catalyst via epoxidation, and check the prepared molybdenum catalyst for activity in oct-1-ene. Students should carry out the calculation of the mass fraction of dissolved and all of the molybdenum (Xm,%), nonene oxide in terms of the epoxy group (Xn,%), and peroxy compounds (Xp,%), plot the graph of mass fraction dependency of dissolved and all of the molybdenum, peroxy compounds and epoxy groups on time and do the statistical analysis by the end of the work.*	
13	p.345-420 [1]	Solid acid catalysis, theory and reaction mechanisms Sem; Solid acid catalysis, theory and reaction mechanisms	
14	p. 429-468 [1]	Zeolitic non-redox and redox catalysis, Lewis acid catalysis **Laboratory work 3.** Preparation of complex molybdenum catalyst via epoxidation and determination of its activity The laboratory work will utilize the following equipment and materials: *rectified technical ethanol,*	

		ethylbenzene hydroperoxide, molybdenum, sodium hydroxide, hydrochloric acid, hydrazine sulfate, sulfuric acid, fenamic acid, sodium carbonate, ammonium metavanadate, distilled water, glacial acetic acid, potassium iodide, soluble starch, sodium thiosulfate, sodium chloride, magnesium chloride, potassium hydroxide, methyl orange; bromocresol green, methyl red; n-hexane, conical flasks, graduated cylinders, graduated pipettes, burette, analytical weights, stopwatch, separatory funnel, electric heater, water bath, dropper, thermometer, installation for complex molybdenum catalyst synthesis. *During laboratory work, students will study the methodology of synthesis of complex molybdenum catalyst via epoxidation, and check the prepared molybdenum catalyst for activity in oct-1-ene. Students should carry out the calculation of the mass fraction of dissolved and all of the molybdenum (Xm,%), nonene oxide in terms of the epoxy group (Xn,%), and peroxy compounds (Xp,%), plot the graph of mass fraction dependency of dissolved and all of the molybdenum, peroxy compounds and epoxy groups on time and do the statistical analysis by the end of the work.*	
15	p.475-540 [1]	Reducible solid state catalysts Sem. Reducible solid state catalysts	
16			Final

RecommendedSources

TEXTBOOK(S)

1. Santen Modern Heterogeneous Catalysis: An Introduction Editor(s): Rutger A. , 2017, p. 553

Assessment

Attendance	0%	At least 75 % class attendance is compulsory
Presentation	10%	
Quiz	10%	
Seminar	0%	
Laboratory	10%	

MidtermExam	20%	Written Exam
FinalExam	50%	Written-oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan State Oil and Industry University for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Work load (hour)
Course duration in class	**14**	**4**	**56**
Presentation	1	26	26
Tutorials	14	2	28
Self –study	14	4	56
Midterm Examination	1	3	3
Preparation for midterm exam	1	32	32
Final Examination	1	3	3
Preparation for final exam	1	36	36
Total Workload			**240**
Total Work load/30(h)			**240/30**
ECTS Credit of the Course			**8**

Chemical engineering (CHEN) master program, "Technology of organic substances and high molecular compounds" department

Course Unit Title	**Modern Technologies of Industrial Organic Chemistry**
CourseUnitCode	ENG 1207
Type of Course Unit	Compulsory
Level of Course Unit	1 st year CHEN master program
National Credits	-
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	2
Course Coordinator	Narmina Guliyeva
Name of Lecturer (s)	Narmina Guliyeva
Name of Assistant (s)	-
Mode of Delivery	Face to Face
Language of Instruction	English, Seminar
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

The demand for organic synthesis products is steadily increasing. One of the main problems in this regard is the expansion of the raw material base for organic synthesis products. In this regard, the use of natural gas, gas condensate, associated gases and refined gases as raw materials is of great importance.

Objectives of the Course:

- to give knowledge about the types of raw materials used in the processes of basic organic synthesis and petrochemical synthesis;

- to familiarize with the composition and preparation of natural gas, gas condensate, associated gases and petroleum refining gases;

- to give knowledge about organic synthesis processes based on natural gas, gas condensate, associated gases and petroleum refining gases.

Learning Outcomes		
At the end of the course the student will be able to		Assessment
1	- know natural gases, their composition, extracted areas and areas of application in the chemical industry.	1, 3, 4
2	- know the composition of associated gases, their characteristics and use in the petrochemical industry.	1, 2, 3, 4
3	- distinguish between liquid and gaseous hydrocarbons of gas condensate fields, their characteristics and main areas of use.	1, 2, 3, 4
4	- must know oil and gas gases, their characteristics and composition.	1, 3, 4
5	- must be able to do chemical processing of hydrocarbon gases.	1, 3, 4
Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm, 4. Quiz		

Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate, and solve complex problems related to the chemistry, technology, and research of the properties of organic compounds and industrial products based on them.	5
4	Ability to apply modern methods to solve scientific problems and develop new scientific research in the field of synthesis and modification of the properties of organic compounds.	5
5	Ability to develop concepts and scientific-technological solutions in the field of petrochemical and basic organic synthesis.	5
6	Ability to use creativity to develop new and improved methods of utilization of waste of petrochemical and organic synthesis, as well as methods of effective use of renewable energy sources.	5
7	The ability to identify, find and provide the necessary information, as well as to plan and conduct analytical, model and experimental studies of catalytic processes involving organic compounds.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of	5

	applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	4

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

CourseContents

Week	Chapter	Topics	Exam
1	p.16-27 [1]	Various Aspects of the Energy and Raw Material Supply **Sem:** Various Aspects of the Energy and Raw Material Supply	
2	p.28-72 [1]	Basic Products of Industrial Syntheses	
3	p.73-104 [1]	Olefins **Sem:** Olefins	
4	p.105-118 [1]	Acetylene	
5	p.119-138 [1]	1,3-Diolefins **Sem:** Acetylene**,** 1,3-Diolefins	
6	p.139-156 [1]	Syntheses involving Carbon Monoxide	
7			Midterm
8	p.157-204 [1]	Oxidation Products of Ethylene **Sem:** Syntheses involving Carbon Monoxide	
9	p.205-227 [1]	Alcohols	
10	p.228-249 [1]	Vinyl-Halogen and Vinyl-Oxygen Compounds **Sem:** Vinyl-Halogen and Vinyl-Oxygen Compounds	
11	p.250-277 [1]	Components for Polyamides	
12	p.278-323 [1]	Propene Conversion Products **Sem:** Propene Conversion Products	

13	p.324-347 [1]	Aromatics - Production and Conversion	
14	p.348-396 [1]	Benzene Derivatives **Sem:** Aromatics - Production and Conversion	
15	p.397-435 [1]	Oxidation Products of Xylene and Naphthalene	
16			Final

Recommended Sources

TEXTBOOK(S)

1. Stephen Hawkins, Hans-Jürgen Arpe, Industrial Organic Chemistry, 5th Edition, Verlagsgesellschaft mbH, 1997, p. 476

Assessment

Attendance	0%	At less 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminar	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan State Oil and Industry University for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Work load (hour)
Course duration in class	**14**	**3**	**42**

Presentation	1	10	10
Tutorials	14	2	28
Self –study	14	5	70
Midterm Examination	1	3	3
Preparation for midterm exam	1	10	10
Final Examination	1	3	3
Preparation for final exam	1	14	14
Total Workload			**180**
Total Work load/30(h)			**180/30**
ECTS Credit of the Course			**6**

Chemical engineering (CHEN) master program, "Technology of organic substances and high molecular compounds" department

Course Unit Title	**Modern problems of synthesis of dielectric organic compounds**
CourseUnitCode	ENG 1105
Type of Course Unit	Compulsory
Level of Course Unit	1st year of master program
National Credits	-
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	Narmina Guliyeva
Name of Lecturer (s)	Narmina Guliyeva
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

Dielectric organic compounds are the most commonly used substances in the electrical industry today. The aim of the course "Modern problems of synthesis of dielectric organic compounds" is to:

- Acquaintance with modern methods of synthesis and production of synthetic dielectric liquids;

- acquaintance with electro-physical, physical and chemical properties of dielectric fluids and their requirements.

Objectives of the Course:

- working conditions of electro-insulating liquids;

- requirements for the quality of electrolytic liquids;

- volume resistance and methods of its determination;

- sales of electrolytic liquids based on chlorinated hydrocarbons; - acquisition of dielectric fluids and types of goods on the basis of silicon organic compounds;		
Learning outcomes		
At the end of the course the student will be able to		Assessment
1	- production of electrolytic liquids based on ethers and esters;	1, 3, 4
2	- obtaining electrolytic liquids based on phenylxylene.	1, 2, 3, 4
3	- working conditions, classification and requirements for synthetic electrolytic fluids;	1, 2, 3, 4
4	- basic electrophysical properties of electrolysis liquids and methods for their testing;	1, 3, 4
5	- determine the dielectric loss and methods for their determination;	1, 3, 4
Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm, 4. Quiz		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate, and solve complex problems related to the chemistry, technology, and research of the properties of organic compounds and industrial products based on them.	5
4	Ability to apply modern methods to solve scientific problems and develop new scientific research in the field of synthesis and modification of the properties of organic compounds.	5
5	Ability to develop concepts and scientific-technological solutions in the field of petrochemical and basic organic synthesis.	5
6	Ability to use creativity to develop new and improved methods of utilization of waste of petrochemical and organic synthesis, as well as methods of effective use of renewable energy sources.	5
7	The ability to identify, find and provide the necessary information, as well as to plan and conduct analytical, model and experimental studies of catalytic processes involving organic compounds.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of	5

	applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.		
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.		4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.		4
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)			
CourseContents			
Week	Chapter	Topics	Exam
1	p.1-28 [1]	Introductory concepts on Dielectrics	
2	p.29-82 [1]	Polarization and static dielectric constant Sem: Dielectrics. Polarization and static dielectric constant	
3	p.83-137 [1]	Dielectric loss and relaxation	
4	p. 247-311 [1]	Experimental data (frequency domain) Sem: Dielectric loss and relaxation	
5	p.312-354 [1]	Absorption and desorption currents	
6	p.355-393 [1]	Inorganic dielectrics Sem: Inorganic dielectrics	
7			Midterm
8	p.394-414 [1]	Microwave measurement methods Sem: Microwave measurement methods	
9	p.415-475 [1]	Dielectrics and allied disciplines	
10	p.476-520 [1]	Field-enhanced conduction Sem: Dielectrics and allied disciplines. Field-enhanced conduction	

11	p.521-599 [1]	Selected aspects of gaseous breakdown	
12	p.600-644 [1]	High-field conduction and breakdown in liquids Sem: High-field conduction and breakdown in liquids	
13	p.645-693 [1]	Breakdown in solid dielectrics	
14	p. 694-726 [1]	Thermally stimulated processes Sem: Breakdown in solid dielectrics. Thermally stimulated processes	
15	p.728-770 [1]	Space charge in solid dielectrics	
16			Final

RecommendedSources

TEXTBOOK(S)

1. Gorur Govinda Raju, Dielectrics in electric fields: tables, atoms and molecules, 2nd edition, 2017, p.796

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminar	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan State Oil and Industry University for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.

• Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations			
ECTS allocated based on Student Workload			
Activities	Number	Duration (hour)	Total Work load (hour)
Course duration in class	**14**	**3**	**42**
Presentation	1	16	16
Tutorials	14	1	14
Self –study	14	5	70
Midterm Examination	1	3	3
Preparation for midterm exam	1	12	12
Final Examination	1	3	3
Preparation for final exam	1	20	20
Total Workload			**180**
Total Work load/30(h)			**180/30**
ECTS Credit of the Course			**6**

Chemical engineering (CHEN) master program, "Technology of organic substances and high molecular compounds" department

Course Unit Title	**Efficient use of renewable energy resources**
CourseUnitCode	ENG 3011
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	8
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	1
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Narmina Guliyeva
Name of Lecturer (s)	Narmina Guliyeva
Name of Assistant (s)	-
Mode of Delivery	Face to Face, laboratory, seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

The development of oil refineries and petrochemicals are characterized by high losses, heat and electricity. The problem with the overestimation of the efficiency of the use of vids is that the energy is easily recovered from the simple problem.

Objectives of the Course:

- study of theoretical knowledge about renewable energy resources, their classification, sources of formation;

- assessment of the economic efficiency of their use and the possibility of using energy resources;

- the current state of the use of renewable energy sources in the oil refining and petrochemical industries;

- identification of renewable energy resources and methods of their use in certain sectors of the oil refining and petrochemical industries;

- to study the prospects of using low-potential renewable energy sources;

- Teaching theoretical knowledge about the use of commercial utility groups.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	-know about renewable energy resources, their classification, sources of formation;	1, 3, 5
2	- evaluate the effectiveness of their use and the possibility of using energy resources;	1, 2, 3, 4, 5
3	- identify renewable energy resources and methods of their use in individual sectors of the oil refining and petrochemical industries;	1, 2, 3, 4, 5
4	- study the prospects of using low-potential renewable energy sources;	1, 3, 4, 5
5	- reveal theoretical knowledge about the use of commercial utilities groups.	1, 3, 5

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm, 4 Laboratory, 5. Quiz

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate, and solve complex problems related to the chemistry, technology, and research of the properties of organic compounds and industrial products based on them.	5

4	Ability to apply modern methods to solve scientific problems and develop new scientific research in the field of synthesis and modification of the properties of organic compounds.	5
5	Ability to develop concepts and scientific-technological solutions in the field of petrochemical and basic organic synthesis.	5
6	Ability to use creativity to develop new and improved methods of utilization of waste of petrochemical and organic synthesis, as well as methods of effective use of renewable energy sources.	5
7	The ability to identify, find and provide the necessary information, as well as to plan and conduct analytical, model and experimental studies of catalytic processes involving organic compounds.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	4
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

CourseContents

Week	Chapter	Topics	Exam
1	p.1-52 [1]	Global energy system Sem; Global energy system	
2	p.142-166 [1]	Environmental impacts and costs of rnergy **Laboratory work 1.** *Low-temperature oxidative chlorination of benzene* *The laboratory work requires the following equipment and materials: mechanical stirrer, thermometer, drip funnel, three-necked flask, chromatograph, hydrochloric acid, benzene, hydrogen peroxide, adsorbent, anionites, installation suitable for this kind of reaction.* *The laboratory work will allow students to independently perform the low-temperature oxidative chlorination reaction on benzene. The kinetics of the*	

		oxidation of hydrogen chloride with hydrogen peroxide will be studied.	
3	p.220-267 [1]	Generation technologies through the year 2025 . Sem; Generation technologies through the year 2025	
4	p.547-620 [1]	Compact heat exchangers—recuperators and regenerators **Laboratory work 1.** *Low-temperature oxidative chlorination of benzene* *The laboratory work requires the following equipment and materials: mechanical stirrer, thermometer, drip funnel, three-necked flask, chromatograph, hydrochloric acid, benzene, hydrogen peroxide, adsorbent, anionites, installation suitable for this kind of reaction.* *The laboratory work will allow students to independently perform the low-temperature oxidative chlorination reaction on benzene. The kinetics of the oxidation of hydrogen chloride with hydrogen peroxide will be studied.*	
5	p.692-745 [1]	Process energy efficiency: pinch technology Sem; Process energy efficiency: pinch technology	
6	p.842-914 [1]	Availability of renewable resources **Laboratory work 2.** *Alkylation of aromatic hydrocarbons with alcohols in the presence of sulfuric acid* *The laboratory work requires the following equipment and materials: benzene, butyl alcohol, sulfuric acid, round-bottomed and three-throated flask, Liebig's refrigerator, stirrer, drip funnel, dividing funnel, device for fractional distillation, receivers.* *The laboratory work will allow students to independently perform the alkylation reaction on benzene nucleus utilizing alcohols and sulfuric acid. The work will explain the mechanism and theoretics behind the reaction and teach students how to carry out such organic syntheses efficiently.*	
7			Midterm
8	p.915-1048 [1]	Solar thermal energy conversion	

		Laboratory work 2. *Alkylation of aromatic hydrocarbons with alcohols in the presence of sulfuric acid* *The laboratory work requires the following equipment and materials: benzene, butyl alcohol, sulfuric acid, round-bottomed and three-throated flask, Liebig's refrigerator, stirrer, drip funnel, dividing funnel, device for fractional distillation, receivers.* *The laboratory work will allow students to independently perform the alkylation reaction on benzene nucleus utilizing alcohols and sulfuric acid. The work will explain the mechanism and theoretics behind the reaction and teach students how to carry out such organic syntheses efficiently.*	
9	1049-1147 [1]	Concentrating solar thermal power Sem; Concentrating solar thermal power	
10	1148-1176 [1]	Waste-to-energy combustion **Laboratory work 2**. *Alkylation of aromatic hydrocarbons with alcohols in the presence of sulfuric acid* *The laboratory work requires the following equipment and materials: benzene, butyl alcohol, sulfuric acid, round-bottomed and three-throated flask, Liebig's refrigerator, stirrer, drip funnel, dividing funnel, device for fractional distillation, receivers.* *The laboratory work will allow students to independently perform the alkylation reaction on benzene nucleus utilizing alcohols and sulfuric acid. The work will explain the mechanism and theoretics behind the reaction and teach students how to carry out such organic syntheses efficiently.*	
11	1282-1350 [1]	Biomass conversion processes for energy recovery Sem; Biomass conversion processes for energy recovery	
12	1352-1396 [1]	Geothermal power generation **Laboratory work 3.** *Dehydration of tertiary butyl alcohol* *The laboratory work requires the following equipment and materials: tertiary butyl alcohol, distilled water, catalyst, Na - 3m zeolite, dehydration unit,*	

		chromatograph, stopwatch, Marriott vessel, measuring cylinder. *The laboratory work will allow students to independently perform the dehydration reaction on tertiary alcohols in order to obtain alkenes. During procedures, students will study kinetics of dehydration reactions. They will better comprehension of such kind of reactions and study the mechanisms and theory behind process.*	
13	1398-1414 [1]	Hydrogen energy technologies Sem; Hydrogen energy technologies	
14	1415-1461 [1]	Fuel cells **Laboratory work 3.** *Dehydration of tertiary butyl alcohol* *The laboratory work requires the following equipment and materials: tertiary butyl alcohol, distilled water, catalyst, Na - 3m zeolite, dehydration unit, chromatograph, stopwatch, Marriott vessel, measuring cylinder.* *The laboratory work will allow students to independently perform the dehydration reaction on tertiary alcohols in order to obtain alkenes. During procedures, students will study kinetics of dehydration reactions. They will better comprehension of such kind of reactions and study the mechanisms and theory behind process.*	
15	1488-1566 [1]	Properties of gases, vapors, liquids and solids Sem; Properties of gases, vapors, liquids and solids	
16			Final

Recommended Sources

TEXTBOOK (S)

1. D. Yogi Goswami , Frank Kreith,Energy Efficiency And Renewable Energy Handbook, CRC Press 2007, p.1568

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	10%	

Quiz	10%	
Seminar	0%	
Laboratory	10%	
MidtermExam	20%	Written Exam
FinalExam	50%	Written -oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan State Oil and Industry University for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Work load (hour)
Course duration in class	**14**	**4**	**56**
Presentation	1	26	26
Tutorials	14	2	28
Self –study	14	4	56
Midterm Examination	1	3	3
Preparation for midterm exam	1	32	32
Final Examination	1	3	3
Preparation for final exam	1	36	36
Total Workload			**240**
Total Work load/30(h)			**240/30**
ECTS Credit of the Course			**8**

Chemical engineering (CHEN) master program, "Technology of organic substances and high molecular compounds" department

Course Unit Title	**Chemical processes on surfaces and interfaces**
CourseUnitCode	ENG 3009
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	8
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	1
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Narmina Guliyeva
Name of Lecturer (s)	Narmina Guliyeva
Name of Assistant (s)	-
Mode of Delivery	Face to Face, laboratory, seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

Surface and interfacial chemistry examine the chemical processes that occur at the phase boundary between gas/liquid, liquid/liquid, liquid/solid and gas/solid interfaces. The surface chemistry is associated with physical chemistry. Chemical properties and reactions at surfaces play a role in many areas of chemistry, but especially in catalysis, the chemical corrosion, in electrochemistry, but also for example in materials research, in surface coatings, etc.

Objectives of the Course:

- surface and interphase chemistry

- chemical properties and reactions on surfaces

- catalysis, chemical corrosion - electrochemistry		
Learning Outcomes		
At the end of the course the student will be able to		Assessment
1	- work and determine the composition on the surface of substances	1, 3, 5
2	- set properties and reactions on surfaces	1, 2, 3, 4, 5
3	- carry out catalysis	1, 2, 3, 4, 5
4	- observe and measure metal corrosion	1, 3, 4, 5
5	- carry out laboratory determinations	1, 3, 5
Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm, 4 Laboratory, 5. Quiz		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate, and solve complex problems related to the chemistry, technology, and research of the properties of organic compounds and industrial products based on them.	5
4	Ability to apply modern methods to solve scientific problems and develop new scientific research in the field of synthesis and modification of the properties of organic compounds.	5
5	Ability to develop concepts and scientific-technological solutions in the field of petrochemical and basic organic synthesis.	5
6	Ability to use creativity to develop new and improved methods of utilization of waste of petrochemical and organic synthesis, as well as methods of effective use of renewable energy sources.	5
7	The ability to identify, find and provide the necessary information, as well as to plan and conduct analytical, model and experimental studies of catalytic processes involving organic compounds.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5

9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.		4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.		4
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)			
CourseContents			
Week	Chapter	Topics	Exam
1	p.2-10 [1]	Highly filled composite materials with regulated physical and mechanical properties based on synthetic polymers and organic and inorganic fillers Sem; Highly filled composite materials with regulated physical and mechanical properties based on synthetic polymers and organic and inorganic fillers	
2	p.12-38 [1]	Prediction of photoelectrochemical properties of selected molecules by their structure **Laboratory work.** Colorimetric determination of cationic surfactant using the methyl orange indicator The laboratory work will utilize the following equipment and materials: *dividing funnel, measuring flasks, fiberglass, fiberglass tube, clean cuvette, basic solution of cetyldimethylbenzylammonium chloride, standard CDMBAC solution, methyl orange, buffer solution.* *During the laboratory work students will performs colorimetric determination of cationic surfactant using the indicator. A calibration graph is constructed in the coordinates: the content of surfactants in solution (mg or mg / l) – optical density.*	
3	p.40-72 [1]	Poly (ethylene-*CO*-vinylacetate) composites in nanoscale: research methodology and developments Sem; Poly (ethylene-*CO*-vinylacetate) composites in nanoscale: research methodology and developments	
4	p.80-97 [1]	Pore structure of poly (2 hydroxyethyl methacrylate scaffolds) Determination of surface tension of liquids **Laboratory work.** Colorimetric determination of cationic surfactant using the methyl orange indicator The laboratory work will utilize the following equipment and materials: *dividing funnel, measuring flasks, fiberglass,*	

		fiberglass tube, clean cuvette, basic solution of cetyldimethylbenzylammonium chloride, standard CDMBAC solution, methyl orange, buffer solution. *During the laboratory work students will performs colorimetric determination of cationic surfactant using the indicator. A calibration graph is constructed in the coordinates: the content of surfactants in solution (mg or mg / l) – optical density.*	
5	p.102-112 [1]	Progress on application of fire-retardant coatings based on perchlorovinyl resin Sem; Progress on application of fire-retardant coatings based on perchlorovinyl resin	
6	p.102-112 [1]	Progress on application of fire-retardant coatings based on perchlorovinyl resin **Laboratory work.** *Determination of the content of cationic surfactant* The laboratory work will utilize the following equipment and materials: *cationic surfactant, distilled water, methyl orange, chloroform, buffer solution, dividing funnel, measuring flasks, fiberglass, fiberglass tube, clean cuvette.* *During the laboratory work students will performs series of tests in order to determine the content of cationic surfactant. According to the calibration schedule, the content of surfactants is found.*	
7			Midterm
8	p.114-133 [1]	The dependencies of dissociation enrgy of binary molecules and formation enthalpies of single-atom gases on initial spatial-enrgy characterictics of free atoms **Laboratory work.** *Determination of the content of cationic surfactant* The laboratory work will utilize the following equipment and materials: *cationic surfactant, distilled water, methyl orange, chloroform, buffer solution, dividing funnel, measuring flasks, fiberglass, fiberglass tube, clean cuvette.* *During the laboratory work students will performs series of tests in order to determine the content of cationic surfactant. According to the calibration schedule, the content of surfactants is found.*	
9	p.136-233 [1]	Nanohydrodynamics and liquid-solid interfaces: a comprehensive review	

		Sem; Nanohydrodynamics and liquid-solid interfaces: a comprehensive review	
10	p.136-233 [1]	Nanohydrodynamics and liquid-solid interfaces: a comprehensive review **Laboratory work.** *Determination of nonionogenic surfactant by weight method using phosphoric-molybdenum acid* The laboratory work will utilize the following equipment and materials: *nonionogenic surfactant, hydrochloric acid, 10% barium chloride solution, 10% solution of phosphoric-molybdenum acid, distilled water, measuring flasks, glass filter.* *During the laboratory work students will performs series of tests in order to determine nonionogenic surfactant. They will perform the laboratory work using by weight method using phosphoric-molybdenum acid.*	
11	p.240-256 [1]	Correlation between the conductive properties of poly (methyl methacrylate) and its microstructure Sem; Correlation between the conductive properties of poly (methyl methacrylate) and its microstructure	
12	p.240-256 [1]	Correlation between the conductive properties of poly (methyl methacrylate) and its microstructure **Laboratory work.** *Determination of nonionogenic surfactant by weight method using phosphoric-molybdenum acid* The laboratory work will utilize the following equipment and materials: *nonionogenic surfactant, hydrochloric acid, 10% barium chloride solution, 10% solution of phosphoric-molybdenum acid, distilled water, measuring flasks, glass filter.* *During the laboratory work students will performs series of tests in order to determine nonionogenic surfactant. They will perform the laboratory work using by weight method using phosphoric-molybdenum acid.*	
13	p.260-269 [1]	Development of elctrohydrodynamics and thermo-electro-hydro dynamics principles for electrospun fiber reinforced through *in situ* nanointerface formation Sem; Development of elctrohydrodynamics and thermo-electro-hydro dynamics principles for electrospun fiber reinforced through *in situ* nanointerface formation	

14	p.260-269 [1]	Development of elctrohydrodynamics and thermo-electro-hydro dynamics principles for electrospun fiber reinforced through *in situ* nanointerface formation **Laboratory work.** *Determination of nonionogenic surfactant by weight method using phosphoric-molybdenum acid* The laboratory work will utilize the following equipment and materials: *nonionogenic surfactant, hydrochloric acid, 10% barium chloride solution, 10% solution of phosphoric-molybdenum acid, distilled water, measuring flasks, glass filter.* *During the laboratory work students will performs series of tests in order to determine nonionogenic surfactant. They will perform the laboratory work using by weight method using phosphoric-molybdenum acid.*	
15	p.272-281 [1]	Liquid jet-air interface in electrospinning processes Sem; Liquid jet-air interface in electrospinning processes	
16			Final

RecommendedSources

TEXTBOOK(S)

1. Nekane Guarrotxena, Research Methodology in Physics and Chemistry of Surfaces and Interfaces 1st Edition , 2014, p.303

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	10%	
Quiz	10%	
Seminar	0%	
Laboratory	10%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan State Oil and Industry University for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload			
Activities	Number	Duration (hour)	Total Work load (hour)
Course duration in class	**14**	**4**	**56**
Presentation	1	17	17
Tutorials	14	2	28
Self –study	14	5	70
Midterm Examination	1	3	3
Preparation for midterm exam	1	31	31
Final Examination	1	3	3
Preparation for final exam	1	32	32
Total Workload			**240**
Total Work load/30(h)			**240/30**
ECTS Credit of the Course			**8**

Chemical engineering (CHEN) master program, Department of "Petrochemical Technology and Industrial Ecology".

Course Unit Title	**Safety engineering in oil industry**
Course Unit Code	**ENG 3017**
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Ramil Sadiqov
Name of Lecturer (s)	Ramil Sadiqov
Name of Assistant (s)	-
Mode of Delivery	Face to Face, seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

This program provides advanced education and training for graduate engineers in the area of safety engineering, reliability engineering, and loss prevention. There is a continuing demand for individuals with specialist knowledge in these areas, partly a result of the legal requirements to assess and control industrial risks to people and the environment and partly because of the need to create high integrity engineering systems in many industries. Safety engineering is not a subject which is adequately covered in most undergraduate degrees, so this MSc program brings together those topics relating to the safety and reliability of engineering products and systems, including the legislative framework, in a unified approach.

Objectives of the Course:

- The course deals with:
- Objectives for work with Health, Safety and Environment (HSE).

- Regulations and guidelines concerning HSE-work
- Systematic HSE work
- Reporting of HSE problems and discrepancies
- Risk Assessment
- HSE responsibilities, roles and resources at NTNU and NV-faculty
- Emergency preparedness: what are you going to do and who to notify when something happens?
- Fire protection-theory and practical exercises using fire extinguishing equipment.
- First aid-theory and practical exercises in heart-lung resuscitation and the use of heart starter.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Planning is the key to ensuring your health and safety arrangements really work. It helps you think through the actions you have set out in your policy and work out how they will happen in practice. what you want to achieve, how you will ensure that your employees and others are kept healthy and safe at work; how you will decide what might cause harm to people and whether you are doing enough or need to do more to prevent that harm;	1,3, 4
2	You need to assess your first-aid requirements to help you decide what equipment and facilities you need, and how many first-aid personnel you should provide. The minimum first-aid provision in any workplace is: a suitably stocked first-aid box; an appointed person to take charge of first-aid arrangements. You also need to put up notices telling your employees where they can find: the first-aiders or appointed persons; the first-aid box.	1,2,3, 4
3	The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) require employers, or in certain circumstances others who control or manage the premises, to report to the relevant enforcing authority and keep records of: work-related deaths; work-related accidents which cause certain specified serious injuries to workers, or which result in a worker being incapacitated for more than seven consecutive days cases of those industrial diseases listed in RIDDOR; certain 'dangerous occurrences' (near-miss accidents);	2,3, 4
4	A safe place of work:	3,4

	make sure your buildings are in good repair; maintain the workplace and any equipment so that it is safe and works efficiently; put right any dangerous defects immediately, or take steps to protect anyone at risk; take precautions to prevent people or materials falling from open edges, fencing or guard rails; fence or cover floor openings, vehicle examination pits, when not in use; have enough space for safe movement and access; provide safety glass, if necessary;	
5	Understand and implement professional and ethical standards.	1,3,4
Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm 4. Quiz		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	3
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	2
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	3
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	3
5	Ability to develop design and scientific-technological solutions in the field of design, modelling and optimization of refining and petrochemical processes, as well as apply the acquired knowledge to improve the management system of the oil refining industry.	4
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	3
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modelling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	1
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research	3

	methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	5
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	4
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	[I] Chap 1 p-8	**How to manage health and safety?** Planning for health and safety. Writing a health and safety policy. Controlling the risks. Accidents and investigations. Multi-occupancy workplaces. Deciding who will help you with your duties. Consulting your employees. Providing training and information	
2	[I] Chap 2 p-25	**How to manage health and safety?** Providing supervision. First aid. Emergency procedures. Reporting accidents, incidents and diseases. The health and safety law poster. Safety signs. Insurance. Inspectors and the law **Seminar 1:** How to manage health and safety?	
3	[I] Chap 2 p-27	**Your organisation** Ergonomics and human factors. Shift work and fatigue. Health surveillance. Work-related stress. Drugs and alcohol. Violence at work	
4	[I] Chap 3 p-30	**Workers** Your responsibilities. New and expectant mothers. Agency/temporary workers. New to the job and young workers. Migrant workers. Lone workers. Homeworkers. Transient workers. People with disabilities. Contractors **Seminar 2:** Workers, Your organisation	
5	[I] Chap 4 p-37	**Workplace** What does the workplace cover? A safe place of work. Designing workstations. Display screen equipment	
6	[I]	**Electrical safety**	

	Chap 5 p-41	Maintenance. When is someone competent to do electrical work? Key points to remember. Overhead electric lines. Underground cables **Seminar 3:** Workplace, Electrical safety	
7	[I] Chap 6 p-45	**Fire and gas safety** General fire safety hazards. Dangerous substances that cause fire and explosion	
8		Exam	Midterm
9	[I] Chap 8 p-49	**Harmful substances** How to carry out a COSHH risk assessment. Maintain controls. Simple checks to control dust and mist. Ventilation. Simple checks to prevent skin damage. Workplace exposure **Seminar 4:** Fire and gas safety, Harmful substances	
10	[I] Chap 9 p-64	**Machinery, plant and equipment** Plant and equipment maintenance. Safe lifting by machine.Vehicle repair	
11	[I] Chap 12 p-80	**Personal protective equipment (PPE)** Selection and use. Maintenance. Types of PPE you can use. Emergency equipment **Seminar 5:** Machinery, plant and equipment, Personal protective equipment (PPE)	
12	[I] Chap 13 p-85	**Pressure equipment** Assess the risks 86 Basic precautions. Written scheme of examination	
13	[I] Chap 14 p-88	**Radiations and vibrations** The hazards. Dos and don’ts of radiation safety **Seminar 6:** Radiations and vibrations	
14	[II] Chap 2 p-5	**Offshore oil and gas accidents**	
15	[II] Chap 2	**International Organization for Standardization (ISO) standards** **Seminar 7:** International Organization for Standardization (ISO) standards	

	p--10		
16			Final

Recommended Sources

TEXTBOOK

1. The health and safety toolbox. Health and Safety Executive. 2014.p.103.

2. “Occupational safety and health and skills in the oil and gas industry operating in polar and subarctic climate zones of the northern hemisphere” International Labour Organization. Geneva 2015. p.51.

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan Ministry of Education for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	**Number**	**Duration (hour)**	**Total Workload(hour)**
Course duration in class	**14**	**3**	**42**
Presentation	1	8	8
Self-study	14	5	70
Tutorials	1	1	14

Midterm Examination	1	3	3
Preparation for midterm exam	1	12	12
Final Examination	1	3	3
Preparation for final exam	1	28	28
Total Workload			**180**
Total Workload/30(h)			**180/30**
ECTS Credit of the Course			**6**

Chemical engineering (CHEN) master program, Department of "Petrochemical Technology and Industrial Ecology".

Course Unit Title	**Alternativ fuel production technology**
Course Unit Code	ENG 2103
Type of Course Unit	Compulsory
Level of Course Unit	2nd year master program
National Credits	-

Number of ECTS Credits Allocated	6
Theoretical (hour/week)	2
Practice (hour/week)	-
Laboratory (hour/week)	1
Year of Study	2
Semester when the course unit is delivered	3
Course Coordinator	AynuraAliyeva
Name of Lecturer (s)	Aynura Aliyeva
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

Renewable energy sources such as biodiesel, bioethanol, biomethane, biomass from wastes or hydrogen are subjects of great interest in the current energy scene. These fuels contribute to the reduction of prices and dependence on fossil fuels. In addition, energy sources such as these could partially replace the use of what is considered as the major factor responsible for global warming and the main source of local environmental pollution. The course aim is to present comprehensive information regarding the science and technology of alternative fuels and their processing technologies. Special emphasis has been placed on environmental and socioeconomic issues associated with the use of alternative energy sources, such as sustainability, applicable technologies, mode of utilization, and impacts on society.

Objectives of the Course:

This course deals with the introduction to alternative fuels, need for alternative fuels, science and technology of coal gasification to produce synthesis gas, of coal for production of clean liquid fuels, discusses the liquid fuels obtained from natural gas, presents the science and technology of resides, describes the occurrence, production, and properties of oil sand bitumen and the methods used to convert the bitumen to synthetic crude oil, explores the science and technology of oil shale utilization. Course focuses on the synthesis of methanol from synthesis gas, chemical reaction mechanisms, catalysis, and process technologies of methanol synthesis are also described. Moreover, this coursepresents the production of fuel ethanol from corn, discusses the detailed process steps and technological issues that are involved in the conversion of lignocellulosic materials into fuel ethanol, deals with a variety of process options for energy generation from biomass. Biomass characterization, environmental benefits, and product fuel properties, hydrogen production and storage are also discussed are also discussed.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	understand the various alternative fuels available, its properties, performance characteristics, combustion characteristics, emission characteristics	1,2.5.
2	describe various alternative fuels that can be utilized for energy and fuel generation	1,2,3
3	explain the composition of various processes necessary for alternative fuels processing	1,2
4	analyze how to utilize biofuels in current fuel infrastructure	1,2,3,4
5	understand the main principles of processing technologies of alternative fuels	1,2,5
Assessment Methods: 1. Final Exam, 2. Midterm 3. Presentation, 4. Laboratory 5. Quiz		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	4
2	Ability to analyze and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	3
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	5
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	4
5	Ability to develop design and scientific-technological solutions in the field of design, modeling and optimization of refining and petrochemical processes, as well as apply the acquired knowledge to improve the management system of the oil refining industry.	4
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	3
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modeling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	3

9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	5

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

Course Content

Week	Chapter	Topics	Exam
1	Book I. Chap.[1] p.1	**Introduction to the course** Petroleum, natural gas, coal, nuclear energy, renewable energy **Laboratory work 1. Laboratory safety**	
2	Book I. Chap.[3] p.85	**Clean Liquid fuels from coal** Coal pyrolysis for liquid fuel. Pyrolysis and hydropyrolysis processes	
3	Book I. Chap.[3] p.85	**Clean Liquid fuels from coal** Direct liquefaction of coal. Thermal liquefaction and catalytic hydrogenation. SRC-II process. H-coal process. **Laboratory 2. Coking of coal** In the laboratory work following equipments and materials are used: flask, condenser, quartz reactor, electric heater, thermometer, thermocouple, latr, potentiometer, coal. The main objective of the laboratory work is to study coking of the coal. The yield of resulting products during the process is determined and the material balance of the process is calculated.	
4	Book I. Chap.[2] p.19	**Gasification of coal** Indirect liquefaction of coal. Goal gasification reactions. Syngas generation via coal gasification. Gasification processes. Future of coal gasification.	
5	Book I Chap.[5] p.157	**Liquid fuels from natural gas** Introduction. Nonassociated gas. Associated gas. Composition. Conversion of natural gas to liquids. Syngas production. Fischer-Tropsprocess. General process description. Chemistry, products, catalysts. **Laboratory 3. Technical analyses of coal**	

		In the laboratory work following equipments and materials are used: muffle furnace, laboratory crucible, exsiccate, flask, condenser, quartz reactor, electric heater, thermometer, thermocouple, latr, potentiometer, coal. The main objective of the laboratory work is to define the amount of ash. The amount of resulting residue is measured and the amount of obtained ash is determined.	
6	Book I Chap.[6] p.179	**Resids** Introduction. Resid production. Properties. Composition. Resid convertion.	
7	Book I Chap.[7] p.209	**Liquid fuels from oil sand** Introduction. Bitumen properties, elemental composition, chemical composition, physical properties. Bitumen recovery. **Laboratory work 4. Coking process of oil shale.** In the laboratory work following equipments and materials are used: flask, condenser, quartz reactor, electric heater, thermometer, thermocouple, latr, potentiometer, oil shale. The main objective of the laboratory work is to study the coking process of oil shale. The process is carried out at temperatures up to 550C in the reactor. The products are cooled, pulled out and output is determined. Balance is calculated according to received results.	
8			Midterm
9	Book I Chap.[10] p.331	**Methanol synthesis from syngas** Introduction. Chemistry of methanol synthesis. Conversion of syngas to methanol. Properties of methanol. Reaction with methanol. Future of methanol.	
10	Book I Chap.[11] p.359	**Ethanol from corn.** Introduction. Corn ethanol as oxygenated fuel. Chemistry of ethanol fermentation. Conversion of sugars to ethanol. Nonfuel uses of ethanol. **Laboratory work 5. Analyses of oil shale coking products** In the laboratory work following equipments and materials are used: flask, condenser, quartz reactor, electric heater, thermometer, thermocouple, latr, aerometer, viscometer, pycnometer, Abel-Pensky's flash point apparatus, oil shale coking products.	

		The main objective of the laboratory work is to determine the properties of the liquid products, such as viscosity, density, flash point.	
11	Book I Chap.[12] p.395	**Ethanol from lignocellulosics** Introduction. Lignocellulose. Lignocellulose conversion. Ethanol. Sources for fermentable sugars.	
12	Book I Chap.[13] p.441	**Biodiesel** Definition of biodiesel. Historical background. Transesterification process for biodiesel manufacture. Properties of biodiesel. **Lab 6. Analyses of oil shale coking products** In the laboratory work following equipments and materials are used: viscosimeter, aerometer, pycnometer, Abel-Pensky's flash point apparatus, oil shale coking products. The main objective of the laboratory work is to determine the properties of the liquid products, such as viscosity, density, flash point.	
13	Book I Chap.[15] p.471	**Thermochemical conversion of biomass.** Biomass and its utilization. Thermal and thermochemical conversion of biomass. Chemistry of biomass gasification.	
14	Book I Chapter [8] p.235	**Shale oil from oil shale.** Oil shale as asynthetic fuel (synfuel) source. Properties of oil shale. Oil shale extraction. **Laboratory work 7 Briquettes obtaining process** In the laboratory work following equipments and materials are used: electric motor, flask, electric heater, thermometer, mixer, manual hydraulic press. The main objective of the laboratory work is to study briquettes production process. The resulting mixture is added to the manual press where briquettes are pressed. After pressing the briquette is removed from the mold.	
15	Book I Chap.[17] p.549	**Geothermal energy.** Introduction. Geothermal energy as renewable energy. Advantage of geothermal energy.	
16			Final
Recommended Sources			

TEXTBOOK

2. Sunggyu Lee, James G.Speight, SudarshanK.Loyalka " *Handbook of alternative fuel technologies"*, CRC Press, Taylor and Francis Group 6000 Broken Sound Parkway NW, Suite 300, Boca Raton, 2015,671 p.

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	10%	
Quiz	10%	
Laboratory	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan State Oil and Industrial University for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations.

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class	**14**	**3**	**42**
Presentation	1	12	12
Self study	14	5	70
Tutorials	14	1	10
Midterm Examination	1	3	3
Preparation for midterm exam	1	12	12
Final Examination	1	3	3

Preparation for final exam	1	28	28
Total Workload			**180**
Total Workload/30(h)			**180/30**
ECTS Credit of the Course			**6**

Chemical Engineering master program. "Chemistry and inorganic substances technology" department

"Industrial technology of inorganic substances" specialization

Course Unit Title	**Research techniques**
Course Unit Code	CHEM 2101
Type of Course Unit	Compulsory
Level of Course Unit	2^{nd} year of the master program
National Credits	-
Number of ECTS Credits Allocated	4
Theoretical (hour/week)	2
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	2
Semester when the course unit is delivered	3
Course Coordinator	Baghiyev Vagif
Name of Lecturer (s)	Baghiyev Vagif
Name of Assistant (s)	-
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

Physico-chemical and physical methods of the investigation of chemical materials and processes provide information on the physical properties of molecules and compounds, the reactivities and reaction mechanisms. Magister program is developed to train skilled professionals by providing fundamental knowledge on modern physicochemical and physical methods of the investigation and hands-on experience with modern analytical equipment used in the various fields of chemistry, petrochemistry, environment and geology.

Objectives of the Course:

The course consists of the fundamentals of physicochemical research methods, basic methodological and methodological techniques necessary for the successful application of these methods. Particular attention in the course is given to modern research methods: chromatography and spectroscopic methods of analysis, types of modern laboratory equipment and methods of working with it.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Understand the major methods of research.	1,2,3,4
2	Describe UV-, IR-spectroscopy, x-ray diffraction methods.	1,2,3,4
3	Describe the fundamentals and applications of spectral methods.	1,2,3,4
4	Describe the fundamentals and applications of electrochemical methods.	1,2,3,4
5	Exemplify industrial applications of the gas chromatography.	1,2
6	Explain research methodology of mechanisms of catalytic reaction by physico-chemical and physical methods of research.	1,2
7	Interpret and synthesize primary research proposal. Prepare research abstract and presentation	1,2

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm exam, 4. Quiz

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate and research complex problems regarding with chemistry, technology and research of properties of ceramic, glass and binding composite materials, refractories, inorganic compounds and mineral fertilizers.	4
4	Ability to apply innovative methods based on key principles of nanochemistry and membrane technology to problem-solving of scientific and technological character.	5
5	Ability to develop concepts and scientific-technological solutions in the field of electrochemical technology, processing of mineral raw materials and water treatment.	4

6	Ability to utilize creativity in elaborating new and inventive products, processes and methods of utilization of solid waste in metallurgy and other areas of inorganic substances manufacturing.	3
7	Ability to identify, find, and provide necessary information, as well as, plan and conduct analytical, model and experimental investigations of inorganic substances and composite materials particularly in the field of catalysts and adsorbents synthesis with further studying their activity.	4
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	5
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	3
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	[3] Part 1,2	The Introduction to research. Research strategies and designs	
2	[3] Part 1,2	Communication and presentation skills	
3	[1] Chapter 1	Research methods of analysis: definition, classification, solved problems.	
4	[1] Chapter 9	Classification of spectroscopic methods. The origin of absorption spectra. Types of molecular spectra.	
5	[1] Chapter 10,12	Optical methods of qualitative and quantitative analysis. X-ray phase analysis of solids.	
6	[1] Chapter 13,14	Methods of atomic spectroscopy. Atomic emission analysis. Methods of molecular spectroscopy.	

7	[1] Chapter 19	Electrochemical methods of analysis. Basic concepts. Classification of electrochemical methods of analysis.	
8			Midterm
9	[1] Chapter 19	Potentiometric methods of analysis. Requirements for indicator electrodes and reference electrodes. Potentiometric titration.	
10	[1] Chapter 20	Voltammetry. Qualitative and quantitative polarographic analysis. Amperometry. Conductometry and conductometric titration.	
11	[1] Chapter 1	Chromatography. Classification of chromatographic methods.	
12	[1] Chapter 2	Gas chromatography, mobile and stationary phases, samplers. Temperature programs. Detectors, their classification.	
13	[1] Chapter 2	Chromatographic methods of quantitative and qualitative analysis. Analytical use.	
14	[1] Chapter 3	High power liquid chromatography. Areas of application of chromatographic methods of separation and determination.	
15	[1] Part 2	Results and discussion of scientific research. Abstract and paper preparation of Scientific Research	
16			Final

Recommended Sources:

1. Francis Rouessac, Annic Rouessac, Chemical Analysis: Modern Instrumentation Methods and Techniques, Second edition, 2007, 599 pages.
2. Helmut Giinzler and Alex Williams, Handbook of Analytical Techniques, 1st Edition, 2001, 1196 pages.
3. John. W.Creswell, Research Design: qualitative, quantitative, and mixed methods approaches (2nd Edition), London, UK, 2003.

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam

Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload (hour)
Course duration in class	**14**	**2**	**28**
Presentation	1	5	5
Self-study	14	4	56
Tutorials	14	0,5	7
Midterm Examination	1	6	6
Preparation for midterm exam	1	5	5
Final Examination	1	3	3
Preparation for final exam	1	10	10
Total Workload			**120**
Total Workload/30(h)			**120/30**
ECTS Credit of the Course			**4**

Chemical Engineering master program. “Chemistry and inorganic substances technology” department

“Oil refining technology” specialization

Course Unit Title	**Research techniques**

Course Unit Code	CHEM 2101
Type of Course Unit	Compulsory
Level of Course Unit	2nd year of the master program
National Credits	-
Number of ECTS Credits Allocated	4
Theoretical (hour/week)	2
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	2
Semester when the course unit is delivered	3
Course Coordinator	Baghiyev Vagif
Name of Lecturer (s)	Baghiyev Vagif
Name of Assistant (s)	-
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

Physico-chemical and physical methods of the investigation of chemical materials and processes provide information on the physical properties of molecules and compounds, the reactivities and reaction mechanisms. Magister program is developed to train skilled professionals by providing fundamental knowledge on modern physicochemical and physical methods of the investigation and hands-on experience with modern analytical equipment used in the various fields of chemistry, petrochemistry, environment and geology.

Objectives of the Course:

The course consists of the fundamentals of physicochemical research methods, basic methodological and methodological techniques necessary for the successful application of these methods. Particular attention in the course is given to modern research methods: chromatography and spectroscopic methods of analysis, types of modern laboratory equipment and methods of working with it.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Understand the major methods of research.	1,2,3,4

2	Describe UV-, IR-spectroscopy, x-ray diffraction methods.	1,2,3,4
3	Describe the fundamentals and applications of spectral methods.	1,2,3,4
4	Describe the fundamentals and applications of electrochemical methods.	1,2,3,4
5	Exemplify industrial applications of the gas chromatography.	1,2
6	Explain research methodology of mechanisms of catalytic reaction by physico-chemical and physical methods of research.	1,2
7	Interpret and synthesize primary research proposal. Prepare research abstract and presentation	1,2
Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm exam, 4. Quiz		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	4
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	5
5	Ability to develop design and scientific-technological solutions in the field of design, modeling and optimization of refining and petrochemical processes, as well as apply the acquired knowledge to improve the management system of the oil refining industry.	4
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	3
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modeling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	4
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5

9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	5
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	3
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	[3] Part 1,2	The Introduction to research. Research strategies and designs	
2	[3] Part 1,2	Communication and presentation skills	
3	[1] Chapter 1	Research methods of analysis: definition, classification, solved problems.	
4	[1] Chapter 9	Classification of spectroscopic methods. The origin of absorption spectra. Types of molecular spectra.	
5	[1] Chapter 10,12	Optical methods of qualitative and quantitative analysis. X-ray phase analysis of solids.	
6	[1] Chapter 13,14	Methods of atomic spectroscopy. Atomic emission analysis. Methods of molecular spectroscopy.	
7	[1] Chapter 19	Electrochemical methods of analysis. Basic concepts. Classification of electrochemical methods of analysis.	
8			Midterm
9	[1] Chapter 19	Potentiometric methods of analysis. Requirements for indicator electrodes and reference electrodes. Potentiometric titration.	
10	[1] Chapter 20	Voltammetry. Qualitative and quantitative polarographic analysis. Amperometry. Conductometry and conductometric titration.	
11	[1]	Chromatography. Classification of chromatographic methods.	

	Chapter 1		
12	[1] Chapter 2	Gas chromatography, mobile and stationary phases, samplers. Temperature programs. Detectors, their classification.	
13	[1] Chapter 2	Chromatographic methods of quantitative and qualitative analysis. Analytical use.	
14	[1] Chapter 3	High power liquid chromatography. Areas of application of chromatographic methods of separation and determination.	
15	[1] Part 2	Results and discussion of scientific research. Abstract and paper preparation of Scientific Research	
16			Final

Recommended Sources:

4. Francis Rouessac, Annic Rouessac, Chemical Analysis: Modern Instrumentation Methods and Techniques, Second edition, 2007, 599 pages.
5. Helmut Giinzler and Alex Williams, Handbook of Analytical Techniques, 1st Edition, 2001, 1196 pages.
6. John. W.Creswell, Research Design: qualitative, quantitative, and mixed methods approaches (2nd Edition), London, UK, 2003.

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.

• Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload			
Activities	Number	Duration (hour)	Total Workload (hour)
Course duration in class	**14**	**2**	**28**
Presentation	1	5	5
Self-study	14	4	56
Tutorials	14	0,5	7
Midterm Examination	1	6	6
Preparation for midterm exam	1	5	5
Final Examination	1	3	3
Preparation for final exam	1	10	10
Total Workload			**120**
Total Workload/30(h)			**120/30**
ECTS Credit of the Course			**4**

Chemical Engineering master program. “Chemistry and inorganic substances technology” department

“Technology of petrochemical synthesis” specialization

Course Unit Title	**Research techniques**
Course Unit Code	CHEM 2101
Type of Course Unit	Compulsory
Level of Course Unit	2nd year of the master program
National Credits	-
Number of ECTS Credits Allocated	4
Theoretical (hour/week)	2
Practice (hour/week)	-
Laboratory (hour/week)	-

Year of Study	2
Semester when the course unit is delivered	3
Course Coordinator	Baghiyev Vagif
Name of Lecturer (s)	Baghiyev Vagif
Name of Assistant (s)	-
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

Physico-chemical and physical methods of the investigation of chemical materials and processes provide information on the physical properties of molecules and compounds, the reactivities and reaction mechanisms. Magister program is developed to train skilled professionals by providing fundamental knowledge on modern physicochemical and physical methods of the investigation and hands-on experience with modern analytical equipment used in the various fields of chemistry, petrochemistry, environment and geology.

Objectives of the Course:

The course consists of the fundamentals of physicochemical research methods, basic methodological and methodological techniques necessary for the successful application of these methods. Particular attention in the course is given to modern research methods: chromatography and spectroscopic methods of analysis, types of modern laboratory equipment and methods of working with it.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Understand the major methods of research.	1,2,3,4
2	Describe UV-, IR-spectroscopy, x-ray diffraction methods.	1,2,3,4
3	Describe the fundamentals and applications of spectral methods.	1,2,3,4
4	Describe the fundamentals and applications of electrochemical methods.	1,2,3,4
5	Exemplify industrial applications of the gas chromatography.	1,2
6	Explain research methodology of mechanisms of catalytic reaction by physico-chemical and physical methods of research.	1,2
7	Interpret and synthesize primary research proposal. Prepare research abstract and presentation	1,2

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm exam, 4. Quiz

Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate, and solve complex problems related to the chemistry, technology, and research of the properties of organic compounds and industrial products based on them.	4
4	Ability to apply modern methods to solve scientific problems and develop new scientific research in the field of synthesis and modification of the properties of organic compounds.	5
5	Ability to develop concepts and scientific-technological solutions in the field of petrochemical and basic organic synthesis.	4
6	Ability to use creativity to develop new and improved methods of utilization of waste of petrochemical and organic synthesis, as well as methods of effective use of renewable energy sources.	3
7	The ability to identify, find and provide the necessary information, as well as to plan and conduct analytical, model and experimental studies of catalytic processes involving organic compounds.	4
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	5
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	3
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents			
Week	Chapter	Topics	Exam
1	[3] Part 1,2	The Introduction to research. Research strategies and designs	
2	[3]	Communication and presentation skills	

	Part 1,2		
3	[1] Chapter 1	Research methods of analysis: definition, classification, solved problems.	
4	[1] Chapter 9	Classification of spectroscopic methods. The origin of absorption spectra. Types of molecular spectra.	
5	[1] Chapter 10,12	Optical methods of qualitative and quantitative analysis. X-ray phase analysis of solids.	
6	[1] Chapter 13,14	Methods of atomic spectroscopy. Atomic emission analysis. Methods of molecular spectroscopy.	
7	[1] Chapter 19	Electrochemical methods of analysis. Basic concepts. Classification of electrochemical methods of analysis.	
8			Midterm
9	[1] Chapter 19	Potentiometric methods of analysis. Requirements for indicator electrodes and reference electrodes. Potentiometric titration.	
10	[1] Chapter 20	Voltammetry. Qualitative and quantitative polarographic analysis. Amperometry. Conductometry and conductometric titration.	
11	[1] Chapter 1	Chromatography. Classification of chromatographic methods.	
12	[1] Chapter 2	Gas chromatography, mobile and stationary phases, samplers. Temperature programs. Detectors, their classification.	
13	[1] Chapter 2	Chromatographic methods of quantitative and qualitative analysis. Analytical use.	
14	[1] Chapter 3	High power liquid chromatography. Areas of application of chromatographic methods of separation and determination.	
15	[1] Part 2	Results and discussion of scientific research. Abstract and paper preparation of Scientific Research	
16			Final
Recommended Sources:			

7. Francis Rouessac, Annic Rouessac, Chemical Analysis: Modern Instrumentation Methods and Techniques, Second edition, 2007, 599 pages.
8. Helmut Giinzler and Alex Williams, Handbook of Analytical Techniques, 1st Edition, 2001, 1196 pages.
9. John. W.Creswell, Research Design: qualitative, quantitative, and mixed methods approaches (2nd Edition), London, UK, 2003.

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload (hour)
Course duration in class	**14**	**2**	**28**
Presentation	1	5	5
Self-study	14	4	56
Tutorials	14	0,5	7
Midterm Examination	1	6	6
Preparation for midterm exam	1	5	5
Final Examination	1	3	3

Preparation for final exam	1	10	10
Total Workload			**120**
Total Workload/30(h)			**120/30**
ECTS Credit of the Course			**4**

Chemical engineering (CHEN) program, Department of "Petrochemical Technology and Industrial Ecology".

Course Unit Title	Modelling, Simulation and Optimization of technical processes.
Course Unit Code	**ENG 1209**
Type of Course Unit	Compulsory
Level of Course Unit	1ST year CHEN program
National Credits	-
Number of ECTS Credits Allocated	4
Theoretical (hour/week)	2
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	2
Course Coordinator	Aytan Mammadova
Name of Lecturer (s)	Aytan Mammadova
Name of Assistant (s)	-
Mode of Delivery	Face to Face, seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

The Process Modeling, Simulation and Optimization of chemical engineering processes is a subject of major importance for the knowledge of transport processes; improved design process and its kinetics. Basically this subject comprises of three parts; modeling, simulation and optimization. Modeling and simulation emphasize on the concept of modeling of chemical engineering processes, parameter estimations, decomposition of networks, application of numerical methods, data regression, convergence promotion, specific-purpose simulation, dynamic simulation, etc. Optimization includes the concept; i.e., how one develops mathematical statements for the objective function (usually economic model) to be minimized or maximized and the equality and inequality constraints (the process model) and selection of optimization technique which is best suited to the problem characteristics.

Objectives of the Course:

-Simulate the chemical processes, different parts of the processes and unit operations.

- Have an understanding of computational techniques to solve the process models.

- Use economics to derive an objective function.

- Use principles of engineering to develop equality and inequality constraints.

- Get familiar with the preferred software packages and optimization techniques to solve linear programming and nonlinear programming problems.

- Think about and use optimization as a tool in process design and operation.

- Get proficient in the applications of optimization for optimizing important industrial processes.

- To provide a systematic introduction to the concepts, principles, methods, and related software tools for mathematical modelling and simulation of chemical process systems;

-To improve and expand chemistry and chemical engineering knowledge;

- To provide experience with planning and implementing experiments. - To review and practice chemical engineering principles.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Basic understanding of the software and the tools for the modeling purpose • Solving one/two demo problems pre-defined in software for the understanding and getting use to the software. • Modeling of ideal and non- ideal flow reactors like: CSTR, PFR, BATCH, etc. • Modeling of unit operations like: Distillation, Evaporation, Extraction, etc.	1,2,3,4
2	Basic understanding of the software and the tools for the simulation purpose. • Solving one/two demo problems pre-defined in software for the understanding and getting use to the software. • Simulation of ideal and non- ideal flow reactors like: CSTR, PFR, BATCH, etc. • Simulation of unit operations	1,2,3,4

3	Basic understanding of the software and the tools for the optimization purpose. Solving one/two demo problems pre-defined in software for the understanding and getting use to the software. Optimization of ideal and non- ideal flow reactors like: CSTR, PFR, BATCH, etc. Optimization of unit operations	2,3,4
4	Get proficient in the applications of optimization for optimizing important industrial processes.	3,4
Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm, 4. Quiz		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	4
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions. .	3
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	4
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	5
5	Ability to develop design and scientific-technological solutions in the field of design, modeling and optimization of refining and petrochemical processes, as well as apply the acquired knowledge to improve the management system of the oil refining industry.	4
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	4
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modeling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	1
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research	3

	methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	3
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	4
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	[I,III] Chapter 3,4	Introduction to Subject	
2	[I,II,III] Chapter 4	Modelling aspects	
3	[II] Chapter 5	Distributed-Parameter Models	
4	[III] Chapter 6	Mathematical Models of Chemical Engineering Systems Reactor basics: Fundamentals of Kinetics and Reaction	
5	[II] Chapter 5	Examples of Mathematical Models of Chemical Engineering Systems: Types and Fundamental Properties of Reactors	
6	[II] Chapter3	Batch Reactor Tubular Plug Flow Reactor	
7	[I] Chapter 8	Heat Transfer in Reactors Reactor Scale Up	

8			Midterm
9	[I] Chapter 8	Introduction to process simulation Basic	
10	[II] Chapter 4.	Physical property estimation for process simulation	
11	[III] Chapter 7	Basic Concepts of Optimization	
12	[I] Chapter5	Linear Programming (LP) and Applications:	
13	[II] Chapter 6	Non Linear Programming (NLP) and Applications: Penalty and Lagrange's method, etc	
14	[I] Chapter 5	Application of Optimizations: Examples of optimization in chemical processes like: optimizing recovery of waste heat, optimal shell and tube heat exchanger design	
15	[III] Chapter 7	Examples of optimization in chemical processes like: optimal design and operation of binary distillation column, chemical reactor design and operation	
16			Final

Recommended Sources

TEXTBOOK

1. B Wayne Bequette, Process Dynamics: Modeling, Analysis and Simulation, Prentice Hall International Inc. New Jersey 07458, 640 pages, 17-41,51-70, 105-127, 145-167,282-295,331-354
2. William L. Luyben, Process Modeling, Simulation and Control for Chemical Engineers, McGraw Hill International Editions,New Jersey, 1999, 741 pages, 15-38, 40-77, 116-142, 167-208, 400-420

3. William L. Luyben, Chemical Reactor Design and Control John Wiley & Sons, Inc., Hoboken, New Jersey, 2007,430 pages, 31-52,107-147, 251-281,

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan Ministry of Education for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class	**14**	**2**	**28**
Presentation	1	8	8
Self study	14	3	42
Tutorials	6	1	6
Midterm Examination	1	3	3
Preparation for midterm exam	1	10	10
Final Examination	1	3	3
Preparation for final exam	1	20	20

Total Workload	**120**
Total Workload/30(h)	**120/30**
ECTS Credit of the Course	**4**

Chemical engineering master program, “Social Disciplines”

“Industrial technology of inorganic substances” specialization

Course Unit Title	**Psychology**
Course Unit Code	PSY 2101
Type of Course Unit	Compulsory
Level of Course Unit	2^{nd} year master program
National Credits	-
Number of ECTS Credits Allocated	2
Theoretical (hour/week)	1
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	2
Semester when the course unit is delivered	3
Course Coordinator	Samadli Ziya
Name of Lecturer (s)	Samadli Ziya
Name of Assistant (s)	-
Mode of Delivery	Face to face
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course Description:

This course provides an overview of the scientific study of human behavior. Topics include but are not limited to history, biopsychology, sensation, perception, learning, motivation, cognition, abnormal behavior, personality theory, social psychology, emotion, and development. Upon completion, students should be able to demonstrate a basic knowledge of the science of psychology.

This course is designed to introduce you to the scientific study of human nature. You will learn how psychologists ask questions from several different perspectives: questions about the relation of brain and behavior, about perception, about learning and thinking, about development, about social behavior and personality, and about psychopathology and psychotherapy. You will also learn about the methods psychologists use to find the answers to these questions and become acquainted with many of the important findings and theoretical approaches in the field of psychology. By the time it's over, we hope that you will have learned to think critically about psychological evidence, and to evaluate its validity and its relevance to important issues in your life.

Objectives of the Course:

With regards to psychological themes, theories, terminology, concepts (ideas and processes), methods, studies and practical applications, candidates should be able to:

1. Demonstrate their knowledge and understanding and applying knowledge and understanding of psychological information, ideas and evidence.
2. Apply their knowledge to familiar and unfamiliar situations and real life and theoretical contexts
3. Analyse, interpret and evaluate psychological information, ideas and evidence.
4. Emphasize the understanding of classic psychological research.
5. Develop oral and written communication skills.
6. Introduce the major concepts, theoretical perspectives, and historical trends in psychology
7. Encourage the critical examination and application of psychological principles to specific situations.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	analyze and interpret a significant body of primary works in psychology.	1,2,3,4
2	develop their ability to read, analyze, and write about complex texts.	1,2,3,4
3	demonstrate knowledge of the major questions and traditions in the psychology.	1,3,4
4	reflect on the socially responsible creation and use of technology, and create a project to further that end.	1,3,4
5	critically analyze and discuss the nature of, value of, and challenges to technology as an intellectual and cultural institution.	1,3,4

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm exam, 4. Quiz

Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition ofchemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate and research complex problems regarding with chemistry, technology and research of properties of ceramic, glass and binding composite materials, refractories, inorganic compounds and mineral fertilizers.	4
4	Ability to apply innovative methods based on key principles of nanochemistry and membrane technology to problem-solving of scientific and technological character.	5
5	Ability to develop concepts and scientific-technological solutions in the field of electrochemical technology, processing of mineral raw materials and water treatment.	4
6	Ability to utilize creativity in elaborating new and inventive products, processes and methods of utilization of solid waste in metallurgy and other areas of inorganic substances manufacturing.	3
7	Ability to identify, find, and provide necessary information, as well as, plan and conduct analytical, model and experimental investigations of inorganic substances and composite materials particularly in the field of catalysts and adsorbents synthesis with further studying their activity.	4
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	5
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	3
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents			
Week	Chapter	Topics	Exam
1	[1], Chapter 1, p. 7-35;	Introduction to psychology	

	[1], Chapter 1, p. 36-64;		
3	[1], chapter 8, p. 255 - 286;	Personality	
5	[2], All Chapters;	Communication as a social psychology phenomenon	
7	[1], Chapter 9, p. 287-330;	The psychology of groups	
8			Midterm
9	[1], Chapter 9, p. 287-330;	The psychology of groups	
11	[1], Chapter 8, p. 259-270;	Temperament	
13	[1], Chapter 8, p. 481-551;	Management and leadership	
16			Final

Recommended Sources:

1. Martha Lally and Suzanne Valentine-French. Introduction to Psychology. College of Lake County Faculty: (Revised July 2018, 2017, 2016, 2015, 2014)
2. Communication theories University of Twente in Enschede, The Netherlands. 2003. This pdf is available for download on www.utwente.nl/communication-theories

Additional readings will be supplied by the instructor via department.

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written Exam
Total	100%	

Assessment Criteria			
Final grades are determined according to the Academic Regulations of ASOIU for Undergraduate Studies			
Course Policies			
• Attendance of the course is mandatory. • Late assignments will not be accepted unless an agreement is reached with the lecturer. • Students cannot use calculators during the exam. • Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations			
ECTS allocated based on Student Workload			
Activities	Number	Duration (hour)	Total Workload (hour)
Course duration in class	**14**	**1**	**14**
Presentation	1	4	4
Self-study	10	2	20
Tutorials	5	1	5
Midterm Examination	1	3	3
Preparation for midterm exam	1	4	4
Final Examination	1	3	3
Preparation for final exam	1	7	7
Total Workload			**60**
Total Workload/16,3 (h)			**60/30**
ECTS Credit of the Course			**2**

Chemical engineering master program, “Social Disciplines”

“Oil refining technology” specialization

Course Unit Title	**Psychology**

Course Unit Code	PSY 2101
Type of Course Unit	Compulsory
Level of Course Unit	2nd year master program
National Credits	-
Number of ECTS Credits Allocated	2
Theoretical (hour/week)	1
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	2
Semester when the course unit is delivered	3
Course Coordinator	Samadli Ziya
Name of Lecturer (s)	Samadli Ziya
Name of Assistant (s)	-
Mode of Delivery	Face to face
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course Description:

This course provides an overview of the scientific study of human behavior. Topics include but are not limited to history, biopsychology, sensation, perception, learning, motivation, cognition, abnormal behavior, personality theory, social psychology, emotion, and development. Upon completion, students should be able to demonstrate a basic knowledge of the science of psychology.

This course is designed to introduce you to the scientific study of human nature. You will learn how psychologists ask questions from several different perspectives: questions about the relation of brain and behavior, about perception, about learning and thinking, about development, about social behavior and personality, and about psychopathology and psychotherapy. You will also learn about the methods psychologists use to find the answers to these questions and become acquainted with many of the important findings and theoretical approaches in the field of psychology. By the time it's over, we hope that you will have learned to think critically about psychological evidence, and to evaluate its validity and its relevance to important issues in your life.

Objectives of the Course:

With regards to psychological themes, theories, terminology, concepts (ideas and processes), methods, studies and practical applications, candidates should be able to:

8. Demonstrate their knowledge and understanding and applying knowledge and understanding of psychological information, ideas and evidence.
9. Apply their knowledge to familiar and unfamiliar situations and real life and theoretical contexts
10. Analyse, interpret and evaluate psychological information, ideas and evidence.
11. Emphasize the understanding of classic psychological research.
12. Develop oral and written communication skills.
13. Introduce the major concepts, theoretical perspectives, and historical trends in psychology
14. Encourage the critical examination and application of psychological principles to specific situations.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	analyze and interpret a significant body of primary works in psychology.	1,2,3,4
2	develop their ability to read, analyze, and write about complex texts.	1,2,3,4
3	demonstrate knowledge of the major questions and traditions in the psychology.	1,3,4
4	reflect on the socially responsible creation and use of technology, and create a project to further that end.	1,3,4
5	critically analyze and discuss the nature of, value of, and challenges to technology as an intellectual and cultural institution.	1,3,4

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm exam, 4. Quiz

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition ofchemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	4
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	5
5	Ability to develop design and scientific-technological solutions in the field of design, modeling and optimization of refining and petrochemical processes, as well	4

	as apply the acquired knowledge to improve the management system of the oil refining industry.	
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	3
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modeling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	4
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	5
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	3
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	[1], Chapter 1, p. 7-35; [1], Chapter 1, p. 36-64;	Introduction to psychology	
3	[1], chapter 8, p. 255 - 286;	Personality	
5	[2], All Chapters;	Communication as a social psychology phenomenon	
7	[1], Chapter 9, p. 287-330;	The psychology of groups	
8			Midterm
9	[1], Chapter 9, p. 287-330;	The psychology of groups	

11	[1], Chapter 8, p. 259-270;	Temperament	
13	[1], Chapter 8, p. 481-551;	Management and leadership	
16			Final

Recommended Sources:

3. Martha Lally and Suzanne Valentine-French. Introduction to Psychology. College of Lake County Faculty: (Revised July 2018, 2017, 2016, 2015, 2014)
4. Communication theories University of Twente in Enschede, The Netherlands. 2003. This pdf is available for download on www.utwente.nl/communication-theories

Additional readings will be supplied by the instructor via department.

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload (hour)
Course duration in class	**14**	**1**	**14**

Presentation	1	4	4
Self-study	10	2	20
Tutorials	5	1	5
Midterm Examination	1	3	3
Preparation for midterm exam	1	4	4
Final Examination	1	3	3
Preparation for final exam	1	7	7
Total Workload			**60**
Total Workload/16,3 (h)			**60/30**
ECTS Credit of the Course			**2**

Chemical engineering master program, "Social Disciplines"

"Technology of petrochemical synthesis" specialization

Course Unit Title	**Psychology**
Course Unit Code	PSY 2101
Type of Course Unit	Compulsory
Level of Course Unit	2nd year master program
National Credits	-
Number of ECTS Credits Allocated	2
Theoretical (hour/week)	1
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	2
Semester when the course unit is delivered	3
Course Coordinator	Samadli Ziya

Name of Lecturer (s)	Samadli Ziya
Name of Assistant (s)	-
Mode of Delivery	Face to face
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course Description:

This course provides an overview of the scientific study of human behavior. Topics include but are not limited to history, biopsychology, sensation, perception, learning, motivation, cognition, abnormal behavior, personality theory, social psychology, emotion, and development. Upon completion, students should be able to demonstrate a basic knowledge of the science of psychology.

This course is designed to introduce you to the scientific study of human nature. You will learn how psychologists ask questions from several different perspectives: questions about the relation of brain and behavior, about perception, about learning and thinking, about development, about social behavior and personality, and about psychopathology and psychotherapy. You will also learn about the methods psychologists use to find the answers to these questions and become acquainted with many of the important findings and theoretical approaches in the field of psychology. By the time it's over, we hope that you will have learned to think critically about psychological evidence, and to evaluate its validity and its relevance to important issues in your life.

Objectives of the Course:

With regards to psychological themes, theories, terminology, concepts (ideas and processes), methods, studies and practical applications, candidates should be able to:

15. Demonstrate their knowledge and understanding and applying knowledge and understanding of psychological information, ideas and evidence.
16. Apply their knowledge to familiar and unfamiliar situations and real life and theoretical contexts
17. Analyse, interpret and evaluate psychological information, ideas and evidence.
18. Emphasize the understanding of classic psychological research.
19. Develop oral and written communication skills.
20. Introduce the major concepts, theoretical perspectives, and historical trends in psychology
21. Encourage the critical examination and application of psychological principles to specific situations.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	analyze and interpret a significant body of primary works in psychology.	1,2,3,4
2	develop their ability to read, analyze, and write about complex texts.	1,2,3,4

3	demonstrate knowledge of the major questions and traditions in the psychology.	1,3,4
4	reflect on the socially responsible creation and use of technology, and create a project to further that end.	1,3,4
5	critically analyze and discuss the nature of, value of, and challenges to technology as an intellectual and cultural institution.	1,3,4
Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm exam, 4. Quiz		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition ofchemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyze and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulates, and solves complex problems related to the chemistry, technology, and research of the properties of organic compounds and industrial products based on them.	4
4	Ability to apply modern methods to solve scientific problems and develop new scientific research in the field of synthesis and modification of the properties of organic compounds.	5
5	Ability to develop concepts and scientific-technological solutions in the field of petrochemical and basic organic synthesis.	4
6	Ability to use creativity to develop new and improved methods of utilization of waste of petrochemical and organic synthesis, as well as methods of effective use of renewable energy sources.	3
7	The ability to identify, find and provide the necessary information, as well as to plan and conduct analytical, model and experimental studies of catalytic processes involving organic compounds.	4
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	5
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	3

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)			
Course Contents			
Week	Chapter	Topics	Exam
1	[1], Chapter 1, p. 7-35; [1], Chapter 1, p. 36-64;	Introduction to psychology	
3	[1], chapter 8, p. 255 - 286;	Personality	
5	[2], All Chapters;	Communication as a social psychology phenomenon	
7	[1], Chapter 9, p. 287-330;	The psychology of groups	
8			Midterm
9	[1], Chapter 9, p. 287-330;	The psychology of groups	
11	[1], Chapter 8, p. 259-270;	Temperament	
13	[1], Chapter 8, p. 481-551;	Management and leadership	
16			Final

Recommended Sources:

5. Martha Lally and Suzanne Valentine-French. Introduction to Psychology. College of Lake County Faculty: (Revised July 2018, 2017, 2016, 2015, 2014)

6. Communication theories University of Twente in Enschede, The Netherlands. 2003. This pdf is available for download on www.utwente.nl/communication-theories

Additional readings will be supplied by the instructor via department.

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	

Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload (hour)
Course duration in class	**14**	**1**	**14**
Presentation	1	4	4
Self-study	10	2	20
Tutorials	5	1	5
Midterm Examination	1	3	3
Preparation for midterm exam	1	4	4
Final Examination	1	3	3
Preparation for final exam	1	7	7
Total Workload			**60**
Total Workload/16,3 (h)			**60/30**
ECTS Credit of the Course			**2**

Chemical engineering (CHEN) program, Department of “Petrochemical Technology and Industrial Ecology”.

Course Unit Title	**Development of oil refining process management systems**
Course Unit Code	**ENG 2104**
Type of Course Unit	Compulsory
Level of Course Unit	2^{nd} year CHEN MASTER program
National Credits	-
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	2
Practice (hour/week)	-
Laboratory (hour/week)	1
Year of Study	2
Semester when the course unit is delivered	3
Course Coordinator	Aynura Aliyeva
Name of Lecturer (s)	Aynura Aliyeva
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Laboratory
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

Petroleum has remained an important aspect of our lives and will do so for the next four or five decades. The fuels that are derived from petroleum supply more than half of the world s total supply of energy. Gasoline, kerosene, and diesel oil provide fuel for automobiles, tractors, trucks, aircraft, and ships. Fuel oil and natural gas are used to heat homes and commercial buildings, as well as to generate electricity. Petroleum products are the basic materials used for the manufacture of synthetic fibers for clothing and in plastics, paints, fertilizers, insecticides, soaps, and synthetic rubber. The uses of petroleum as a source of raw material in manufacturing are central to the functioning of modern industry. In fact, the increasing supply of heavy crude oils as refinery feedstocks is a serious matter and it is essential that refineries are able to accommodate these heavy feedstocks. Indeed, in order to satisfy the changing pattern of product demand, significant investments in refining conversion processes will be necessary to profitably utilize these heavy crude oils. The most efficient and economical solution to this problem will depend to a large extent on individual country and company situations. However, the most promising technologies will likely involve the conversion of heavy crude oil, vacuum bottom residua, asphalt from deasphalting processes, and bitumen from tar sand deposits. Therefore, a thorough understanding of the benefits and limitations of petroleum processing is necessary and is introduced in this subject.

Objectives of the Course:

Course contains the origin and characterization of petroleum, petroleum products, physico-chemical and other properties, the characteristics feedstock, introduction to thermal and catalytic proceses, main features of these processes, catalyst selection, the influence of process parameters on unit performance and yields. Moreover, the main objective point of the course is to study the major processes for fuel production, and environmental pollution control. It also will focuse on lubricants, hydrogen production, process modeling, automation, and online optimization.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	define the significant properties of crude oil, including density, viscosity, average boiling point, sulfur, and salt content	1,2,5
2	distinguish and evaluate the functions of different refinery processes to control refinery product yield and composition	1,3,4
3	explain the role of major processes for oil industry	1,2,3,4
4	explain major differences between thermal and catalytic processes	1,2,3
5	understand the main principles both primary and secondary processes	1,2,3
6	understand and explain the impact of each process on environment	1,2,3

Assessment Methods: 1. Final Exam, 2. Midterm 3. Presentation, 4 Quiz, 5 Laboratory

Course’s Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	4
2	Ability to analyze and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	3
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	5
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	4
5	Ability to develop design and scientific-technological solutions in the field of design, modeling and optimization of refining and petrochemical processes, as well	4

	as apply the acquired knowledge to improve the management system of the oil refining industry.	
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	3
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modeling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	3
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	5
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	Book I. Chap.1	**Refinery feedstocks and products**. Introduction. Refining processes. Crude oil composition. Products composition. Petroleum, natural gas, manufactured materials.	
2	Book I. Chap.2	**Feedstock Evaluation.** Physical properties, thermal properties, electrical properties, Chromatographic Properties. **Laboratory work 1. Safety rules.**	
3	Book I. Chap.3	**Feedstock Composition** Elemental composition, chemical composition, hydrocarbon constituents, nonhydrocarbon constituents, chemical composition by distillation.	
4	Book I. Chap.4	**Crude Distillation** Fractionation. Operation of crude distillation units. Crude oil desalting. Desalting process. Description of desalter. Atmospheric distillation. Vacuum distillation. **Laboratory work 2. Determination of petroleum products density**	

		In the laboratory work following equipments and materials are used: Aerometer, pycnometer, light and heavy petroleum products The main objective of laboratory work is determine the density of petroleum products by aerometer and pycnometer.	
5	Book 2. Chap.8	**Chemical Catalytic conversion processes. Fluidised Catalytic cracking.** Introduction. Feedstocks and products. Fludisation.FCC reactions. FCC catalyst. Process description.	
6	Book 2. Chap.5	**Cataytic reforming and isomerization** Introduction. Catalytic reforming. Reformer feed characterization. Role of reformer in the refinery and feed preparation. Reforming reactions. Process technology. **Laboratory work 3 Determination of petroleum products viscosity.** In the laboratory work following equipments and materials are used: Viscometer, light and heavy petroleum products. The main objective of laboratory work is to determine the viscosity of petroleum products.	
7	Book 2. Chap.5	**Cataytic reforming and isomerization** Introduction. Isomerization of light naptha. Thermodynamics of isomerization. Isomerization catalyst. Isomerization reactions.	
8			Midterm
9	Book 2 Chap.6	**Thermal cracking and coking.** Introduction. Coke formation. Visbreaking. Feed sources. Visbreaking reactions. Process description. **Delayed coking .** Role of delayed coker. Delayed coking variables. Process description. **Laboratory work 4: Determination of the flash, combustion, spontaneous temperature** In the laboratory work the following equipment and materials are used: porcelain bowl, thermometer, closed and open crucible.	

		The main objective of laboratory work is determine the flash, combustion, spontaneous temperature of petroleum products.	
10	Book 2 Chap.6	**Fluid coking. Flexicoking.** Introduction. Role of fluid coking. Process description.	
11	Book 2 Chap.7	**Hydroconversion.** Introduction. Hydrotreating. Objectives of hydrotreating, Role of hydrotreating. Chemistry of hydrotreating. **Laboratory work 5** Determination of the water content in petroleum products In the laboratory work the following equipment and materials are used: Flask of 500ml capacity, graduated cylinder, electric heater The main objective of laboratory work is to determine the water content of oil and oil products	
12	Book 2 Chap.7	**Hydroconversion.** Hydrocracking. Role of hydrocracking in the refinery. Feeds and products, Hydrocracking catalysts. Process description	
13	Book 2. Chap.10	**Cataylitic Alkylation** Introduction.Role of alkylation and polymerization units in the refinery. Alkylatuon processes. Sulphuric Acid alkylation process. **Laboratory work 6** Analysis of gasoline (fraction composition) In the laboratory work the following equipment and materials are used: Engler device, flask, thermometer, gasoline The main objective of laboratory work is to analyze the fraction composition of gasoline.	
14	Book 2. Chap.10	**Hydrogen production** Introduction. Hydrogen requirements in modern refineries. Steam reforming..	
15	Book 2. Chap.13	**Residue upgrading.** Introduction. Upgrading options. Non-catalytic residue upgrading processes. Catalytic processes. **Laboratory work 7 Determination of aniline point.** In the laboratory work the following equipment and materials are used:	

		Thermometer, mixer, tube, water bath, aniline, gasoline. The main objective of the laboratory work is to determine the aniline point of gasoline.	
16			Final

Recommended Sources

TEXTBOOK

1 James G. Speight " *Handbook of petroleum refining"*, 2006, p 727

2. M. A. Fahim, T. A.Alsahhaf, A.,S.Elkilani "*Fundamentals of petroleum refining*", 2010

3. Uttam Ray Chaudri *Fundamentals of petroleum and petrochemical engineering*., 2011

REFERENCES

I Robert A. Mayers " Hand book of petroleum refining process"

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	10%	
Quiz	10%	
Seminars	0%	
Laboratory	10%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU.

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)

Course duration in class	**14**	**3**	**42**
Presentation	1	8	8
Self-study	14	5	70
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	12	12
Final Examination	1	3	3
Preparation for final exam	1	28	28
Total Workload			**180**
Total Workload/30(h)			**180/30**
ECTS Credit of the Course			**6**

Chemical engineering master program, "Social subjects" department

"Industrial technology of inorganic substances" specialization

Course Unit Title	**Azerbaijani multiculturalism**
Course Unit Code	SSC 3002
Type of Course Unit	Elective
Level of Course Unit	1st year of master program
National Credits	-
Number of ECTS Credits Allocated	2

Theoretical (hour/week)	1
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	Samadli Ziya
Name of Lecturer (s)	Samadli Ziya
Name of Assistant (s)	-
Mode of Delivery	Face to face
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

General Course Description:

By accelerating interaction of cultures and civilizations, the ongoing process of globalization increases the importance of multiculturalism policy both at national and international levels. In the context of growing ethnic and cultural diversity, lack of alternatives to multiculturalism, which provides the necessary conditions for ethnic, religious and cultural tolerance, has become even more visible. Despite the increasing importance of multiculturalism policy, some countries tend to keep away from this policy due to a number of reasons. This, in turn, leads to the crimes motivated by anti-Semitism, racism, xenophobia, Islam phobia and other forms of hate crime. Whilst in some countries the multiculturalism policy has failed, the Republic of Azerbaijan declared it as the state policy. Azerbaijan has been successfully implementing this policy. Its achievements have been recognized at the international level. In addition, many countries have expressed their willingness to study and apply the Azerbaijani model of multiculturalism.

Objectives of the Course:

1. explaining the object and significance of the course;
2. providing students with conceptual framework of the course;
3. giving historical background of the traditions of multiculturalism in Azerbaijan;
4. analyzing the concepts of multiculturalism and tolerance reflected in Azerbaijani philosophic thought from historical perspective;
5. analyzing theoretical and ideological foundations of Azerbaijani model of multiculturalism;
6. presenting the history and key models of multicultural policy in Western states;
7. illustrating the criteria for identifying the multiculturalism security principles of the Republic of Azerbaijan;

	8. illustrating the activities of the Republic of Azerbaijan on cooperation with international organizations in the implementation of multiculturalism policy and the importance of this cooperation.		
Learning Outcomes			
At the end of the course the student will be able to		Assessment	
1	obtain general theoretical information about multiculturalism;	1,2,3,4	
2	analyze the multiculturalism experience of countries around the world;	1,2,3,4	
3	realize the nature, specific features and priorities of the Azerbaijani model of multiculturalism;	1,3,4	
4	learn about the historic roots of multiculturalism traditions in Azerbaijan;	1,3,4	
5	get knowledge of the ideas about multiculturalism and tolerance in the Azerbaijani social and philosophical thought from historical perspective as well as with the theoretical and ideological bases of Azerbaijani multiculturalism;	1,3,4	
Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm exam, 4. Quiz			
Course's Contribution to Program			
			CL
1	Ability to demonstrate well-developed erudition ofchemistry, mathematical-scientific and engineering principles of chemical engineering.		5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.		5
3	Ability to summarize, formulate and research complex problems regarding with chemistry, technology and research of properties of ceramic, glass and binding composite materials, refractories, inorganic compounds and mineral fertilizers.		4
4	Ability to apply innovative methods based on key principles of nanochemistry and membrane technology to problem-solving of scientific and technological character.		5
5	Ability to develop concepts and scientific-technological solutions in the field of electrochemical technology, processing of mineral raw materials and water treatment.		4
6	Ability to utilize creativity in elaborating new and inventive products, processes and methods of utilization of solid waste in metallurgy and other areas of inorganic substances manufacturing.		3
7	Ability to identify, find, and provide necessary information, as well as, plan and conduct analytical, model and experimental investigations of inorganic substances and composite materials particularly in the field of catalysts and adsorbents synthesis with further studying their activity.		4

8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	5
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	3

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

Course Contents

Week	Chapter	Topics	Exam
1	[1], chapter 1, p. 36-40;	The subject matter and significance of the *Azerbaijani Multiculturalism* course	
3	[1], chapter 7, p. 421-480; [2] p. 361-526;	Models of multiculturalism in the world	
5	[1], chapter 4, p.132-260	The ideas of tolerance and multiculturalism in socio-philosophic thought of Azerbaijan	
7	[1], chapter 3, p. 67-119;	Multiculturalism in Azerbaijan: history, essence and main peculiarities	
8			Midterm
9	[1], chapter 5, p. 275-357;	Multiconfessionality, ethnic diversity and multiculturalism policy in the Republic of Azerbaijan	
11	[1], chapter 5, p. 275-357;	Multiculturalism policy in the Republic of Azerbaijan and the socio-economic development of the country	
13	[1], chapter 6, p. 367-416	Multiculturalism and foreign policy of the Republic of Azerbaijan. Multiculturalism and current realities in Azerbaijan	
16			Final

Recommended Sources:

7. Azerbaijani multiculturalism. Textbook for higher education. “Sharg-Garb”, Baku – 2018.

8. The President of the Republic of Azerbaijan Ilham Aliyev on the Azerbaijani model of multiculturalism. BBMM, Baku-2017.

9. Liberal Multiculturalism: Western Models, Global Trends, and Asian Debates. Will Kymlicka, Queen's University, october 2005.

10. **Multiculturalism,** Stanford Encyclopedia of Philosophy, http://plato.stanford.edu/entries/multiculturalism/.

11. Azərbaycanda multikulturalizm Biblioqrafiya BAKI – © M.F.Axundov adına Azərbaycan Milli Kitabxanası, 2016.

Assessment		
Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload (hour)
Course duration in class	**14**	**1**	**14**
Presentation	1	4	4
Self-study	10	2	20
Tutorials	6	1	6
Midterm Examination	1	3	3

Preparation for midterm exam	1	5	5
Final Examination	1	3	3
Preparation for final exam	1	5	5
Total Workload			**60**
Total Workload/30(h)			**60/30**
ECTS Credit of the Course			**2**

Chemical engineering master program, "Social subjects" department

"Oil refining technology" specialization

Course Unit Title	**Azerbaijani multiculturalism**
Course Unit Code	SSC 3002
Type of Course Unit	Elective
Level of Course Unit	1st year of master program
National Credits	-
Number of ECTS Credits Allocated	2
Theoretical (hour/week)	1
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	1

Semester when the course unit is delivered	1
Course Coordinator	Samadli Ziya
Name of Lecturer (s)	Samadli Ziya
Name of Assistant (s)	-
Mode of Delivery	Face to face
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

General Course Description:

By accelerating interaction of cultures and civilizations, the ongoing process of globalization increases the importance of multiculturalism policy both at national and international levels. In the context of growing ethnic and cultural diversity, lack of alternatives to multiculturalism, which provides the necessary conditions for ethnic, religious and cultural tolerance, has become even more visible. Despite the increasing importance of multiculturalism policy, some countries tend to keep away from this policy due to a number of reasons. This, in turn, leads to the crimes motivated by anti-Semitism, racism, xenophobia, Islam phobia and other forms of hate crime. Whilst in some countries the multiculturalism policy has failed, the Republic of Azerbaijan declared it as the state policy. Azerbaijan has been successfully implementing this policy. Its achievements have been recognized at the international level. In addition, many countries have expressed their willingness to study and apply the Azerbaijani model of multiculturalism.

Objectives of the Course:

9. explaining the object and significance of the course;
10. providing students with conceptual framework of the course;
11. giving historical background of the traditions of multiculturalism in Azerbaijan;
12. analyzing the concepts of multiculturalism and tolerance reflected in Azerbaijani philosophic thought from historical perspective;
13. analyzing theoretical and ideological foundations of Azerbaijani model of multiculturalism;
14. presenting the history and key models of multicultural policy in Western states;
15. illustrating the criteria for identifying the multiculturalism security principles of the Republic of Azerbaijan;
16. illustrating the activities of the Republic of Azerbaijan on cooperation with international organizations in the implementation of multiculturalism policy and the importance of this cooperation.

Learning Outcomes

At the end of the course the student will be able to	Assessment

1	obtain general theoretical information about multiculturalism;	1,2,3,4
2	analyze the multiculturalism experience of countries around the world;	1,2,3,4
3	realize the nature, specific features and priorities of the Azerbaijani model of multiculturalism;	1,3,4
4	learn about the historic roots of multiculturalism traditions in Azerbaijan;	1,3,4
5	get knowledge of the ideas about multiculturalism and tolerance in the Azerbaijani social and philosophical thought from historical perspective as well as with the theoretical and ideological bases of Azerbaijani multiculturalism;	1,3,4
Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm exam, 4. Quiz		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	4
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	5
5	Ability to develop design and scientific-technological solutions in the field of design, modeling and optimization of refining and petrochemical processes, as well as apply the acquired knowledge to improve the management system of the oil refining industry.	4
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	3
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modeling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	4
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	5

10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	3
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	[1], chapter 1, p. 36-40;	The subject matter and significance of the *Azerbaijani Multiculturalism* course	
3	[1], chapter 7, p. 421-480; [2] p. 361-526;	Models of multiculturalism in the world	
5	[1], chapter 4, p.132-260	The ideas of tolerance and multiculturalism in socio-philosophic thought of Azerbaijan	
7	[1], chapter 3, p. 67-119;	Multiculturalism in Azerbaijan: history, essence and main peculiarities	
8			Midterm
9	[1], chapter 5, p. 275-357;	Multiconfessionality, ethnic diversity and multiculturalism policy in the Republic of Azerbaijan	
11	[1], chapter 5, p. 275-357;	Multiculturalism policy in the Republic of Azerbaijan and the socio-economic development of the country	
13	[1], chapter 6, p. 367-416	Multiculturalism and foreign policy of the Republic of Azerbaijan. Multiculturalism and current realities in Azerbaijan	
16			Final

Recommended Sources:

12. Azerbaijani multiculturalism. Textbook for higher education. “Sharg-Garb”, Baku – 2018.

13. The President of the Republic of Azerbaijan Ilham Aliyev on the Azerbaijani model of multiculturalism. BBMM, Baku-2017.

14. Liberal Multiculturalism: Western Models, Global Trends, and Asian Debates. Will Kymlicka, Queen’s University, october 2005.

15. **Multiculturalism,** Stanford Encyclopedia of Philosophy**,** http://plato.stanford.edu/entries/multiculturalism/.

16. Azərbaycanda multikulturalizm Biblioqrafiya BAKI – © M.F.Axundov adına Azərbaycan Milli Kitabxanası, 2016.

Assessment		
Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload (hour)
Course duration in class	**14**	**1**	**14**
Presentation	1	4	4
Self-study	10	2	20
Tutorials	6	1	6
Midterm Examination	1	3	3
Preparation for midterm exam	1	5	5
Final Examination	1	3	3
Preparation for final exam	1	5	5
Total Workload			**60**
Total Workload/30(h)			**60/30**

ECTS Credit of the Course	**2**

Chemical engineering master program, “Social subjects” department

“Technology of petrochemical synthesis” specialization

Course Unit Title	**Azerbaijani multiculturalism**
Course Unit Code	SSC 3002
Type of Course Unit	Elective
Level of Course Unit	1st year of master program
National Credits	-
Number of ECTS Credits Allocated	2
Theoretical (hour/week)	1
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	Samadli Ziya
Name of Lecturer (s)	Samadli Ziya
Name of Assistant (s)	-
Mode of Delivery	Face to face

Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

General Course Description:

By accelerating interaction of cultures and civilizations, the ongoing process of globalization increases the importance of multiculturalism policy both at national and international levels. In the context of growing ethnic and cultural diversity, lack of alternatives to multiculturalism, which provides the necessary conditions for ethnic, religious and cultural tolerance, has become even more visible. Despite the increasing importance of multiculturalism policy, some countries tend to keep away from this policy due to a number of reasons. This, in turn, leads to the crimes motivated by anti-Semitism, racism, xenophobia, Islam phobia and other forms of hate crime. Whilst in some countries the multiculturalism policy has failed, the Republic of Azerbaijan declared it as the state policy. Azerbaijan has been successfully implementing this policy. Its achievements have been recognized at the international level. In addition, many countries have expressed their willingness to study and apply the Azerbaijani model of multiculturalism.

Objectives of the Course:

17. explaining the object and significance of the course;
18. providing students with conceptual framework of the course;
19. giving historical background of the traditions of multiculturalism in Azerbaijan;
20. analyzing the concepts of multiculturalism and tolerance reflected in Azerbaijani philosophic thought from historical perspective;
21. analyzing theoretical and ideological foundations of Azerbaijani model of multiculturalism;
22. presenting the history and key models of multicultural policy in Western states;
23. illustrating the criteria for identifying the multiculturalism security principles of the Republic of Azerbaijan;
24. illustrating the activities of the Republic of Azerbaijan on cooperation with international organizations in the implementation of multiculturalism policy and the importance of this cooperation.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	obtain general theoretical information about multiculturalism;	1,2,3,4
2	analyze the multiculturalism experience of countries around the world;	1,2,3,4
3	realize the nature, specific features and priorities of the Azerbaijani model of multiculturalism;	1,3,4
4	learn about the historic roots of multiculturalism traditions in Azerbaijan;	1,3,4

5	get knowledge of the ideas about multiculturalism and tolerance in the Azerbaijani social and philosophical thought from historical perspective as well as with the theoretical and ideological bases of Azerbaijani multiculturalism;	1,3,4

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm exam, 4. Quiz

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition ofchemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate, and solve complex problems related to the chemistry, technology, and research of the properties of organic compounds and industrial products based on them.	4
4	Ability to apply modern methods to solve scientific problems and develop new scientific research in the field of synthesis and modification of the properties of organic compounds.	5
5	Ability to develop concepts and scientific-technological solutions in the field of petrochemical and basic organic synthesis.	4
6	Ability to use creativity to develop new and improved methods of utilization of waste of petrochemical and organic synthesis, as well as methods of effective use of renewable energy sources.	3
7	The ability to identify, find and provide the necessary information, as well as to plan and conduct analytical, model and experimental studies of catalytic processes involving organic compounds.	4
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	5
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	3

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

Course Contents

Week	Chapter	Topics	Exam

1	[1], chapter 1, p. 36-40;	The subject matter and significance of the *Azerbaijani Multiculturalism* course	
3	[1], chapter 7, p. 421-480; [2] p. 361-526;	Models of multiculturalism in the world	
5	[1], chapter 4, p.132-260	The ideas of tolerance and multiculturalism in socio-philosophic thought of Azerbaijan	
7	[1], chapter 3, p. 67-119;	Multiculturalism in Azerbaijan: history, essence and main peculiarities	
8			Midterm
9	[1], chapter 5, p. 275-357;	Multiconfessionality, ethnic diversity and multiculturalism policy in the Republic of Azerbaijan	
11	[1], chapter 5, p. 275-357;	Multiculturalism policy in the Republic of Azerbaijan and the socio-economic development of the country	
13	[1], chapter 6, p. 367-416	Multiculturalism and foreign policy of the Republic of Azerbaijan. Multiculturalism and current realities in Azerbaijan	
16			Final

Recommended Sources:

17. Azerbaijani multiculturalism. Textbook for higher education. “Sharg-Garb”, Baku – 2018.

18. The President of the Republic of Azerbaijan Ilham Aliyev on the Azerbaijani model of multiculturalism. BBMM, Baku-2017.

19. Liberal Multiculturalism: Western Models, Global Trends, and Asian Debates. Will Kymlicka, Queen’s University, october 2005.

20. **Multiculturalism,** Stanford Encyclopedia of Philosophy**,** http://plato.stanford.edu/entries/multiculturalism/.

21. Azərbaycanda multikulturalizm Biblioqrafiya BAKI – © M.F.Axundov adına Azərbaycan Milli Kitabxanası, 2016.

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	

Seminars	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of ASOIU for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload (hour)
Course duration in class	**14**	**1**	**14**
Presentation	1	4	4
Self-study	10	2	20
Tutorials	6	1	6
Midterm Examination	1	3	3
Preparation for midterm exam	1	5	5
Final Examination	1	3	3
Preparation for final exam	1	5	5
Total Workload			**60**
Total Workload/30(h)			**60/30**
ECTS Credit of the Course			**2**

Chemical engineering (CHEN) master program, "Technology of organic substances and high molecular compounds" department

for "Industrial technology of inorganic substances" specialization

Course Unit Title	**History and methodology of chemical engineering**
Course Unit Code	ENG 1101
Type of Course Unit	Compulsory
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	2
Theoretical (hour/week)	1
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	Narmina Guliyeva
Name of Lecturer (s)	Narmina Guliyeva
Name of Assistant (s)	-
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

Chemical technology plays an important role in the modern world. Alchemy caused chemical production. Modern chemical enterprises are automated large industrial complexes that perform

complex processes. Special training should be organized for these companies. Teaching the course "History and Methodology of Chemical Engineering" is very important		
Objectives of the Course: - to give necessary knowledge on the history and methodology of chemical technology; - to teach the importance of scientific theories in the development of chemical technology.		
Learning Outcomes		
At the end of the course the student will be able to		Assessment
1	freely work with the proposed literature;	1, 3, 4
2	actively participate in classes, ask teachers questions on obscure issues;	1, 2, 3, 4
3	knowledge of historical facts about the subject	2, 3, 4
4	thorough mastering of the subject and writing of the article	3, 4
5	apply methodological processes	1, 3, 4
Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm, 4. Quiz		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate and research complex problems regarding with chemistry, technology and research of properties of ceramic, glass and binding composite materials, refractories, inorganic compounds and mineral fertilizers.	5
4	Ability to apply innovative methods based on key principles of nanochemistry and membrane technology to problem-solving of scientific and technological character.	5
5	Ability to develop concepts and scientific-technological solutions in the field of electrochemical technology, processing of mineral raw materials and water treatment.	5
6	Ability to utilize creativity in elaborating new and inventive products, processes and methods of utilization of solid waste in metallurgy and other areas of inorganic substances manufacturing.	5
7	Ability to identify, find, and provide necessary information, as well as, plan and conduct analytical, model and experimental investigations of inorganic	5

	substances and composite materials particularly in the field of catalysts and adsorbents synthesis with further studying their activity.	
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	4

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

Course Contents

Week	Chapter	Topics	Exam
1	p.1-13 [1]	The ancients: fire and stone, metals, 353urop "Elements'', 353urop "Atoms".	
	p.15-29 [1]	Alchemy. Alexandria. The arabs. Revival in 353urope. The end of alchemy.	
3	p.34-43 [1]	Transition. Measurement. Boyle's law. The new view of elements. Phlogiston.	
	p.49-61 [1]	The gases. Carbon dioxide and nitrogen. Hydrogen and oxygen. The triumph of measurement. Combustion.	
5	p.70-88 [1]	Atoms. Proust's law. Dalton's theory. Avogadro's hypothesis. Weights and symbols. Electrolysis.	
	p.93-100 [1]	Organic chemistry. The breakdown of vitalism. The building blocks of life. Isomers and radicals.	
7			Midterm
8	p.106-119	Molecular structure. The theory of types. Valence. Structural formulas. Optical isomers. Molecules in three dimensions	
	p.1240140 [1]	The periodic table. Elements in disorder. Organizing the elements. Filling the gaps. New elements by groups.	
10	p.146-164 [1]	Physical chemistry. Heat. Chemical thermodynamics. Catalysis. Ionic dissociation. More on gases.	
	p.168-182 [1]	Synthetic organic chemistry. Dyes. Drugs. Proteins. Explosives. Polymers.	

12	p.189-197 [1]	Inorganic chemistry. The new metallurgy. Nitrogen and fluorine. Inorganic-organic borderland.	
	p.201-209 [1]	Electrons. Cathode rays. The photoelectric effect. Radioactivity.	
14	p.214-232 [1]	The nuclear atom. Atomic number. Electron shells. Resonance. Half-life. Isotopes	
	p.239-249 [1]	Nuclear reactions. The new transmutation. Artificial radioactivity. Transuranium elements. Nuclear bombs.	
16			Final

Recommended Sources

TEXTBOOK(S)

1. A Short History of Chemistry, Isaac Asimov, 1965, Publisher: Anchor (Doubleday)

p.279

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminar	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-oral exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan Ministry of Education for Undergraduate Studies

CoursePolicies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	**Number**	**Duration (hour)**	**Total Workload (hour)**

Course duration in class	14	1	14
Tutorials	4	1	4
Presentation	1	5	5
Midterm examination	1	3	3
Self study	7	3	21
Preparation for midterm exam	1	5	5
Final examination	1	3	3
Preparation for final exam	1	5	5
Total workload			**60**
Total workload/30(h)			**60/30**
ECTS Credit of the Course			**2**

Chemical engineering (CHEN) master program, "Technology of organic substances and high molecular compounds" department

for "Oil refining technology" specialization

Course Unit Title	**History and methodology of chemical engineering**
Course Unit Code	ENG 1101
Type of Course Unit	Compulsory
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	2
Theoretical (hour/week)	1
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	Narmina Guliyeva
Name of Lecturer (s)	Narmina Guliyeva
Name of Assistant (s)	-
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

Chemical technology plays an important role in the modern world. Alchemy caused chemical production. Modern chemical enterprises are automated large industrial complexes that perform complex processes. Special training should be organized for these companies. Teaching the course "History and Methodology of Chemical Engineering" is very important

Objectives of the Course:

- to give necessary knowledge on the history and methodology of chemical technology; - to teach the importance of scientific theories in the development of chemical technology.		
Learning Outcomes		
At the end of the course the student will be able to		Assessment
1	freely work with the proposed literature;	1, 3, 4
2	actively participate in classes, ask teachers questions on obscure issues;	1, 2, 3, 4
3	knowledge of historical facts about the subject	2, 3, 4
4	thorough mastering of the subject and writing of the article	3, 4
5	apply methodological processes	1, 3, 4
Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm, 4. Quiz		
Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	5
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	5
5	Ability to develop design and scientific-technological solutions in the field of design, modeling and optimization of refining and petrochemical processes, as well as apply the acquired knowledge to improve the management system of the oil refining industry.	5
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	5
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modeling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research	5

	methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	4
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	p.1-13 [1]	The ancients: fire and stone, metals, 358urop "Elements'', 358urop "Atoms".	
	p.15-29 [1]	Alchemy. Alexandria. The arabs. Revival in 358urope. The end of alchemy.	
3	p.34-43 [1]	Transition. Measurement. Boyle's law. The new view of elements. Phlogiston.	
	p.49-61 [1]	The gases. Carbon dioxide and nitrogen. Hydrogen and oxygen. The triumph of measurement. Combustion.	
5	p.70-88 [1]	Atoms. Proust's law. Dalton's theory. Avogadro's hypothesis. Weights and symbols. Electrolysis.	
	p.93-100 [1]	Organic chemistry. The breakdown of vitalism. The building blocks of life. Isomers and radicals.	
7			Midterm
8	p.106-119	Molecular structure. The theory of types. Valence. Structural formulas. Optical isomers. Molecules in three dimensions	
	p.1240140 [1]	The periodic table. Elements in disorder. Organizing the elements. Filling the gaps. New elements by groups.	
10	p.146-164 [1]	Physical chemistry. Heat. Chemical thermodynamics. Catalysis. Ionic dissociation. More on gases.	
	p.168-182 [1]	Synthetic organic chemistry. Dyes. Drugs. Proteins. Explosives. Polymers.	
12	p.189-197 [1]	Inorganic chemistry. The new metallurgy. Nitrogen and fluorine. Inorganic-organic borderland.	

	p.201-209 [1]	Electrons. Cathode rays. The photoelectric effect. Radioactivity.	
14	p.214-232 [1]	The nuclear atom. Atomic number. Electron shells. Resonance. Half-life. Isotopes	
	p.239-249 [1]	Nuclear reactions. The new transmutation. Artificial radioactivity. Transuranium elements. Nuclear bombs.	
16			Final

Recommended Sources

TEXTBOOK(S)

1. A Short History of Chemistry, Isaac Asimov, 1965, Publisher: Anchor (Doubleday)

p.279

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminar	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-oral exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan Ministry of Education for Undergraduate Studies

CoursePolicies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload (hour)
Course duration in class	14	1	14

Tutorials	4	1	4
Presentation	1	5	5
Midterm examination	1	3	3
Self study	7	3	21
Preparation for midterm exam	1	5	5
Final examination	1	3	3
Preparation for final exam	1	5	5
Total workload			**60**
Total workload/30(h)			**60/30**
ECTS Credit of the Course			**2**

Chemical engineering (CHEN) master program, "Technology of organic substances and high molecular compounds" department

for "Technology of petrochemical synthesis" specialization

Course Unit Title	**History and methodology of chemical engineering**
Course Unit Code	ENG 1101
Type of Course Unit	Compulsory
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	2
Theoretical (hour/week)	1
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	Narmina Guliyeva
Name of Lecturer (s)	Narmina Guliyeva
Name of Assistant (s)	-
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

Chemical technology plays an important role in the modern world. Alchemy caused chemical production. Modern chemical enterprises are automated large industrial complexes that perform complex processes. Special training should be organized for these companies. Teaching the course "History and Methodology of Chemical Engineering" is very important

Objectives of the Course:

- to give necessary knowledge on the history and methodology of chemical technology;

- to teach the importance of scientific theories in the development of chemical technology.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	freely work with the proposed literature;	1, 3, 4
2	actively participate in classes, ask teachers questions on obscure issues;	1, 2, 3, 4
3	knowledge of historical facts about the subject	2, 3, 4
4	thorough mastering of the subject and writing of the article	3, 4
5	apply methodological processes	1, 3, 4

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm, 4. Quiz

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate, and solve complex problems related to the chemistry, technology, and research of the properties of organic compounds and industrial products based on them.	5
4	Ability to apply modern methods to solve scientific problems and develop new scientific research in the field of synthesis and modification of the properties of organic compounds.	5
5	Ability to develop concepts and scientific-technological solutions in the field of petrochemical and basic organic synthesis.	5
6	Ability to use creativity to develop new and improved methods of utilization of waste of petrochemical and organic synthesis, as well as methods of effective use of renewable energy sources.	5
7	The ability to identify, find and provide the necessary information, as well as to plan and conduct analytical, model and experimental studies of catalytic processes involving organic compounds.	5

8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	4

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

Course Contents

Week	Chapter	Topics	Exam
1	p.1-13 [1]	The ancients: fire and stone, metals, 363urop "Elements'', 363urop "Atoms".	
	p.15-29 [1]	Alchemy. Alexandria. The arabs. Revival in 363urope. The end of alchemy.	
3	p.34-43 [1]	Transition. Measurement. Boyle's law. The new view of elements. Phlogiston.	
	p.49-61 [1]	The gases. Carbon dioxide and nitrogen. Hydrogen and oxygen. The triumph of measurement. Combustion.	
5	p.70-88 [1]	Atoms. Proust's law. Dalton's theory. Avogadro's hypothesis. Weights and symbols. Electrolysis.	
	p.93-100 [1]	Organic chemistry. The breakdown of vitalism. The building blocks of life. Isomers and radicals.	
7			Midterm
8	p.106-119	Molecular structure. The theory of types. Valence. Structural formulas. Optical isomers. Molecules in three dimensions	
	p.1240140 [1]	The periodic table. Elements in disorder. Organizing the elements. Filling the gaps. New elements by groups.	
10	p.146-164 [1]	Physical chemistry. Heat. Chemical thermodynamics. Catalysis. Ionic dissociation. More on gases.	
	p.168-182 [1]	Synthetic organic chemistry. Dyes. Drugs. Proteins. Explosives. Polymers.	
12	p.189-197 [1]	Inorganic chemistry. The new metallurgy. Nitrogen and fluorine. Inorganic-organic borderland.	

	p.201-209 [1]	Electrons. Cathode rays. The photoelectric effect. Radioactivity.	
14	p.214-232 [1]	The nuclear atom. Atomic number. Electron shells. Resonance. Half-life. Isotopes	
	p.239-249 [1]	Nuclear reactions. The new transmutation. Artificial radioactivity. Transuranium elements. Nuclear bombs.	
16			Final

Recommended Sources

TEXTBOOK(S)

1. A Short History of Chemistry, Isaac Asimov, 1965, Publisher: Anchor (Doubleday)

p.279

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminar	0%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-oral exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan Ministry of Education for Undergraduate Studies

CoursePolicies

- Attendance of the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students cannot use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations

ECTS allocated based on Student Workload

Activities	**Number**	**Duration (hour)**	**Total Workload (hour)**
Course duration in class	14	1	14

Tutorials	4	1	4
Presentation	1	5	5
Midterm examination	1	3	3
Self study	7	3	21
Preparation for midterm exam	1	5	5
Final examination	1	3	3
Preparation for final exam	1	5	5
Total workload			**60**
Total workload/30(h)			**60/30**
ECTS Credit of the Course			**2**

Chemical engineering (CHEN) master program, "Technology of organic substances and high molecular compounds" department

Course Unit Title	**Synthetic detergent technology**
CourseUnitCode	ENG 3010
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	8
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	1
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Narmina Guliyeva
Name of Lecturer (s)	Narmina Guliyeva
Name of Assistant (s)	-
Mode of Delivery	Face to Face, laboratory, Seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-
Course description:	

The majority of chemical and technological processes are catalytic processes, and the effectiveness of chemical processes - product output, selectivity of the target product, and the rate of raw material conversion - depends on the correct choice of the highly utilized catalyst.
Objectives of the Course: - to give knowledge about the basic organic and catalysts used in petrochemical synthesis processes; - to give basic knowledge about the types of raw materials used for the preparation of basic organic and catalysts used in petrochemical synthesis processes; - to acquaint the types of catalytic processes with the main indicators characterizing the catalyst.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	must know Anionic Surfactant Production Technology	1, 3, 5
2	must be able to separate the surface substance and the environment	1, 2, 3, 5
3	must know the technology for the production of synthetic detergents	1, 2, 3, 4, 5
4	should know the technology of production of alkyl sulfates	1, 3, 4, 5
5	should know the technology of production of alkyl sulfonates	1, 3, 4, 5

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm, 4.Laboratory, 5.Quiz

Course's Contribution to Program

		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	4
3	Ability to summarize, formulate, and solve complex problems related to the chemistry, technology, and research of the properties of organic compounds and industrial products based on them.	5
4	Ability to apply modern methods to solve scientific problems and develop new scientific research in the field of synthesis and modification of the properties of organic compounds.	5
5	Ability to develop concepts and scientific-technological solutions in the field of petrochemical and basic organic synthesis.	5

6	Ability to use creativity to develop new and improved methods of utilization of waste of petrochemical and organic synthesis, as well as methods of effective use of renewable energy sources.	5
7	The ability to identify, find and provide the necessary information, as well as to plan and conduct analytical, model and experimental studies of catalytic processes involving organic compounds.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	4
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	4

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

Course Contents

Week	**Chapter**	**Topics**	**Exam**
1	p.1-50 [1]	Soap, fatty acids and synthetic detergents Sem : Soap, fatty acids and synthetic detergents	
2	p.51-56 [1]	Detergent components **Laboratory work 1**. Methods of analysis of the obtained products (Determination of the class of surfactants) The laboratory work will utilize the following equipment and materials: surfactants, distilled water, alcohol solution of potassium hydroxide, methylene blue, carbon tetrachloride or chloroform, dividing funnel, measuring flasks. The laboratory work will provide an insight to the phyco-chemical aspects of washing process. The method is based on the redistribution of the methylene blue dye in the water-chloroform layer when the test substance is added.	
3	p.57-65 [1]	Surfactants Sem : Detergent components Surfactants	

4	p.66-68 [1]	Builders **Laboratory work 2.** Definition of foaming surfactant abilities The laboratory work will utilize the following equipment and materials: investigated surfactant, distilled water, dividing funnel, measuring cylinders. During the laboratory work students will performs series of tests, and according to the results will plot a graph of the dependence of the height of the foam column on time.	
5	p.69-84 [1]	Raw materials Sem : Builders , materials	
6	p.85-115 [1]	Analysis and testing **Laboratory work 3.** Determination of surface tension of surfactant solutions by the method of maximum air bubble pressure (Rebinder method): The laboratory work will utilize the following equipment and materials: surfactants, distilled water, dividing funnel, measuring flasks, stopwatch. During the laboratory work students will performs series of tests in order to determine surface tension of surfactant solutions. The method consists in measuring the pressure at which the separation of air bubbles occurs, blown through a capillary lowered into a solution of the surfactant under study.	
7			Midterm
8	p.116-126 [1]	Synthetic detergents **Laboratory work 4.** Determination of free maleic anhydride The laboratory work will utilize the following equipment and materials: surfactants, distilled water, alcohol solution of potassium hydroxide, phenolphthalein, carbon tetrachloride alcohol-toluene mixture, dividing funnel, measuring flasks, water bath. During the laboratory work students will performs series of tests in order to determine the amount of free maleic anhydride in solution. They will also apply	

		analytical methods like titration in the presence of phenolphthalein.	
9	p.127-136 [1]	Manufacture of acid slurry Sem : Manufacture of soap	
10	p.137-150 [1]	Manufacture of soap **Laboratory work 5.** Determination of acid number The laboratory work will utilize the following equipment and materials: surfactants, distilled water, alcohol solution of potassium hydroxide, phenolphthalein, alcohol-toluene mixture, dividing funnel, measuring flasks, water bath. During the laboratory work students will performs series of tests in order to determine the acid number. They will also apply analytical methods like titration in the presence of phenolphthalein and calculate the acid number by resembling equation.	
11	p.151-161 [1]	Technology of surfactants Sem : Polymeric surfactants	
12	p.162-208 [1]	Polymeric surfactants **Laboratory work 6.** Determination of saponification value The laboratory work will utilize the following equipment and materials: cationic surfactant, distilled water, alcohol solution of potassium hydroxide, phenolphthalein, hydrochloric acid solution, dividing funnel, conical flasks, water bath. During the laboratory work students will performs series of tests in order to determine the saponification value. They will also apply analytical methods like titration in the presence of phenolphthalein and calculate the saponification value by resembling equation. The essential number of the product under study is calculated as the difference between the saponification number and the acid number.	
13	p.209-222 [1]	Important physico-chemical characteristics of surfactants Sem : Manufacture of synthetic detergents	
14	p.223-250 [1]	Manufacture of synthetic detergents	

		Laboratory work 7. Colorimetric determination of cationic surfactant using the methyl orange indicator The laboratory work will utilize the following equipment and materials: dividing funnel, measuring flasks, fiberglass, fiberglass tube, clean cuvette, basic solution of cetyldimethylbenzylammonium chloride, standard CDMBAC solution, methyl orange, buffer solution. During the laboratory work students will performs colorimetric determination of cationic surfactant using the indicator. A calibration graph is constructed in the coordinates: the content of surfactants in solution (mg or mg / l) – optical density.	
15	p.251-257 [1]	Detergent soap and additives Sem : Manufacture of synthetic detergents	
16			Final

Recommended Sources

TEXTBOOK(S)

1. Modern technology of acid slurry, surfactants, soap and detergents with formulae. EIRI board of consultants & engineers paperback – 2011 by EIRI

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	10%	
Quiz	10%	
Seminar	0%	
Laboratory	10%	
Midterm Exam	20%	Written Exam
Final Exam	50%	Written-oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan State Oil and Industry University for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.

• Late assignments will not be accepted unless an agreement is reached with the lecturer. • Students cannot use calculators during the exam. • Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industrial University General Student Discipline Regulations
ECTS allocated based on Student Workload

Activities	**Number**	**Duration (hour)**	**Total Work load (hour)**
Course duration in class	**14**	**4**	**56**
Presentation	1	22	22
Tutorials	14	2	28
Self –study	14	6	84
Midterm Examination	1	3	3
Preparation for midterm exam	1	20	20
Final Examination	1	3	3
Preparation for final exam	1	24	24
Total Workload			**240**
Total Work load/30(h)			**240/30**
ECTS Credit of the Course			**8**

Azerbaijan State Oil and Industry University

Chemical Engineering Program

MODULE DESCRIPTION FOR GRADUATION PROJECTS

“Industrial technology of inorganic substances” specialization

Course unit title	**MASTER THESIS**
Course unit code	**MT 4201**
Type of course unit	Compulsory
Level of course unit	Master
Year of study	1-2nd years
Semester/trimester when the course unit is delivered	2-4th semesters
Number of ECTS credits allocated	18
Workload	540 hrs.: Attendance: 106 hrs; Self-study: 434 hrs.
Class information	Office hours: upon appointment Contact:
Learning outcomes of the course unit	Description: The aim of the course is to develop the ability to conduct and report scientific researches by integrated and advanced independent work. The ability to make scientific research includes the ability to identify problems, collect relevant information, formulate problems, and solve them with the aid of scientific methods. To do this, many skills are required, such as knowledge in chemistry and chemical technology, and the ability to recognize and treat problems from different perspectives. The ability to report scientific work means being able to write lucid and interesting reports, as well as making oral presentations. Both the work itself and how it is presented should be adapted to the problem and the user. Learning outcomes: After completion of the thesis the master should be able to: • understand different science-theoretical, engineering and methodological starting-points • independently and critically examine different theoretical and empirical phenomena • discover and handle problems and alternatives considering different perspectives and methodological frames of reference • execute, in practice, scientifically based surveys, researches and engineering calculations

	• present arguments orally and in writing in an objective, interesting, and convincing manner.

Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate and research complex problems regarding with chemistry, technology and research of properties of ceramic, glass and binding composite materials, refractories, inorganic compounds and mineral fertilizers.	5
4	Ability to apply innovative methods based on key principles of nanochemistry and membrane technology to problem-solving of scientific and technological character.	5
5	Ability to develop concepts and scientific-technological solutions in the field of electrochemical technology, processing of mineral raw materials and water treatment.	5
6	Ability to utilize creativity in elaborating new and inventive products, processes and methods of utilization of solid waste in metallurgy and other areas of inorganic substances manufacturing.	5
7	Ability to identify, find, and provide necessary information, as well as, plan and conduct analytical, model and experimental investigations of inorganic substances and composite materials particularly in the field of catalysts and adsorbents synthesis with further studying their activity.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	5
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	4

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)	
Mode of delivery	Face-to-face
Prerequisites and co-requisites	All compulsory courses of the programme Permission from Supervisor and Head of department
Grading system:	The grading scale comprises FD, DD, DC, CC, CB, BB, BA and AA grades. To obtain the AA or BA grades the student must fulfill all the learning outcomes. To obtain BA, BB or CB grades the thesis should also be characterized by excellent theoretical, methodological and analytical qualities. To obtain FD, DD, DC or CC grades the thesis should be characterized by not high theoretical, methodological and analytical qualities.
Assessment:	Students'performance in the course will be evaluated mainly on the basis of the final thesis, but thesis defence are also taken into account. In order to pass the Master's Thesis course, students need to complete all compulsory course elements and to hand in an approved thesis within the prescribed time limit.
Thesis Supervisor and Committee	Students should consult with appropriate professor or professors whose expertise relates most closely to the proposed topic concerning the feasibility of the topic and the willingness of the professor or professors to direct the thesis. Head of department assists in identifying potential thesis supervisors. At the end of the first semester supervisors of selected projects are assigned for each master. This document is signed by dean of master department, vice-rector on academic affairs and approved by rector.
Thesis Proposal	Master select the project from the list offered by the departments during the first semester. Then the list of selected projects with the masters' names are signed by dean of master department, vice-rector on academic affairs and approved by rector of the University at the end of the first semester.
Academic Integrity	The University takes cheating and plagiarism seriously, and disciplinary action will be taken against any master suspected of being involved in any sort of cheating and/or plagiarism. The disciplinary action takes the form of warnings or limited suspensions. Plagiarism is taking someone else's work and passing it off as your own. Plagiarism includes taking phrases, sentences, or paragraphs from someone else's writing and using them in your own writing without providing true attribution of their source. Avoiding plagiarism, of course, does not mean neglecting to conduct solid research. It is appropriate to read what scholars and experts have written about an issue before you form your own conclusions about it. However, you must ensure that you

	understand the literature. At a minimum, masters should rephrase the literature's content, rather than quoting it verbatim. This practice also helps to ensure student understanding of the issue, as you cannot write intelligently unless you know your subject. Another way to avoid plagiarism is to ensure that you utilize a large number of sources, so that your knowledge goes beyond that of any particular book or article. The internet now provides masters with the opportunity to purchase term papers or otherwise copy someone else's work. Turning in any work that is not your own is a violation of academic integrity.
Language of instruction	English
Defense:	Mandatory thesis defense will be open to all faculty from all institutions, some of whom may participate via teleconferencing or other media. Masters will briefly present their work (15 minutes), followed by a question-and-answer session, during which anyone in attendance may pose questions to the presenting team. Questions may relate to the thesis or to general knowledge that should have been obtained in the Chemical Engineering program. With the permission of the masters, videotapes of the defenses will be made, so that those unable to participate during the session may see the results.
Plagiarism check	All the theses are to be checked through "StrikePlagiarism" Program
Week 1 (or earlier)	Prepare work schedule. Meet with supervisor and if necessary with head of the department Begin scientific work
Week 2-15	Preparing of survey on technical publications for last 10-15 years Preparing of elements of laboratory facility for the conducting of researches.
Week 16-30	Conducting of scientific researches and analysis Participation in scientific conferences or publication of research paper
Week 31-38	Completion of scientific researches and preparing of thesis draft Participation in scientific conferences
Week 39-45	Completion of thesis preparing, revising of thesis draft and initial defense
Week 46-49	Final State Attestation
Week 49	Present thesis into archive

“Technology of oil refining” specialization

Course unit title	**MASTER THESIS**
Course unit code	**MT 4201**
Type of course unit	Compulsory
Level of course unit	Master
Year of study	1-2nd years
Semester/trimester when the course unit is delivered	2-4th semesters
Number of ECTS credits allocated	18
Workload	540 hrs.: Attendance: 106 hrs; Self-study: 434 hrs.
Class information	Office hours: upon appointment Contact:
Learning outcomes of the course unit	Description: The aim of the course is to develop the ability to conduct and report scientific researches by integrated and advanced independent work. The ability to make scientific research includes the ability to identify problems, collect relevant information, formulate problems, and solve them with the aid of scientific methods. To do this, many skills are required, such as knowledge in chemistry and chemical technology, and the ability to recognize and treat problems from different perspectives. The ability to report scientific work means being able to write lucid and interesting reports, as well as making oral presentations. Both the work itself and how it is presented should be adapted to the problem and the user. Learning outcomes: After completion of the thesis the master should be able to: • understand different science-theoretical, engineering and methodological starting-points • independently and critically examine different theoretical and empirical phenomena • discover and handle problems and alternatives considering different perspectives and methodological frames of reference • execute, in practice, scientifically based surveys, researches and engineering calculations

	• present arguments orally and in writing in an objective, interesting, and convincing manner.

Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate and solve complex problems related to the technology and research of the properties of alterative and conventional fuels, lubricants and additives, taking into account production safety issues.	5
4	Ability to apply modern analytical methods to solve scientific problems and to develop new scientific methods in the field of chemistry of petroleum and oil products.	5
5	Ability to develop design and scientific-technological solutions in the field of design, modeling and optimization of refining and petrochemical processes, as well as apply the acquired knowledge to improve the management system of the oil refining industry.	5
6	Ability to use creativity to develop new and improved methods of separation and extraction processes used in processing of petroleum and oil products, as well as methods of heat recovery of production processes.	5
7	Ability to identify, find and provide necessary information, as well as plan and conduct analytical, modeling and experimental research in the field of catalytic and non-catalytic processes of oil and petroleum products refining.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	5
10	Ability to use the foreign language skills to obtain needful information of scientific and technical character and also to prepare of research and review articles, conference materials and master thesis. Ability to use the foreign language to prepare presentations and in oral speech.	4
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Mode of delivery	Face-to-face
Prerequisites and co-requisites	All compulsory courses of the programme Permission from Supervisor and Head of department
Grading system:	The grading scale comprises FD, DD, DC, CC, CB, BB, BA and AA grades. To obtain the AA or BA grades the student must fulfill all the learning outcomes. To obtain BA, BB or CB grades the thesis should also be characterized by excellent theoretical, methodological and analytical qualities. To obtain FD, DD, DC or CC grades the thesis should be characterized by not high theoretical, methodological and analytical qualities.
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Week 39-45	Completion of thesis preparing, revising of thesis draft and initial defense
Week 46-49	Final State Attestation
Week 49	Present thesis into archive

“Technology of petrochemical synthesis” specialization

Course unit title	**MASTER THESIS**
Course unit code	**MT 4201**
Type of course unit	Compulsory
Level of course unit	Master
Year of study	1-2nd years
Semester/trimester when the course unit is delivered	2-4th semesters
Number of ECTS credits allocated	18
Workload	540 hrs.: Attendance: 106 hrs; Self-study: 434 hrs.
Class information	Office hours: upon appointment Contact:
Learning outcomes of the course unit	<u>Description:</u> The aim of the course is to develop the ability to conduct and report scientific researches by integrated and advanced independent work. The ability to make scientific research includes the ability to identify problems, collect relevant information, formulate problems, and solve them with the aid of scientific methods. To do this, many skills are required, such as knowledge in chemistry and chemical technology, and the ability to recognize and treat problems from different perspectives. The ability to report scientific work means being able to write lucid and interesting reports, as well as making oral presentations. Both the work itself and how it is presented should be adapted to the problem and the user. <u>Learning outcomes:</u> After completion of the thesis the master should be able to: • understand different science-theoretical, engineering and methodological starting-points • independently and critically examine different theoretical and empirical phenomena • discover and handle problems and alternatives considering different perspectives and methodological frames of reference • execute, in practice, scientifically based surveys, researches and engineering calculations

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Course's Contribution to Program		
		CL
1	Ability to demonstrate well-developed erudition of chemistry, mathematical-scientific and engineering principles of chemical engineering.	5
2	Ability to analyse and solve extraordinary or partly determined problems scientifically revealing contesting specifications, as well as defend the advanced scientific propositions.	5
3	Ability to summarize, formulate, and solve complex problems related to the chemistry, technology, and research of the properties of organic compounds and industrial products based on them.	5
4	Ability to apply modern methods to solve scientific problems and develop new scientific research in the field of synthesis and modification of the properties of organic compounds.	5
5	Ability to develop concepts and scientific-technological solutions in the field of petrochemical and basic organic synthesis.	5
6	Ability to use creativity to develop new and improved methods of utilization of waste of petrochemical and organic synthesis, as well as methods of effective use of renewable energy sources.	5
7	Ability to identify, find and provide the necessary information, as well as to plan and conduct analytical, model and experimental studies of catalytic processes involving organic compounds.	5
8	Ability to systematize and systematically unify knowledge of different areas of science, cope with the complexity and also ability to assess of applied research methods and their limits in accordance with relevant laws, regulations, standards, methods and guidelines.	5
9	Ability to function efficiently as a team leader being composed of different countries, disciplines and levels representatives.	5
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Mode of delivery	Face-to-face

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