CHEMICAL ENGINEERING MODULE DESCRIPTIONS

Chemical engineering (CHEN) program, "Foreign languages-2" department

Course Unit Title	English I
Course Unit Code	ENGL 1101
Type of Course Unit	Compulsory
Level of Course Unit	1st year CHEN program
National Credits	0
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	0
Practice (hour/week)	3
Laboratory (hour/week)	0
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	Sevil G. ALIYEVA
Name of Lecturer (s)	-
Mode of Delivery	Seminar, Face to face teaching
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	Elementary English level grammar, reading, writing and listening skills.

Course description:

ENGL 1101 provides students with pre-intermediate level structure and vocabulary, as well as cultural knowledge that is necessary for effective communication in this language. The Structures class focuses on acquiring knowledge of English grammar and the practical ability to apply this knowledge in oral and written discourse. The Communicative part is devoted to gaining practical competence in English by means of exercises in conversation, oral presentation, comprehension of texts, and writing skills. Students will be encouraged to read a variety of texts as well as chapters from textbooks so that they can pursue their undergraduate studies at the university without major difficulty. This module includes conversations, texts, letters, forms, tests and so on. The exercises fulfil a number of purposes. They reinforce and consolidate what has been heard, said, written and seen, thus teaching four main skills of language: listening, speaking, reading and writing. The course is designed to improve the students' presentation ability. At the end of the course they are expected to do an oral presentation.

Objectives of the Course:

This course aims to bring the students to a level that will enable them fulfil the requirements of main courses of their departments.

English -1 is aimed to:

- improve and update their English language productive skills;
- get new ideas and explore current issues in the English language;
- acquaint students with some writing skills to apply in their social life;
- develop Reading and Listening skills;
- provide opportunities for students to work in teams in order to develop their Speaking skills;
- provide students with language knowledge and skills which are essential for general communication purposes and help students develop positive attitudes towards the target foreign language;

- lead students to deliver oral presentations in order to enhance cooperation.

Learning Outcomes

At the end of the course the student should be able to:		Assessment
1	Focus on language functions and structures;	1,2,3,4
2	Use pre-intermediate level of target language grammar and vocabulary in discussions and talks;	3,4
3	Write simple connected text on topics;	1,2,4
4	Understand the main points of clear standard speech;	1,4
5	develop pre-intermediate level reading, writing, listening, speaking, and presentation skills in the target language;	1,2,3,4
6	Identify, find and analyse information that's needed for a particular task;	4
7	Translate intermediate and upper intermediate level texts into native language;	4
8	work cooperatively in teams and small groups.	4

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	1
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	2
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	2
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	3
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	3
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	5
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3

9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	4

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

Course Contents

Week	Chapter	Topics	Exams
1	[1] Unit 1A,1B; pp.4-7	Reading: Who is who? Grammar spot: Word order. Present simple. Speaking and Listening exercises.	
1	[1] Unit 1C pp.8-9	Reading: At the Moulin Rouge. Grammar spot: The Present Continuous. Speaking and Listening exercises	
2	[1] Unit 1D pp,10-11	Reading: Devil's dictionary". Grammar spot: Defining relative clauses. Speaking and Listening exercises.	
3	[1] Unit 1 pp. 12-15	Practical English: at the airport. Writing: describing yourself. Revise and check: What do you remember? What can you do?	
3	[1] Unit 2A pp.16-17	Reading: Right places, wrong time. Grammar spot: Past simple regular and irregular verbs. Speaking and Listening exercises.	
4	[1] Unit 2B pp.18-19	Reading: A moment in time. Grammar spot: Past continuous. Speaking and Listening exercises.	
5	[1] Unit 2C pp.20-21	Reading: Fifty years of pop. Grammar spot: Questions with and without auxiliary. Speaking and Listening exercises.	
5	[1] Unit 2D pp.22-23	Reading: One October evening. Grammar spot: so, because, but, although. Speaking and Listening exercises.	
6	[1] Unit 2 pp.24-27	Practical English: at the conference hotel. Writing: the story behind a photo. Revise and check: What do you remember? What can you do?	
7	[1] Unit 3A pp.28-29	Reading: Where are you going? Grammar spot: going to, Present continuous. Speaking and Listening exercises.	

7	[1] Unit 3B pp.30-31	Reading: The pessimist's phrase book. Grammar spot: will/won't predictions). Speaking and Listening exercises.	
8			Midterm exam
9	[1] Unit 3C pp.32-33	Reading: I will always love you. Grammar spot: will /won't (promises, offers, decisions). Speaking and Listening exercises.	
9	[1] Unit 3D pp.34-35	Reading: I was only dreaming. Grammar spot: review of tenses: present, past and future. Speaking and Listening exercises.	
10	[1] Unit 3 pp.36-39	Practical English: restauraant problems. Writing: an informal letter. Revise and check: What do you remember? What can you do?	
11	[1] Unit 4A pp.40-41	Reading: From rag to riches. Grammar spot: Present perfect (experience) + ever, never; Present perfect and Past simple. Speaking and Listening exercises.	
11	[1] Unit 4B pp.42-43	Reading: Family conflict. Grammar spot: Present perfect simple + yet, just already. Speaking and Listening exercises.	
12	[1] Unit 4C pp.44-45	Reading: Faster, faster. Grammar spot: comparative. As…..as,/less…..than. Speaking and Listening exercises.	
13	[1] Unit 4D pp.46-47	Reading: The world's friendliest city. Grammar spot: superlative (+ ever+ present perfect). Speaking and Listening exercises.	
13	[1] Unit 4 pp.48-51	Practical English: lost in San Francisco. Writing: describing where you live. Revise and check: What do you remember? What can you do?	
14	[1] Unit 5A pp.52-53	Reading: Are you party animals? Grammar spot: uses of the infinitive (with" to"). Speaking and Listening exercises.	
15	[1] Unit 5B pp.54-55	Reading: What makes you feel good? Grammar spot: verb + ing. Speaking and Listening exercises.	
16			Final exam
Recommended Sources			

1. Clive Oxenden, Christina Latham-Koenig, Paul Seligson - New English File (Pre-intermediate Student's book and Work book), Oxford University Press, 2010

Supplementary Course Material:

1. John Eastwood, Oxford Practice Grammar-Intermediate, Oxford, 2009
2. Tom Hutchinson. English for Life, Oxford Press,2010
3. Michael McCarthy, Felicity O'Dell. English Vocabulary in use, Second Edition. Oxford Press,2010
4. Raymond Murphy. Essential Grammar in Use, Cambridge University Press, 2013
5. Stuart Redman, English Vocabulary in Use. Pre-intermediate. Cambridge. 2002

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	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 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.
- 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
Tutorials	14	1	14
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	30	30
Total Workload			**180**
Total Workload/30(h)			**180/30**
ECTS Credit of the Course			**6**

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

Course Unit Title	General Chemistry I
Course Unit Code	CHEM 1101
Type of Course Unit	Compulsory
Level of Course Unit	1st year CHEN program
National Credits	0
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	0
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	Minira M. Aghahuseynova
Name of Lecturer (s)	Minira M. Aghahuseynova
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

Historical development of chemistry science. Matter and measurements. Classification of inorganic compounds. Electronic structure of atom and molecule. Atomic properties and Periodic table. The main Laws of chemistry. Bonding Theory. Hybridization of AO. Classification and nomenclature of complex compounds. Bases of Thermodynamics.

Objectives of the Course:

The aim of the subject is formation of real comprehension of the world- scientific view of contemporary theories based on interrelation of nature laws and phenomena, systematization and deepening of students' knowledge in the field of chemistry. The main goal of the subject in the process of training is to master theoretical and practical basis of analytical chemistry for its application in solution of various ecological problems, analysis of water, seil, air and in chemical technology industry.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Define principal chemical concepts. Explain chemical composition and gas laws.	1
2	Name the inorganic compounds.	1,2,3
3	Explain unit systems. Explain basic and derivative quantities.	1

4	Solve problems with the help chemical reactions. Define Chemical reactions. Compose reaction stoichiometry.	1
5	Explain Periodic table and properties of elements. Explain the properties of matter and chemical bonds by using electron configurations.	1,2
6	Define internal energy, state functions and Laws of thermodynamics.	1,3

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	5
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	4
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	4
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	3
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	2

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

Course Contents

Week	Chapter	Topics	Exam
1	[1]: Chapter 2, s: 4-40	Chemistry: Matter and measurement	
2	[1]: Chapter 1, s: 26-53	Atoms. Molecules and ions. Chemical and physical properties. Seminar 1: General consepts and stoichiometric laws of chemistry.	
3	[1]: Chapter 3, s:68-78	Stoichiometry: Chemical Calculations; Chemical reactions in aqueous solutions.	

4	[1]: Chapter 1, s:14-26	The main laws of chemistry. Seminar 2: Main concepts of quantum theory. Quantum numbers. Electron energy. Filling of energy levels and sublevels.	
5	[1]: Chapter 3, s:84-110	Atomic structure. Explaining the properites of elements.	
6	[1]: Chapter 3, s:110-133	Electron configurations, atomic properties and Periodic table. Seminar 3: Contemporary approaches to Mendeleev's periodic law. Energetic characteristic of atoms.	
7			Midterm
8	[1]: Chapter 4, s:140-167	Chemical bonds Seminar 4: Types of chemical bonds. Types of molecular interaction. Donor-acceptor bond.	
9	[1]: Chapter 5, s:192-239	Bonding Theory and Molecular structure.	
10	[1]: Chapter 5, s:208-222	Hybridization of atomic orbitals Seminar 5: Hybridization of atomic electron orbitals	
11	[2]: Chapter 23, s:737-770	Complex compounds. Verner's theory.	
12	[1]: Chapter 23, s:1056-1071	Classification and nomenclature of complex compounds Seminar 6: Coordination theory of Werner. The structure of complex compounds.	
13	[1]: Chapter 6, s:248-261	State of matter and Intermolecular forces.	
14	[2]: Chapter 17, s:530-572	Thermodynamics Seminar 7: Energy of chemical process.	
15	[1]: Chapter 9, s:372-413	Thermochemistry.	
16			Final

Recommended Sources

TEXTBOOK(S)

1. Thomas R. Gilbert, Rein V. Kirss, Natalie Foster, Stacey Lowery Bretz, Chemistry. An Atoms-Focused Approach (Second Edition) W.W.Norton@Company, London, 2018. p.1256 .
2. Catherine E.Housecroft, Edüin C.Constable, Chemistry, Prentice Hall, Upper Saddle River, United States, 2005, p.1316.

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 Workload(hour)
Course duration in class	**14**	**3**	**42**
Presentation	1	10	10
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
Self-study	14	5	70
Total Workload			**180**
Total Workload/30(h)			**180/30**
ECTS Credit of the Course			**6**

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

Course Unit Title	Introduction to laboratory safety & hazardous materials
Course Unit Code	LAB 1101
Type of Course Unit	Compulsory
Level of Course Unit	1 st year CHEN program
National Credits	0
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	1
Course Coordinator	Leyla Z.Vezirova
Name of Lecturer (s)	Leyla Z.Vezirova
Name of Assistant (s)	-
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

Practicing safe science is an essential and fundamental responsibility of every laboratory worker. In this course, we will examine some common laboratory procedures, the hazards associated with these procedures, personal protective equipment that can be used to minimize associated with the laboratory accidents and emergency equipment that can be used in the event of specific types of laboratory accidents. In order to assure consumer safety and product quality, the biomedical and pharmaceutical industry is regulated by various government agencies. Compliance with the regulations and guidelines set forth buy these agencies is essential for successful product development, licensing and marketing. Therefore, we will examine some of the predominant regulations and the enforcing agencies.

Objectives of the Course:

Students should know more about lab safety culture, precautionary labels, Material Safety Data Sheets, using personal protective equipment, handling lab equipment safely, handling , storing and disposing of chemicals safely, using emergency equipment as well as safety planning.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	An understanding of Chemical Labeling & Safety. Demonstrate safe handling of chemicals and equipment in the laboratory	1,3

2	An understanding of Good Lab Practice, Good Manufacturing Practice & Fire Safety Demonstrate knowledge of Good Laboratory Practices (GLPs), Good Manufacturing Practices (GMPs) and Fire Safety	1,2,3
3	Ability to analyze Regulatory Agencies Demonstrate familiarity with international and federal regulatory agencies that impact the work of Biotechnology	2,3
4	An understanding of Emergency Equipment & Standard Operating Procedures Recognize and maintain various PPE and emergency equipment in a laboratory setting as well as evaluating Standard Operating Procedures (SOPs) and safety plans.	2,3
5	Understand and exercise professional and ethical norms.	1,3
Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm exam		

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	4
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	3
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	4
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	4
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents			
Week	Chapter	Topics	Exam
1	[2] c.1, p.1.3-1.45	Introduction to the course: The Business of Biotechnology: The Transformation of Knowledge into Products	
2	[3] ch.2, p.9-35	The Lifecycle of Pharmaceutical Products **Semnar: Introduction to the course: The Business of Biotechnology: The Transformation of Knowledge into Products**	
3	[3] ch.4, p.59-85	Introduction to Product Quality Systems. Biotechnology and the Regulation of Medical Food Products.	
4	[3] ch.9, p.74-90	Documentation **Seminar: Biotechnology and the Regulation of Medical Food Products. Documentation**	
5	[3] ch.11, p.103-190	Quality Systems in the Production Facility. Quality Systems in the Laboratory	
6	[2] ch.7, p. 7.4-7.91 [2] ch.8, p. 8.3-8.39	Minimizing, controlling, and managing hazards. Chemical management: inspections, storage, wastes, and security. **Seminar: Quality Systems in the Production Facility. Quality Systems in the Laboratory, Chemical management: inspections, storage, wastes, and security.**	
7			Midterm
8	[3] ch.21, p.157-165	GMP , Quality Control/Quality Assurance Manager,	
9	[2] ch.2, p. 2.3-2.37	Fire Safety. Introduction to a Safe Workplace. **Seminar: GMP, Fire Safety**	
10	[2] ch.1, p. 1.3-1.45 [2] ch.3, p. 3.3-3.47	Working Safely in the Laboratory:	
11	[2] ch.5, p. 5.3-5.131	General Considerations and Physical Hazards. **Seminar: Working Safely in the Laboratory, General Considerations and Physical Hazards**	
12	[4] ch.2,3,4,5, p.25-160	Good Laboratory Practice (FDA/GLP Regulations, The Good Automated Laboratory Practices, Implementing GLPs in a Non-GLP Analytical Laboratory)	
13	[4] ch.6,7,8,9, p.167-240	Good Laboratory Practice (Controlling the Good Laboratory Practices Inspection Process, GLP Documentation, The FDA's GLP Inspection Program, The Future of the Good Laboratory Practice Regulations) **Seminar: GLP**	
14	[2] ch.1, p. 1.3-1.45	Working Safely with Chemicals	
15	[2] ch.4, p. 4.1-4.47	Working Safely with Toxic substances and Biological Agents **Seminar: Working safely with chemicals**	
16			Final exam
Recommended Sources **TEXTBOOK(S)**			

1. Martin Holtzhauer, Basic methods for the biochemical Lab,Springer, 2006.
2. Robert H., Hill J.R., David C., Laboratory safety fo chemistry students, Kindle Edition, 2005

Assessment

Attendance	0%	Less than 75% class attendance results in NA grade
Presentation	20%	k
Quiz	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 İndustry University for undergraduate studies

Course Policies

- Attendance of the course is mandatory.
- Material presented in the lecture as well as assigned readings will be included in testing.
- 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**	**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) program, "Chemistry and inorganic substances technology" department

Course Unit Title	General Chemistry Laboratory
Course Unit Code	LAB 1102
Type of Course Unit	Compulsory
Level of Course Unit	1st year CHEN program
National Credits	0
Number of ECTS Credits Allocated	4
Theoretical (hour/week)	0
Practice (hour/week)	0
Laboratory (hour/week)	2
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	Minira M. Aghahuseynova
Name of Lecturer (s)	Minira M. Aghahuseynova
Name of Assistant (s)	Leyla Vazirova
Mode of Delivery	Laboratory
Language of Instruction	English
Prerequisites	CHEM 1101 General Chemistry I
Recommended Optional Program Components	-

Course description:

Historical development of chemistry science. Matter and measurements. Classification of inorganic compounds. Electronic structure of atom and molecule. Atomic properties and Periodic table. The main Laws of chemistry. Bonding Theory. Hybridization of AO. Classification and nomenclature of complex compounds. Bases of Thermodynamics.

Objectives of the Course:

The aim of the subject is formation of real comprehension of the world- scientific view of contemporary theories based on interrelation of nature laws and phenomena, systematization and deepening of students' knowledge in the field of chemistry. The main goal of the subject in the process of training is to master theoretical and practical basis of chemistry for its application in solution of various ecological problems, analysis of water, seil, air and in chemical technology industry.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Recognise the laboratory environment. Name laboratory equipments. Describe how they securely/safely work with these equipment	1
2	Express theoretical knowledge of chemistry with experimental methods.	1,4
3	Express reaction products in terms of stoichiometric relations.	1,3,4

4	Interpret and report results of experiments.	3,4
5	Collect and report datas of experiments. Report results in a proper format.	1,3

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	5
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	4
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	4
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	3
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	2

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.43-55	**Familiarization with common laboratory equipment and safety rules**.	
2	[1] Chapter 2, p.91-103	**Accuracy and Precision of Laboratory Glassware** The purpose of this experiment is to practice using various types of volume measuring apparatus, focusing on their uses, accuracy and precision.	
3	[1] Chapter 4, p.149-161	**Accuracy and Precision of Laboratory Glassware** The purpose of this experiment is to practice using various types of volume measuring apparatus, focusing on their uses, accuracy and precision.	

4	[1] Chapter 5, p.173-181	**Test of ions** This experiment involves the qualitative analysis of solutions containing different ions. The presence of certain ions in an aqueous solution can be detected by making chemical tests. The common procedure for testing any unknown sample is to make its solution and test this solution with various reagents for the ions present in it. Testing with various reagents gives characteristic reaction of certain ions, which may be a colour change, a solid formation or any other visible changes. Several specific reactions will be carried out on solutions that will either separate the ions from each other or confirm the presence of one particular ion. The reactions that confirm the presence of a particular ion involve the creation of visible products such as precipitates or colored species. A reaction that results in a precipitation can also be used to separate ions from the solution.	
5	[1] Chapter 3, p.115-143	**Test of ions** This experiment involves the qualitative analysis of solutions containing different ions. The presence of certain ions in an aqueous solution can be detected by making chemical tests. The common procedure for testing any unknown sample is to make its solution and test this solution with various reagents for the ions present in it. Testing with various reagents gives characteristic reaction of certain ions, which may be a colour change, a solid formation or any other visible changes. Several specific reactions will be carried out on solutions that will either separate the ions from each other or confirm the presence of one particular ion. The reactions that confirm the presence of a particular ion involve the creation of visible products such as precipitates or colored species. A reaction that results in a precipitation can also be used to separate ions from the solution.	
6	[1] Chapter 11, p.377-385	**Obtaining of soap** Aim of this experiment prepare soap and compare properties of obtained soap to those of a commercial soap and a detergent.	
7	[1] Chapter 11, p.385-397	**Obtaining of soap** Aim of this experiment prepare soap and compare properties of obtained soap to those of a commercial soap and a detergent.	
8			Midterm
9	[1] Chapter 9, p.293-305	**Extraction of benzoic acid** Mixtures of compounds can be separated in many ways. Extraction is one of the most common and often used techniques in organic chemistry. It is a common way of separating a desired compound from a mixture. The separation is usually based on polarity differences of the target compound and other compounds in the mixture. Often, a chemical reaction is needed to alter the polarity of one of the components of the mixture. This type of separation is called a chemically active extraction.	
10	[1] Chapter 8, p.271-281	**Extraction of benzoic acid** Mixtures of compounds can be separated in many ways. Extraction is one of the most common and often used techniques in organic chemistry. It is a common way of separating a desired compound from a mixture. The separation is usually based on polarity differences of the target compound and other compounds in the mixture. Often, a chemical reaction is needed to alter the polarity of one of the components of the mixture. This type of separation is called a chemically active extraction.	
11	[1] Chapter 8, p.271-281	**Determining concentration of solution by titration** Develop and implement a protocol to accurately verify the active ingredient (acetylsalicylic acid) content of an aspirin tablet, by titration. To plot a graph of pH as a function of the volume of titrant added and generate a titration curve.	

12	[1] Chapter 7, p.207-219	**Determining concentration of solution by titration** Develop and implement a protocol to accurately verify the active ingredient (acetylsalicylic acid) content of an aspirin tablet, by titration. To plot a graph of pH as a function of the volume of titrant added and generate a titration curve.	
13	[1] Chapter 6, p.189-190	**Preparing solutions and defining their concentration.** Upon completion of this lab, the student should be able to ➢ Proficiently calculate molarities for solutions. ➢ Prepare a solution of known concentration. ➢ Prepare a dilute solution from a more concentrated one. ➢ Perform serial dilutions. ➢ Use a pipet and a volumetric flask	
14	[1] Chapter 6, p.190-199	**Preparing solutions and defining their concentration.** Upon completion of this lab, the student should be able to ➢ Proficiently calculate molarities for solutions. ➢ Prepare a solution of known concentration. ➢ Prepare a dilute solution from a more concentrated one. ➢ Perform serial dilutions. ➢ Use a pipet and a volumetric flask	
15	[1] Chapter 2, p.67-75	**Checking reports**	
16			Final

Recommended Sources

TEXTBOOK(S)

1. J.A.Beran, Laboratory manual for pronciples of general chemistry. 10th edition. Kindle. 2014

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	10%	
Laboratories	20%	
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 Workload(hour)
Course duration in class	**14**	**2**	**28**
Presentation	1	5	5
Midterm Examination	1	3	3
Preparation for midterm exam	1	10	10
Final Examination	1	3	3
Preparation for final exam	1	15	15
Tutorials	14	1	14
Self-study	14	3	42
Total Workload			**120**
Total Workload/30(h)			**120/30**
ECTS Credit of the Course			**4**

Chemical engineering program, "Physics" department

Course Unit Title	Engineering Physics I
Course Unit Code	PHYS 1101
Type of Course Unit	Compulsory
Level of Course Unit	1st year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
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	Jeyhun Naziyev
Name of Lecturer (s)	Jeyhun Naziyev
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Laboratory.
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	General physics

Course description:

Physics is a basic subject for many engineering specialties at Technical Higher Education Institutions. Physics laws and research methods are widely used in the teaching of many subjects, including material science, electrotechnical, power and heat engineering, chemical engineering and others. The development of any field of modern energetics is inextricably linked with physics. For this reason, the students to be supposed to have the ability to apply physics in chemical engineering.

Objectives of the Course:

During orientation you can expect to:

Learn more about your academic program.

Learn about why Computer Engineering and how to be familiar with that since

Schedule your first set of classes

Meet faculty, advisors, and current State students

Interact with fellow incoming students

Learn how to Ask Questions!

Learning Outcomes

At the end of the course the student should be able to		Assessment
1	explain the measurement technique.	1,3
2	describe the concepts of distance, mass and time.	1,2,3
3	convert the units of distance and mass used in different systems of unit.	1,3
4	determine the amount of error in calculations.	1,2,3

5	perform calculations related with vectors.	1,2
6	identify the coordinate systems.	1,2,3
7	specify the location of a body (or a point particle) in a coordinate system.	1,2,3
8	determine the direction of a vector.	1,2
9	explain the motion in one and two dimensions.	1,2
10	express the velocity of a particle as a function of time.	1,2
11	express the direction and the magnitude of the velocity.	1,2
12	express the concept of acceleration.	1,2
13	explain the relative motion of reference frames.	1,3
14	analyze the causes of motion.	1,3
15	express the inertial and non-inertial reference frames.	1,2
16	analyze the source of acceleration.	1,2,3
17	examine action and reaction principle.	1,2,3
18	Explain circular motion.	1,2,3
19	explain the energy and transfer of energy.	1,3
20	explain the concept of work.	1,2,3
21	express that the work done is a transfer of energy.	1,2,3
22	describe the difference in the energies of a particle due to its position and motion.	1,2
23	explain the linear momentum and the collision.	1,2,3
24	Explain the linear momentum.	1,2,3
25	explain the concept of conservation of momentum.	1,2,3
26	analyze the collisions in one and two dimensions.	1,2,3
27	analyze the rotational motion of a rigid body about a specified axis.	1,2,3
28	explain the concepts of angular position, angular velocity and angular acceleration.	1,2
29	relate the angular acceleration with angular velocity.	1,2
30	analyze the effect that causes rotation of bodies.	1,3
31	examine the rotation of bodies having different geometrical shape and mass, about a fixed axis.	1,2,3
21	analyze the rolling motion of a body.	1,2,3
33	explain the concept of equilibrium.	1,2,3
34	define the conditions for equilibrium.	1,2,3
35	explain the difference between the center of gravity and the center of mass.	1,2
36	explain the phases of matter.	1,2,3
37	define the pressure, Pascal's and Archimedes' Principles.	1,2,3
38	analyze fluids in motion and define the viscosity.	1,2,3
39	define the Equation of Continuity and Bernoulli's Equation.	1,2,3
Assessment Methods: 1. Written Exam, 2. Presentation, 3. Lab. Work		
Course's Contribution to Program		

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	5
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	5
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	2
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	4
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	2
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	5
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	2
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	3

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

Course Contents

Week	Chapter	Topics	Exam
1	[1], chap1, pgs3-11	Physics and Measurement: a) Standards of length, mass and time b) Dimensional analysis. c) Significant figures	
2	[1], chap3, pgs59-75	Vectors: a) Coordinate systems b) Vector and scalar quantities c) Some properties of vectors d) Components of a vector and unit vectors e) Multiplication of two vectors **Laboratory Work №1**. Determination of Young's modulus by bending method. ***Accessories:*** Device to determine the Young's modulus, calliper or micrometre, loads. In a device the rod with the load suspended in the centre of it is located on two vertical supports that are on a solid plate. One can calculate the numerical value of Young's modulus by measuring of rod bend for each weight.	
3	[1], chap2, pgs22-43	Motion in one dimension: a) Position, velocity and speed b) Instantaneous velocity and speed c) Acceleration d) Motion in one dimension with constant acceleration e) Freely falling objects	
4	[1], chap4, pgs78-111	Motion in two dimensions a) The position, velocity and acceleration vectors b) Two-dimensional motion with constant acceleration c) Projectile motion d) Uniform circular motion e) Tangential and radial acceleration f) Relative velocity and relative acceleration **Laboratory Work №2**. Study of the impact mechanism ***Accessories*:** Installation for the study of the impact mechanism. Considering the elastic collision of steel balls of equal masses are suspended on electricity conducting non-extensible threads, and taking the system as a closed, we can calculate the speed of the balls after the collision by applying	

		the momentum and energy conservation laws. In an elastic collision of balls the force of collision depends on the mass and speed and on the values characterizing the elastic properties of balls.	
5	[1], chap6, pgs150-161	Motion in three dimensions a) The position, velocity and acceleration vectors b) Two-dimensional motion with constant acceleration c) Projectile motion d) Uniform circular motion e) Tangential and radial acceleration f) Relative velocity and relative acceleration	
6	[1], chap7, pgs178-191	Work and Kinetic Energy: a) Work done by a constant force b) Work done by a variable force c) Kinetic energy and theorem of work-kinetic energy **Laboratory Work №3**. Determination of the free fall acceleration by turned pendulum. ***Accessories:*** Turned pendulum, stopwatch, ruler. Determination of acceleration of gravity with the help of the so-called turned pendulum is based on the property of reciprocity. Revolving pendulum consists of a metal rod longer than one meter, which has two parallel fixed near its ends bearing prisms, on which it may alternatively be suspended. Calculate the acceleration of free fall is going by measuring the oscillation periods when hanging pendulum on any of the prisms.	
7	[1], chap8, pgs191-237	Potential Energy and Conservation Of Energy a) Potential energy b) Conservative and neoconservative forces c) Conservative forces and potential energy d) Conservation of mechanical energy e) Work done by neoconservative forces f) Power	
8			MidTerm
9	[1], chap9, pgs247-277	Linear Momentum and Collisions: a) Linear momentum and conservation of linear momentum b) Impulse and momentum c) Collisions d) Elastic and inelastic collisions in one dimension e) Collisions in two dimensions f) Center of mass g) Motion of a system of particles **Laboratory Work №4**. Determination of the moment of inertia of the solids using a torsion pendulum. **Accessories:** torsional pendulum, loads of varying weight and shape, a stopwatch, an etalon cylinder, caliper. The same experiments are carried and periods of torsional pendulum, etalon body and study load are determined. With the help of these data the moment of inertia can be calculated.	
10	[1], chap10, pgs293-300	Rotation of a Rigid Object About a Fixed Axis: a) Angular position, velocity and acceleration b) Rotational kinematics: rotational motion with constant angular acceleration c) Angular and linear quantities	
11	[1], chap10, pgs300-316	Rotation of a Rigid Object About a Fixed Axis (Continues): d) Torque e) Rigid Object Under a Net Torque f) Calculation of moments of inertia g) Rotational Kinetic Energy h) Energy Considerations in Rotational Motion. Work, power and energy in rotational motion **Laboratory Work № 5**. Determination of moment of inertia by the method of falling. **Accessories**:Installation for determining of the moment of inertia, metallic hoop, stopwatch, Vernier calliper, ruler, loads of different masses. For rotation of disc the thin rope is wrapped around drum. This rope threw down from pulley and load attached to another end of rope. Falling because of gravity load pull the rope and rotate drum and disc around the axis. While the load is falling, the potential energy of the load is spending to work done agents the friction force and to increasing of the kinetic energy of all system. The moment of inertia is determined applying energy conservation law.	

12	[1], chap11, pgs316-345	Rolling Motion and Angular Momentum: a) Rolling motion of a rigid object b) Angular momentum of a particle c) Angular momentum of a rotating rigid object d) Conservation of angular momentum	
13	[1], chap12, pgs363-373	Static Equilibrium: a) The Conditions for equilibrium b) Center of gravity c) Examples to rigid objects in static equilibrium	
14	[1], chap14, pgs417-427	Fluid Mechanics: a) Pressure b) Variation of Pressure with Depth c) Pressure Measurements d) Buoyant Forces and Archimedes's Principle d)Fluid Dynamics e) Bernoulli's Equation f) Other Applications of Fluid Dynamics **Laboratory work №6** . Determination of the coefficient of internal friction of a liquid according to the Poiseuille law. ***Accessories:*** Viscometer, stopwatch, picnometer, distilled water, test liquid, scales and weights. If we take the same volumes of two different liquids, then depending on the coefficient of internal friction, the time of the outflow of these liquids through the same tube will be different. Calculation of the coefficient of internal friction of the liquid being studied can be completed using densities of water and liquid and knowing outflow times and the coefficient of internal friction of water.	
15	[1], chap14, pgs427-449	Fluid Mechanics (Continues): g) Fluid Dynamics f) Equation of Continuity. h) Bernoulli's Equation. i) Viscosity **Laboratory work № 7** . Determination of viscosity of liquids by Stokes's method. **Accessories**: Investigated liquids, beaker, an aqueous solution of copper sulphate, stopwatch, accurate scales and weights. The ball moves in a liquid gravity force, the force of internal friction (drag force) and the Archimedes' buoyant force are acting on it. Using equation of motion of drop the viscosity of liquid is calculated.	
16			Final

Recommended Sources

TEXTBOOK(S)

1. R.A.Serway,J.W.Jewett.Physics for Scientists and Engineers with Modern Physics.9thEdt, Cengage Learning, 2014,p.1622 (main)

2. Hugh D. *Young*and Roger A. Physics with Modern *Physics,14thEdt*, *Freedman,University,* Pearson, 2009, p.1596 (additional)

3. Douglas C.Giancoli,Physics for Scientists and Engineers with Modern Physics,4thEdt, Pearson, 2009,p.1322(additional)

Assessment

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

Assessment Criteria

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

Course Policies

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

- Students may use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industry 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	1	14
Self-study	14	4	56
Presentation	1	4	4
Preparation for midterm exam	1	5	5
Midterm Examination	1	3	3
Preparation for final exam	1	35	35
Final Examination	1	23	23
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

Chemical engineering (CHEN) program, "General and applied mathematics" department

Course Unit Title	Calculus for engineers I
Course Unit Code	MATH 1101
Type of Course Unit	Compulsory
Level of Course Unit	1st year of CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	1
Year of Study	1
Semester when the course unit is delivered	1
Course Coordinator	Azimova G.M.
Name of Lecturer (s)	Azimova G.M.
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	None
Recommended Optional Programme Components	-

Course description:

In this course, the basic classical methods of mathematics, necessary for future engineers, are given. This course includes the following chapters of "Calculus I":

1. Elements of linear algebra and analytical geometry. Matrices and operations on matrices. Determinants.Basic properties,rules for calculation. Equation ofa straight line in plane and in space. Equation of a plane. Second –order curves. Ellipse, hyperbola, parabola.

2.Differential calculus of functions of one variable and its applications. Limit of a function. Continuity of a function. Derivative. Basic differentiation rules. Differentiation of Transcendental Functions. Basic theorems of differential calculus. Application of differential calculus to investigation of behavior of functions.

3. Complex Numbers. Operations on Complex Numbers. Geometric interpretation

4. Integration. Antiderivative and Indefinite Integral. Integration Methods. Integration of Rational Functions. Integration of Irrational Functions. Integration of Trigonometric Functions.

This course provides students possibility to achieve high level of mathematical knowledge.

Objectives of the Course:

The teaching students of backgrounds of Calculus needed for future chemical engineers. Students must know the basic principles of mathematics should be able to apply them. Studying mathematics requires the student to try solving problems using the knowledge they have gained.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Know and apply methods for finding limits and derivatives of single variable functions.	1,2,3
2	Find the maximum and minimum values of single variable functions.	1,2,3
3	Know and apply integration methods to find Indefinite integrals	1,2

Assessment Methods: 1. Final Exam, 2. Independent works 3. Midterm

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	5
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	3
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	5
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	2

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

Course Contents

Week	Chapter	Topics	Exam

1	[4] Chapter 6, pp 200-203, Chapter 11, pp329--335	Matrices and operations on matrices. Determinants.Basic properties,rules for calculation. Inverse Matrix	
2	[4], Chapter 2, pp 94-102	Equation ofa straight line in plane and in space. Equation of a plane. Second –order curves. Ellipse, hyperbola, parabola. **Seminar1:** Matrices and operations on matrices. Determinants. Inverse Matrix. Equation ofa straight line in plane and in space. Equation of a plane. Second –order curves. Ellipse, hyperbola, parabola	
3	[4], Chapter 8, pp 259-267	Complex Numbers. Operations on Complex Numbers. Conjugate Complex Numbers. Euler`s formula.Geometric interpretation.	
4	[1], Chapter 2, pp 83-113	Limit of a function. Basic theorems on limits. Calculating limits using the Limits Laws. Remarkable limits. One- sided Limits. Infinite Limits. **Seminar 2:** Complex Numbers. Operations on Complex Numbers. Conjugate Complex Numbers. Euler`s formula.Geometric interpretation. Limit of a function. . Remarkable limits. One- sided Limits. Infinite Limits.	
5	[1], Chapter 2, pp115-125	Continuity of a function. Points of discontinuity of a function. Properties of continuous functions	
6	[1], Chapter 2, pp140-165	Derivative. Geometrical meaning of the derivative. Differential.. Table of derivatives. Basic differentiation rules. Higher derivatives. **Seminar 3:** Continuity of a function. Points of discontinuity of a function. Derivative. Geometrical meaning of the derivative. Differential.. Table of derivatives. Basic differentiation rules. Higher derivatives	
7			Midterm
8	[1], Chapter 3, pp172-182, 190-197, 218-224	Differentiation of Transcendental Functions. Differentiation of Exponential Functions. Differentiation of Trigonometric Functions. Differentiation of Logarithmic Functions. **Seminar 4**: Differentiation of Transcendental Functions. Differentiation of Exponential Functions. Differentiation of Trigonometric Functions. Differentiation of Logarithmic Functions.	

9	[1], Chapter 4, Pp287-293, 304-314	Basic theorems of differential calculus. Theorems of Rolle, Lagrange, Cauchy.L`Hospital`s rule.Indeterminate forms of the type $\frac{0}{0}, \frac{\infty}{\infty}$ .Taylor`s formula.	
10	[1], Chapter 4, Pp276-287	Application of differential calculus to investigation of behavior of functions. Testing functions for monotonicity. Extrema of functions. **Seminar 5**: Theorems of Rolle, Lagrange, Cauchy.L`Hospital`s rule.Indeterminate forms of the type $\frac{0}{0}, \frac{\infty}{\infty}$ .Taylor`s formula Application of differential calculus to investigation of behavior of functions. Testing functions for monotonicity. Extrema of functions	
11	[4], Chapter 4, Pp 173-175	Convexity and concavity of a curve. Point of inflection. Asymptotes of a curve.	
12	[1], Chapter 7, Pp472-479	Antiderivative and Indefinite Integral. Properties of an antiderivative and Indefinite Integral. Table of Basic Integrals. Integration Methods. Integration by parts. Integration by change of variable. **Seminar 6**: Convexity and concavity of a curve. Point of inflection. Asymptotes of a curve. Antiderivative and Indefinite Integral. Properties of an antiderivative and Indefinite Integral. Table of Basic Integrals. Integration Methods.	
13	[1], Chapter 7, Pp 493-503	Integration of Rational Functions (Rational Fractions). Integration of Irrational Functions	
14	[1], Chapter 7, Pp 479-486	Integration of Trigonometric Functions. Universal trigonometric substitution. **Seminar 7:** Integration of Rational Functions (Rational Fractions). Integration of Irrational Functions. Integration of Trigonometric Functions. Universal trigonometric substitution	
15	[1], Chapter 5, Pp 366-378	Application of Integration. The Area Problem. The Distance Problem	
16			Final

Recommended Sources

TEXTBOOK(S)

1. James Stewart, Calculus. Early Transcendentals. McMaster University and University of Toronto. Printed in USA, 2014.

2.Thomas`. George B. Thomas. Calculus, Massachusetts Institute of Technology. 2004

3. Ron Larson. Bruce Edwards , Calculus. Cengage Learning, 2014

4. A.D.Myshkis. Introductory Mathematics for Engineers. Physica, Moscow. 2001

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Independent works	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**
Independent works	10	1	10
Self-study	14	3,5	49
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	7	7

Final Examination	1	3	3
Preparation for final exam	1	26	26
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

Chemical engineering (CHEN) program, "Foreign languages-2" department

Course Unit Title	English II
Course Unit Code	ENGL 1201
Type of Course Unit	Compulsory
Level of Course Unit	1st year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	0
Practice (hour/week)	3
Laboratory (hour/week)	0
Year of Study	1
Semester when the course unit is delivered	2
Course Coordinator	Sevil G. ALIYEVA
Name of Lecturer (s)	-
Name of Assistant (s)	-
Mode of Delivery	Seminar, Face to face teaching
Language of Instruction	English
Prerequisites	ENGL 1101 English I
Recommended Optional Program Components	Pre-intermediate English level grammar, reading, writing and listening skills.

Course description:

ENGL 1201 is designed for studying general English where students continue learning English grammar and vocabulary. This course provides students with pre-intermediate and intermediate level structure and vocabulary. The Structures class focuses on acquiring knowledge of English grammar and the practical ability to apply this knowledge in oral and written discourse. Grammar section is intended to give practical aid to students and help the students correct their gaps that become increasingly apparent as they put the language in writing form. The Communicative part is devoted to gaining practical competence in English by means of exercises in conversation, oral presentation, comprehension of texts, and writing skills. Students will be encouraged to read a variety of texts as well as chapters from textbooks so that they can pursue their undergraduate studies at the university without major difficulty. The multipurpose exercises reinforce and consolidate what has been heard, said, written and seen. Collaborating with a partner or working as a member of small group students will consider different topics while improving their vocabulary and four main skills of language: listening, speaking, reading and writing. The course is designed to improve the students' presentation ability. At the end of the course they are expected to do an oral presentation.

Objectives of the Course:

This course aims to bring the students to a level that will enable them fulfil the requirements of main courses of their departments.

English -2 is aimed to:

- develop students' language skills and capacity to conduct writing task through the vocabulary, listening and speaking skills;
- develop their level of knowledge, communicative capacity, and ability to analyse and reflect on the language;
- develop confidence and competence in using the language and expand the students' vocabulary and range of expressions;
- gain the language skills in English to communicate and to use for academical purposes;
- provide students with language knowledge and skills which are essential for general communication purposes and future academic studies, and also help students develop positive attitudes towards the target foreign language;
- gain insight into different language situations by achieving B1/B2 level in the Common European Framework of Reference

Learning Outcomes

	At the end of the course the student will be able to:	Assessment
1	Communicate and share ideas and concepts using general language in discussions and talks;	1,3,4
2	Use intermediate level of target language grammar and vocabulary in discussions and talks;	1,2,3,4
3	gain intermediate level reading, writing, listening, speaking, and presentation skills;	1,2,3,4
4	Write connected text on topics at intermediate level in the target language;	3,4
5	Explain what they read in the target language;	3,4
6	Narrate a story or relate the plot of a book or film;	4
7	Have the basic academic skills in order to communicate both in daily life and in the academic environment;	1, 3,4
8	Make presentations in English, observe peers and provide peer feedback.	3,4

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	1
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	2
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	2
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	3

5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	3
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	5
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	4

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

Course Contents

Week	Chapter	Topics	Exams
1	[1] Unit 5C; pp.56-57	Reading: How much can you learn in a month? Grammar spot: Grammar: have to, don't have to, must, mustn't. Lexical exercises. Speaking and Listening exercises.	
1	[1] Unit 5D; pp.58-59	Reading: The name of the game. Grammar spot: expressing movement. Lexical exercises. Speaking and Listening exercises.	
2	[1] Unit 5 pp.60-63	Practical English: at a department store. Writing: a formal e-mail. Revise and check: What do you remember? What can you do?	
3	[1] Unit 6A pp.64-65	Reading: If something bad can happen, it will. Grammar spot: if +present simple. Lexical exercises. Speaking and Listening exercises.	
3	[1] Unit 6B pp.66-67	Reading: Never smile at a crocodile. Grammar spot: If+past; would + infinitive. Lexical exercises. Speaking and Listening exercises.	
4	[1] Unit 6C pp.68-69	Reading: Decisions, decisions. Grammar spot: may/might (possibility) Word building: noun formation. Lexical exercises. Speaking and Listening exercises.	
5	[1] Unit 6D pp.70-71	Reading: What should I do? Grammar spot: should/shouldn't. Verb – "get". Lexical exercises. Speaking and Listening exercises.	
5	[1] Unit 6 pp.72-75	Practical English: at a pharmacy. Writing: writing to a friend. Revise and check: What do you remember? What can you do?	
6	[1] Unit 7A pp.76-77	Reading: Famous fears and phobias. Grammar spot: Present perfect+ for and since. Lexical exercises. Speaking and Listening exercises.	
7	[1] Unit 7B pp.78-79	Reading: Born to direct. Grammar spot: . Lexical exercises. Speaking and Listening exercises.	

7	[1] Unit 7C pp.80-81	Reading: I used to be a rebel. Grammar spot: used to/didn't use to. Lexical exercises. Speaking and Listening exercises.	
8			Midterm exam
9	[1] Unit 7D pp.82-83	Reading: The mothers of invention. Grammar spot: Passive voice. Lexical exercises. Speaking and Listening exercises.	
9	[1] Unit 7 pp.84-87	Practical English: a boat trip. Writing: describing a building. Revise and check: What do you remember? What can you do?	
10	[1] 6Unit 8A pp.88-89	Reading: I hate weekends. Grammar spot: something, anything, nothing. Lexical exercises. Speaking and Listening exercises.	
11	[1] Unit 8B pp.90-91	Reading: How old is your body. Grammar spot: quantifiers, too, not enough. Lexical exercises. Speaking and Listening exercises.	
11	[1] Unit 8C pp.92-93	Reading: Waking up is hard to do. Grammar spot: word order of phrasal words. Lexical exercises. Speaking and Listening exercises.	
12	[1] Unit 8D pp.94-95	Reading: I'm Jim" 'So am I. Grammar spot: so/neither+auxiliaries. Lexical exercises. Speaking and Listening exercises.	
13	[1] Unit 8 pp.96-99	Practical English: on the phone. Writing: giving your opinion. Revise and check: What do you remember? What can you do?	
13	[1] Unit 9A pp.100-101	Reading: Fact is always stranger than fiction. Grammar spot: Past perfect tense. Adverbs: suddenly, immediately, etc. Lexical exercises. Speaking and Listening exercises.	
14	[1] Unit 9B pp.102-103	Reading: Then he kissed me. Grammar spot: Reported speech. Say, tell, or ask? Lexical exercises. Speaking and Listening exercises.	
15	[1] Unit 9 pp.104-107	Revise and check: Grammar. Vocabulary.	
16			Final exam

Recommended Sources

Course book:

1. Clive Oxenden, Christina Latham-Koenig, Paul Seligson - New English File (Pre-intermediate Student's book and Work book), Oxford University Press.2010.

Supplementary Course Material:

- Oxford Practice Grammar-Intermediate, John Eastwood, Oxford,2010
- Tom Hutchinson. English for Life, Oxford Press.2009
- Michael McCarthy, Felicity O'Dell. English Vocabulary in use, Second Edition,2000
- Raymond Murphy. Essential Grammar in Use, Cambridge University Press.2000
- Stuart Redman, English Vocabulary in Use. Pre-intermediate Cambridge 2002

Assessment

Attendance	0%	Less than 75% class attendance results in NA grade
Presentation	20%	

Quiz	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.
- 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	14	14
Tutorials	14	1	14
Self-study	14	3,5	49
Midterm Examination	1	3	3
Preparation for midterm exam	1	7	7
Final Examination	1	3	3
Preparation for final exam	1	28	28
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

Chemical engineering (CHEN) program, "Engineering and computer graphics" department

Course Unit Title	Introduction to Engineering Design
Course Unit Code	ENG1201
Type of Course Unit	Compulsory
Level of Course Unit	1nd year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	1
Practice (hour/week)	2
Laboratory (hour/week)	-
Year of Study	1
Semester when the course unit is delivered	2
Course Coordinator	R.Kh.Malikov
Name of Lecture	R.Kh.Malikov
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

The major focus of the IED course is to expose students to design process, research and analysis, teamwork, communication methods, , engineering standards, and technical documentation.

Students will employ engineering and scientific concepts in the solution of engineering design problems. In addition, students use a state of the 3D solid modeling design software package to help them design solutions to solve proposed problems. Students will develop problem-solving skills and apply their knowledge of research and design to create solutions to various challenges that increase in difficulty throughout the course.

The students acquaint with the basic knowledge and skills in engineering drawings and the capability to read and interpret blue prints for manufacturing. The students can also develop an understanding of 2D and 3D computer aided drafting with the requirements of good engineering drawings and be able to apply them to their work.

Using computers at the beginning of the engineering education will help the students visualize engineering components. Appropriate sketching exercises will be done during practice hours by using a package program namely AutoCAD. The CAD software should be perceived by the student as a tool for producing engineering drawings.

Objectives of the Course:

The purpose of the course is to educate students with the main objectives and principles of design.

Students improve their design skills in the areas of geometric shapes and solids, sizes, and the use of our 3D modeling software.
Students will use engineering and scientific concepts in solving engineering design problems. In addition, students use the state of the software package to design three-dimensional solid modeling to help them develop solutions to solve the proposed problems.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	have knowledge of Technical Sketching and Drawing	1,2,3
2	understand the main idea of using dimension for engineering drawing	1,2,3
3	know the principles and tasks of design	1,2,3
4	apply knowledge of 3D modeling in the process of designing	1,2,3
5	skillfully use engineering and scientific concepts in solving engineering design problems	1,2,3

Assessment Methods: 1. Final Exam, 2. Independent works, 3.Midterm Exam

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	1
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	1
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	3
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	2
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	5
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	4
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	4
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	5

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

Course Contents

Week	Topics	Exam
1	Design Process. Design process steps.	
3	Technical Sketching and Drawing. Sketch multiview drawings. Sketch an isometric view of simple geometric solids	
5	Measurements and Statistics. Measure and record linear distances using a scale. Measure and record linear distances using a dial caliper. Apply linear dimensions to a multiview drawing.	
7	Modeling Skills Create Computer Aided Design (CAD) models from dimensioned sketches. Assemble the product using the CAD modeling software	
8		Midterm
9	Geometry of Design. Geometric Shapes and Solids. Calculate the area of simple geometric shapes. Calculate the surface area and volume of simple geometric forms	
11	Dimensions and Tolerances	
13	Design Team Identify group norms that allow a virtual design team to function efficiently. Brainstorm and sketch possible solutions to an existing design problem. Create a decision making matrix	
16		Final

Recommended Sources

TEXTBOOK(S)

1. D. M. Kulkarni, A.P. Rastogi, A.K. Sarkar Engineering Graphics with Autocad, Delmar Publications, 2009

2. John R. Karsnitz. Engineering Design Publisher: Delmar Publications, 2013

3.C. Stark, David A. Madsen Engineering Drawing and Design Publisher: Delmar Publications, 1996

Assessment Criteria

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

Assessment

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

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

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**	**3**	**42**
Independent works	10	1,5	15
Tutorials	14	0,5	7
Midterm Examination	1	3	3
Preparation for midterm exam	1	7	7
Final Examination	1	3	3
Preparation for final exam	1	20	20
Self-study	14	4	56
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

Chemical engineering (CHEN) program, "Computer Engineering" department

Course Unit Title	Computers and chemical engineering
Course Unit Code	COMP 1201
Type of Course Unit	Compulsory
Level of Course Unit	1nd year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
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	Mustafayeva Sevinj
Name of Lecturer (s)	Mustafayeva Sevinj
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Laboratory
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	Basic computer programming skills

Course description:

A first introduction to the discipline of basics of modern information technology. A brief survey of the computer science discipline, focusing on the computer's role in representing, storing, manipulating, organizing and communicating information. For students considering further computer science offerings, this course provides an accurate picture of what lies ahead, hopefully increasing interest in the discipline.

Objectives of the Course:

The overall goals of the course are to provide a solid introduction to systematic problem solving methods as well as effective technical writing skills. Students will receive instruction in the use of the software product MATLAB . Example problems and laboratory projects draw from the chemical engineering field whereby the student learns to apply appropriate software techniques and/or numerical methods.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	To enter high technology workforce, and make significant contributions to Computer Engineering through the research, design and development of a wide range of embedded systems and system-on-chip applications.	1,3
2	To help further the state's economic growth by developing innovative ideas, and translating them into commercial products that benefit society.	1,2,3,4

3	To function effectively as a team member and/or leader in multidisciplinary and multicultural environments.	2,3
4	To recognize the societal and global context of their work and to understand professional and ethical responsibilities.	3
5	To pursue lifelong learning through such activities as graduate school, distance education, professional training and membership in professional societies and to be able to adapt to new engineering tools	1,3

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering	4
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses	2
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods	5
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment	2
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them	4
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering	2
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines	5

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

Course Contents

Week	Chapter	Topics	Exam
1	1	Introduction and Computer in Chemical Engineering **Lab.. – Writing Equations in Microsoft Word**	

		Familiarity with the interface of the word processor; acquaintance with the main teams;working with tables,working with formulas.	
2	2	Architecture of the Computers and Modeling in Chemical Engineering	
3	3	Basic Concepts of Computer Hardware and Software. System and Application Software **Lab.. – Writing Equations in Microsoft Word** Familiarity with the interface of the word processor; acquaintance with the main teams;working with tables,working with formulas.	
4	4	Number systems. Binary Math.	
5	5	Introduction to Computer programming **Lab.. – Writing Equations in Microsoft Word** Familiarity with the interface of the word processor; acquaintance with the main teams;working with tables,working with formulas.	
6	6	Software packages that used in Chemical Engineering calculation	
7	6,7	Mathematical methods in Chemical Engineering **Lab – Use of MATLAB quad and trap Functions** integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation	
8			Midterm
9	8	Algorithms and Flowcharts. Design and Analysis of Chemical Engineering **Lab – Use of MATLAB quad and trap Functions** integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation	
10	9	Programming in C/C++ and C/C++ data input/output	
11	10	Control statements. Applications Dev C++ **Lab 3 – Linear, control programming in C++** Write a C++ programs to implement recursive and non recursive i) Linear search ii) Binary search	
12	11	Loop organization Dev C++	
13	12	Array: One dimensional and two dimensional arrays **Lab 4 –Looping programming in C++** The purpose of this lab is to gain practical experience with loops in C++. You will do this by examining a program that includes several loops, modifying it to incorporate further loop behavior, and modifying another program to handle input and output from files.	
14	12	Arrays processing in Dev C++	
15	13	Design programs with structures in Dev C++ **Lab 5 –Array processing in C++** To implement Stack ADT and Queue ADT using a singly linked list	
16			Final

Recommended Sources

TEXTBOOK(S)

1. Peter Norton, Introduction to Computers , Career Education, 2008
2. Geoffrey Steinberg, Introduction to Computer Information System , Kendall Hunt Publishing, 2015

3. A Modern Approach, K. N. King, W.W., C Programming, Norton&Company, 2nd Edition, 2008.

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	10%	
Laboratories	20%	
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 Workload(hour)
Course duration in class	**14**	**3**	**42**
Self-study	14	3,5	49
Preparation for presentation	1	8	8
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	21	21
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

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

Course Unit Title	General Chemistry II
Course Unit Code	CHEM 1201
Type of Course Unit	Compulsory
Level of Course Unit	1st year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	0
Laboratory (hour/week)	1
Year of Study	1
Semester when the course unit is delivered	2
Course Coordinator	Minira M. Aghahuseynova
Name of Lecturer (s)	Minira M. Aghahuseynova
Name of Assistant (s)	Leyla Vezirova
Mode of Delivery	Face to Face, Laboratory.
Language of Instruction	English
Prerequisites	CHEM 1101 General Chemistry I
Recommended Optional Program Components	-

Course description:

Chemical Kinetics. Le Chatelier's principle on chemical equilibrium. Disperse systems. Classification of solutions. Solubility. Methods of expressing the concentration of solutions. Solutions of electrolytes. Strong and weak electrolytes, the degree and the dissociation constant hydrogen index. Reactions in solutions of electrolytes. Ionic exchange reactions. Hydrolysis of salts. The modern theory of acids and basis. Oxidation-reduction reactions and factors affecting their direction. Electrolysis of melts and solutions. Laws of electrolysis. General properties of metals. Obtaining metals from ores. Corrosion of metals and method of protection.

Objectives of the Course:

The aim of the subject is formation of real comprehension of the world- scientific view of contemporary theories based on interrelation of nature laws and phenomena, systematization and deepening of students' knowledge in the field of chemistry. The main goal of the subject in the process of training is to master theoretical and practical basis of chemistry for its application in solution of various ecological problems, analysis of water, seil, air and in chemical technology industry.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Describe chemical kinetics. Define reaction rate.	1,
2	Calculate halflife and concentration for the first and second order reactions.	1,2,4,3

3	Express chemical equilibrium. Define equilibrium constant.	1,3
4	Express importance of Le Chatelier's principle on chemical equilibrium	1,3,4
5	List basics and acids Electrochemistry. Write redox reactions.	1,3
6	Ability write electrolysis solutions of salts.	1,3

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	5
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	4
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	4
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	3
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	2

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

Course Contents

Week	Chapter	Topics	Exam
1	[1]: Chapter13, s:558-590	Elements of IA group. Natural compounds, obtaining, properties and application.	
2	[2]: Chapter15, s:458-482	Elements of IIA group. Beryllum, magnesium and their properties, compounds and application. Calsium and hardness of water. **Lab: Laboratory Techniques. Safety rules**	
3	[1]: Chapter14, s:620-657	Elements of IIIA group. Bor and its properties. Aluminium, natural compounds, obtaining, properties and application.	
4	[1]: Chapter11, s:480-488	Elements of IVA group. Carbon, allotropy and compounds. Oxides, accids and salts of carbon. Obtaining, properties and application. Silisium, natural compounds, properties and silicate industry.	

		Lab. Determination of the hardness of water Learn to accurately dose cations H + , Ca+2, Mg+2 and anions NO3 − , SO4 2− in water to evaluate the quality of the water. ii) Learn different analysis techniques: complexometric titration, colorimetry.	
5	[1]: Chapter11, s:490-510	Semicondactors- Ge, Sn, Pb. Natural compounds, obtaining, properties.	
6	[1]: Chapter8, s:353-363	Elements of VA group. Nitrogen, natural compounds, obtaining, properties. Hydrogen and oxygen compounds of nitrogen. Oxides and acids. **Lab: Synthesis of Alum** **i)** To be aware of the need for recycling solid wastes, particularly scrap metal like aluminum. **ii)** To learn some of the chemistry of aluminum. **iii)** To become familiar with the use of laboratory equipment such as beakers, flasks, Buchner funnel, and so on. **iv)** To be able to perform the techniques of weighing, vacuum filtration and crystallization. **v)** To be able to apply a knowledge of the stoichiometry of a sequence of chemical reactions to the calculation of the percent yield of alum synthesized from aluminum scrap.	
7			Midterm
8	[1]: Chapter8, s:320-340	Phosphorus, allotropy, properties, compounds and application. **Lab. Synthesis of Aspirin** - To synthesize aspirin and better understand carbonyl chemistry. - To purify the crude aspirin with recrystallization method	
9	[1]: Chapter15, s:676-697	Elements of VIA group. Oxygen, obtaining, physical and chemical properties application. Water. Hydrogen peroxide	
10	[1]: Chapter17, s:772-791	Sulphur. Natural compounds, obtaining, properties and application. Oxides and acids of sulphur. **Lab. Determination of NO2 ions** i) Learn to evaluate the quality of water by determining concentration of NO3 - anions ii) Learn principles and application of the colorimetric analysis method.	
11	[1]: Chapter8, s:341-348	Elements of VIIIA group. Hydrogen. Obtaining, properties and application. Hallogens and all properties, obtaining, properties and application.	
12	[2]: Chapter18, s:588-595	d- elements.Elements of IB group. Copper, Silver and Gold. Obtaining, properties and application. **Lab. Determination of NO2 ions** i) Learn to evaluate the quality of water by determining concentration of NO3 - anions ii) Learn principles and application of the colorimetric analysis method.	
13	[1]: Chapter 29, s:970-1001	d- elements.Elements of IIB group. Zinc, cadmium, mercury. Obtaining, properties and application.	
14	[2]: Chapter21, s:654-666	d- elements of VIIIB group.Iron, cobalt, Nickel.Obtaining, properties amnd application. Lab: **Water Analysis: Solids** PURPOSE - To determine the total, dissolved, and suspended solids in a water sample • To determine the ions present in the solids of a water sample	

15	[1]: Chapter17, s:797-811	f- elements. Lantanoids and actinoids.	
16			Final

Recommended Sources

TEXTBOOK(S)

1. Thomas R. Gilbert, Rein V. Kirss, Natalie Foster, Stacey Lowery Bretz, Chemistry.An Atoms-Focused Approach (Second Edition) **W.W.Norton@Company**, London, 2018.p.1256 .
2. Catherine E.Housecroft, Edwin C.Constable, Chemistry, Prentice Hall, Upper Saddle River, United States, 2005, p.1316.

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	10%	
Laboratories	20%	
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 Workload(hour)
Course duration in class	**14**	**3**	**42**
Presentation	1	4	4
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	8	8
Final Examination	1	3	3
Preparation for final exam	1	20	20
Self-study	14	4	56
Total Workload			**150**

Total Workload/30(h)	**150/30**
ECTS Credit of the Course	**5**

Chemical engineering (CHEN) program, "General and applied mathematics" department

Course Unit Title	Calculus for engineers II
Course Unit Code	MATH 1201
Type of Course Unit	Compulsory
Level of Course Unit	1st year of CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	1
Year of Study	1
Semester when the course unit is delivered	2
Course Coordinator	Azimova G.M.
Name of Lecturer (s)	Azimova G.M.
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	MATH 1101 Calculus for engineers I
Recommended Optional Programme Components	-

Course description:

In this course, the basic classical methods of mathematics, necessary for future engineers, are given. This course includes the following chapters of "Calculus II":

1. Definite Integral. Applications of Definite Integral.
2. Differential calculus of functions of several variable and its applications
3. Numerical Series. Alternating series. Functional Series. Taylor and Maclaurin Series.

This course provides students possibility to achieve high level of mathematical knowledge.

Objectives of the Course:

The teaching students of backgrounds of Calculus needed for future chemical engineers. Students must know the basic principles of mathematics should be able to apply them. Studying mathematics requires the student to try solving problems using the knowledge they have gained.

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Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Apply the limits, continuity, derivative and integral concepts related with the multi-variable functions..	1,2,3

2	Calculate the maximum and minimum values of multi-variable functions	1,2,3
3	Calculate the areas bounded by the curves, the volumes and the lateral areas of rotating bodies by using the integrals.	1,2

Assessment Methods: 1. Final Exam, 2. Independent works, 3.Midterm exam

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	5
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	3
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	5
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	2

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

Course Contents

Week	Chapter	Topics	Exam
1	[2], Chapter 5, pp256-265	Sums and Sigma Notation. Areas as Limits of Sums. Riemann Sums. Limits of Riemann Sums. Definition of the Definite Integral. Integrable and Nonintegrable functions	

2	[2], Chapter 5, pp265-280	Basic Properties of a Definite Integral. The Newton-Leibniz Theorem. Methods of evaluating definite integral. **Seminar 1**: Sums and Sigma Notation. Areas as Limits of Sums. Riemann Sums. Limits of Riemann Sums. The Newton-Leibniz Theorem. Methods of evaluating definite integral.	
3	[2], Chapter 6, pp326-337	Applications of Definite Integral. Arc Length .The Differential Formula for Arc Length. Areas of Surfaces of Revolution. Defining Surface Area. Revolution about the y-axis.	
4	[2], Chapter 6, pp308-326	Volumes Using Cross-Sections. Slicing by Parallel Planes . Solids of Revolution: The Disk Method. Volumes Using Cylindrical Shells.The Shell Method **Seminar 2**: Applications of Definite Integral. Arc Length. Areas of Surfaces of Revolution. Volumes Using Cross-Sections. Volumes Using Cylindrical Shells	
5	[2], Chapter 8, pp 478-489	Improper Integrals. Improper integrals with infinite limits. Improper integrals of unbounded functions. Tests for Convergence and Divergence.	
6	[2], Chapter 14, pp747-764	Functions of two variables. Domains and Ranges. Limit of a function of two variables. Continuity of a function of two variables. **Seminar 3**: Improper integrals with infinite limits. Improper integrals of unbounded functions. . Limit of a function of two variables. Continuity of a function of two variables	
7			Midterm
8	[2], Chapter 14, pp 764-780	Partial derivatives of a function of two variables .The Chain Rule. Implicit differentiation revisited. Differentials. Total differential. **Seminar 4**: Partial derivatives of a function of two variables .The Chain Rule. Implicit differentiation revisited. Differentials. Total differential.	
9	[2], Chapter 14, pp784-790	Directional Derivatives and Gradient Vectors. Properties of Directional Derivatives. Algebra Rules for Gradients. Tangent Planes and Normal lines.	
10	[2], Chapter 14, pp769-771, 802-811	Derivatives and differentials of higher orders. Extrema of function of two variables. Derivative tests for Local Extreme Values **Seminar 5**: Directional Derivatives and Gradient Vectors. Derivatives and differentials of higher orders. Extrema of function of two variables.	
11	[2], Chapter 10 , pp 532-567	Numerical Series. Properties of Convergent Series. Necessary Condition for Convergence of a Series. Comparison Tests for Positive series. D'Alembert's Test. Cauchy' Root Test.	

12	[2], Chapter 10, pp 568-575	Alternating series. Absolute and conditional convergence. Leibniz' test. **Seminar 6**:Comparison Tests for Positive series. D'Alembert's Test. Cauchy' Root Test. Leibniz' test.	
13	[2], Chapter 10, pp 575-584	Functional Series. Weierstrass' test. Power Series. Abel's theorem. The Radius of Convergence of a Power Series.	
14	[2], Chapter 10, pp584-600	Taylor and Maclaurin Series. Applications of Taylor and Maclaurin Series. Taylor Polynomials. **Seminar 7**: Functional Series. Weierstrass' test. Power Series. Abel's theorem. The Radius of Convergence of a Power Series. Taylor and Maclaurin Series	
15	[2], Chapter 11, pp610-631	Parametric Equations and Polar Coordinates. Parametrizations of Plane Curves. Calculus with Parametric Curves. Length of a Parametrically Curve.	
16			Final

Recommended Sources

TEXTBOOK(S)

1. George B. Thomas. Calculus, Massachusetts Institute of Technology.2004
2. Ron Larson., Calculus. Bruce Edwards ,2014
3 .A.F. Bermant , I.G.Aramanovich. Mathematical Analysis., Moscow. 2005

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Independent works	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**
Independent works	10	1	10
Self-study	14	4	56
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	8	8
Final Examination	1	3	3
Preparation for final exam	1	23	23
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

Chemical engineering (CHEN) program, "Physics" department

Course Unit Title	Engineering Physics II
Course Unit Code	PHYS 1201
Type of Course Unit	Compulsory
Level of Course Unit	1st year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
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	Jeyhun Naziyev
Name of Lecturer (s)	Jeyhun Naziyev
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Laboratory.
Language of Instruction	English
Prerequisites	PHYS 1101 Engineering Physics I
Recommended Optional Program Components	General physics

Course description:

Physics is a basic subject for many engineering specialties at Technical Higher Education Institutions. Physics laws and research methods are widely used in the teaching of many subjects, including material science, electrotechnical, power and heat engineering, chemical engineering and others. The development of any field of modern energetics is inextricably linked with physics. For this reason, the students to be supposed to have the ability to apply physics in chemical engineering.

Objectives of the Course:

During orientation you can expect to:

Learn more about your academic program.
Learn about why Computer Engineering and how to be familiar with that since
Schedule your first set of classes
Meet faculty, advisors, and current State students
Interact with fellow incoming students
Learn how to Ask Questions!

Learning Outcomes

At the end of the course the student should be able to		Assessment
1	Explain the Simple Harmonic Motion.	1,2,3
2	Define the Harmonic Oscillator.	1,2,3
3	Analyse the Pendulums.	1,2,3
4	Identify the Characteristics of wave motion.	1,2,3
5	Analyse the Transverse and Longitudinal Waves.	1,2,3
6	Define the Temperature.	1,2,3
7	Explain the Thermal Equilibrium and the Laws of Thermodynamics.	1,2,3
8	Determine the Thermal Expansion.	1,2
9	Describe The Gas Laws.	1,2
10	Define the Electric Charges.	1,2
11	Determine the Coulomb's Law.	1,2
12	Express the Properties of electric charges.	1,2,3
13	Describe the Electric Field and the Motion in Electric Field.	1,3
14	Define the Electric Potential and Potential difference.	1,2,3
15	Analyse the Potential difference in a uniform electric field.	1,2
16	Analyse the Capacitors and Dielectrics.	1,3
17	Definition the capacitance.	1,3

18	Explain the Energy stored in a charged capacitor	1,3
19	Describe the Magnetic Fields.	1,3
20	Define the properties of the magnetic field.	2,3
21	Analyse the Magnetic force on a current- carrying conductor.	2,3
22	Describe the Motion of a charged particle in a magnetic field.	1,2
23	Define the Inductance.	1,2
24	Describe the Self-inductance,	1,3
25	Express the Energy in magnetic field.	1,2
26	Define the Mutual inductance.	2,3
27	Analyse the Interference of light waves.	2,3
28	Analyse The applications of interference phenomenon.	2,3
29	Analyse the Interferometers.	2,3
30	Describe the Diffraction of light.	1,2
31	Analyse the Fresnel theory.	1,2
32	Analyse the Fraunhofer Diffraction.	1,3
33	Describe the Diffraction grating.	1,3
34	Describe the Polarization of light.	1,3
35	Describe the Malus's and Brewster's Laws.	1,3
36	Define the Thermal radiation.	1,3
37	Express the Thermal radiation laws.	1,3

Assessment Methods: 1. Written Exam, 2. Presentation, 3. Lab. Work

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	5
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	5
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	2
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	4
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	2
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	5
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	2
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	3

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

Course Contents

Week	Chapter	Topics	Exam
1	[1], chap15 pgs450-471	Oscillatory Motion: a) Simple Harmonic Motion. b) Harmonic Oscillator. c) Pendulums.	

		Laboratory work № 1. Determination of unknown frequency by addition mutually perpendicular oscillations. ***Accessories:*** The oscilloscope and two generators. Installation consists of a generator of known frequencies, oscilloscope and generator of unknown frequencies. Signals from generators come to oscilloscope, and Lissajous' figures are appeared on a screen. We can calculate the unknown frequency using a known frequency.	
2	[1], chap16-17 pgs483-517	Wave Motion: a) Characteristics of wave motion. b) Transverse and Longitudinal Waves. c) Wave Equation. d) Characteristics, Intensity and Sources of Sound.	
3	[1], chap19, 21 pgs567-580, 626-631, 639-645 [2], chap13-6, pgs369-376	The Kinetic Theory of Gases: a) Temperature. b) Thermal Equilibrium and Zeroth Law of Thermodynamics. c) Thermal Expansion. d) The Gas Laws. e) Distribution of Molecular Speeds. f) Real Gases and changes of Phase. Van der Waals Equation of State. g) Mean Free Path. Diffusion. **Laboratory work № 2**. Determination of the average free path length and the effective diameter of air molecules. ***Accessories:*** capillary and a glass jar with a tap, a stopwatch, beaker, ruler. First measured the volume of water leaked from container and the flow time. The same volume of air will come into container. Knowing the value of atmospheric pressure and temperature we calculate numerical values of the average free path length and the effective diameter of air molecules respectively.	
4	[1] , chap20, 21 pgs590-615, 631-639	The First Law of Thermodynamics: a) Heat. b) Internal energy. c) Specific heat. Latent Heat. d) The First Law of Thermodynamics. e) Adiabatic Expansion of Gases. f) Heat Transfer.	
5	[1] , chap22, pgs653-678	The second law of Thermodynamics: a) The second law of Thermodynamics b) Heat Engines. c) Reversible and Irreversible Processes. d) The Carnot Engine. e) Entropy. **Laboratory work № 3**. Determination of the ratio of heat capacities of gases by Clement – Desorme's method. ***Accessories:*** Glass bottle with capacity of 5 - 6 cubic meters, manometer, air pump. A gas can be pumped into the glass balloon with a capacity of 15 - 20 liters by the pump. The difference between pressure in balloon and atmospheric pressure is fixed by manometer coupled with the balloon. Gas first is compressed then adiabatically expands. Substituting numerical values hight level differences in manometer the value of the ratio of heat capacities can be calculated.	
6	[3], chap15-11, pgs424,434-436	Thermodynamic Temperature. The Third Law of Thermodynamics. Thermal Pollution, Global Warming, and Energy Resources.	
7	[1], chap23, pgs690-695	Electric Charges and Coulomb's Law: a) Properties of electric charges b) Insulators and conductors c) Coulomb's Law **Laboratory work № 4**. Determination of electric capacity of the capacitor by ac bridge. ***Accessories:*** Capacitors with known and unknown capacities, slide wire, telephone, an oscilloscope, an alternator, a sound generator. The principle of this method lies in the fact that the unknown capacitance is included in one of the arms of the bridge, then by selection of known capacitances and resistances balance of the bridge is achieved.	
8			MidTerm
9	[1] , chap23, pgs704-713	Electric Field and the Motion in Electric Field: a) Electric field b) Electric field lines c) Electric field of a continuous charge distribution d) Motion of charged particles in a uniform electric field.	

		Laboratory work № 5. Determination of the horizontal component of the earth's magnetic intensity. ***Accessories:*** Tangent - galvanometer, constant current source, ammeter, rheostat. Along with the magnetic field of the Earth, a magnetic field is created by created by a circular current in the centre of the turns of tangent-galvanometer acts to the needle of compass and it rotates. Knowing the angle of needles turn we and the current in turns of coil we calculate the horizontal component of the earth's magnetic intensity.	
10	[1] , chap25, pgs746-764	Electric Potential: a) Potential difference and electric potential b) Potential difference in a uniform electric field c) Electric potential and potential energy due to point charge d) Electric potential due to continuous charge distributions e) Obtaining electric field from the electric potential	
11	[1], chap26, pgs777-793	Capacitors and Dielectrics: a) Definition of capacitance b) Calculation of capacitance c) Combinations of capacitors d) Capacitors with dielectrics e) Energy stored in a charged capacitor **Laboratory work № 6**. Determination of the coefficient of self – induction by Joubert method. ***Accessories:*** The study coil, iron core, voltmeter and ammeter AC, power supply. The volt-ampere characteristics of solenoid with core inside and without is determined. Then the impedance and inductance of the solenoid for the two cases is found. At last using these data the coefficient of self – induction of coil is computed.	
12	[1], chap29, pgs868-884	Magnetic Fields: a) Definition and properties of the magnetic field b) Magnetic force on a current- carrying conductor c) Motion of a charged particle in a magnetic field	
13	[1], chap32, pgs970-979	Inductance: a) Self-inductance b) Energy in magnetic field c) Mutual inductance.	
14	[1], chap37, pgs1134-1149, Chap38, pgs1160-1168	Wave Optics: a) Interference of light waves. b) The applications of interference phenomenon, Interferometers. c) Diffraction of light. Fresnel theory.	
15	[1] , chap38, pgs1161-1165,1169-1173, 1175-1180, Chap40, pgs1234-1238	Wave Optics (Continues): Fraunhofer Diffraction. Diffraction grating. Polarization of light. Malus's and Brewster's Laws. Thermal radiation. Thermal radiation laws. **Laboratory work № 7.** Studying of the Malus's law and determination of the degree of polarization of the laser radiation. **Accessories**: Laser, polarizer, micro-ammeter and photocell. A polarized light beam from the laser is incident on the polarizer mounted on the rim. The polarizer can rotate together with the angle indicator relative to the fixed disk. The disk has a scale, allowing to determine the angle of rotation. Passing through the polarizer, the light hits the surface of the photodiode. Under the action of light, a photo-emf is produced in the photodiode. The photocurrent is proportional to the intensity of the incident light. Rotating the polarizer to the different angles φ and note the corresponding values of the current the degree of polarization of the laser radiation is calculated.	
16			Final

Recommended Sources

TEXTBOOK(S)

1.R.A.Serway,J.W.Jewett.Physics for Scientists and Engineers with Modern Physics.9thEdt, Cengage Learning, 2014,p.1622 (main)

2. Hugh D. *Young* and Roger A. Physics with Modern *Physics,14th Edt, Freedman,University,* Pearson, p.1596 (additional)

3. Douglas C.Giancoli,Physics for Scientists and Engineers with Modern Physics,4th Edt, Pearson, 2009,p.1322(additional)

Assessment

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

Assessment Criteria

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

Course Policies

- Attendance to the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students may use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industry 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	1	14
Self-study	14	3,5	49
Preparation for presentation	1	10	10
Preparation for midterm exam	1	9	9
Midterm Examination	1	3	3
Preparation for final exam	1	25	25
Final Examination	1	3	3
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

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

Course Unit Title	Chemical Engineering Material and Energy Balances
Course Unit Code	CHEM 2101
Type of Course Unit	Compulsory
Level of Course Unit	2nd year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	0
Year of Study	2
Semester when the course unit is delivered	3
CourseCoordinator	Narmina Guliyeva
NameofLecturer (s)	Narmina Guliyeva
NameofAssistant (s)	-
Mode of Delivery	Face to Face, Seminar
Language of Instruction	English
Prerequisites	CHEM 1201 General Chemistry II
Recommended Optional Programme Components	-

Course description:

How can you estimate the release of pollutants from a coal-fired power plant and how changes to processes within the plant might influence the amount released to the environment? If a bench-scale drug compound is showing promising results, how do you start to think about producing enough to treat millions of people? Chemical engineers are challenged with similar questions across a wide variety of fields and applications including petroleum refining, pharmaceuticals, polymers, consumer products, water purification, food science, and commodity and specialty chemicals. In designing the processes to support these various needs, chemical engineers need to consider the operations involved, the amounts of raw materials that are required, separations of more and less valuable materials, and energy requirements. In this course you will be introduced to how to start to evaluate and estimate the necessary components of a chemical process as chemical engineers. The decisions related to chemical processes can have profound economic, environmental, and even political consequences.

Objectives of the Course:

-Recognize the value of chemical technology through being introduced to the field of chemicalengineering.

-Create representative process flow diagrams and use them to organize systems ofequations.

-Formulatematerialbalancestosolve forcompositionsandflowratesofprocessstreams.

-Incorporate single and multiple reactions into unit operations within chemicalprocesses.

-Identify and calculate physical and chemical properties for compounds and approachesto estimate these values for chemicalprocesses.

-Deriveenergybalancesforchemicalprocessesand integratewithmaterialbalance calculations to solve for energy inputs and/oroutputs.

-Collaborate effectively on a team project integrating multiple chemicalprocesses.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	To be able to have knowledge about unit systems (Metric, S.I., British Unit Systems) to be used in chemical engineering	1,3
2	To be able to solve chemical processes by using process parameters such as mass, volume, chemical content, pressure and temperature to be used in chemical engineering.	1,2,3
3	To be able to establish mass balances for different components which do not have a chemical reaction.	2,3
4	To be able to establish mass equivalents for the chemical reactions for different components forming a process.	3
5	Know plant site/place selection, ethics and professionalism	1,3

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	5
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	3
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5

5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	4
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	3

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

Course Contents

Week	Chapter	Topics	Exam
1	[1] Part 1 Chapter 2	Dimensions, units and conversion factors, conversion of units	
2	[1] Part 1 Chapter 2	Dimensions, units and conversion factors, conversion of units **Sem:** Dimensions, units and conversion factors, conversion of units	
3	[1] Part 2 Chapter 5	Material balances Liquid and solid densities. Gas laws, ideal gases, real gases	
4	[1] Part 2 Chapter 4	Material balances. Process classification.Problem solving techniques, introduction to mass balance **Sem:** Material balances	
5	[1] Part 2 Chapter 5	Material balances . multiphase systems. Mass balance in the absence of chemical reaction	
6	[1] Part 2	Mass balance in mixing and drying processes	

	Chapter 5	**Sem**: Material balances . multiphase systems. Mass balance in mixing and drying processes.	
7			Midterm
8	[1] Part 3 Chapter 7	Mass Equilibrium in Distillation and Absorption Processes **Sem:** Mass Equilibrium in Distillation and Absorption Processes	
9	[1] Part 3 Chapter 7	Mass balance in extraction and crystallization processes	
10	[1] Part Chapter	Back-loop and side-pass in systems without chemical reaction **Sem:** Mass balance in extraction and crystallization processes. Back-loop and side-pass in systems without chemical reaction	
11	[1] Part Chapter	Mass equilibrium in chemical reaction	
12	[1] Part 3 Chapter 7	Mass equilibrium in chemical reaction **Sem:** Mass equilibrium in chemical reaction	
13	[1] Part 3 Chapter 8-9	Back-loop and side-pass in systems with chemical reaction	
14	[1] Part 3 Chapter 8	Mass equilibrium in a system with chemical reaction and non-chemical reactions **Sem:** Mass equilibrium in a system with chemical reaction and non-chemical reactions	
15	[1] Part 4 Chapter 12	Mass balance in systems with and without chemical reaction	
16			Final

Recommended Sources

TEXTBOOK(S)

1. Felder, Richard M. and Rousseau, Ronald W.; "Elementary Principlesof Chemical Processes", Third Edition; John Wiley & Sons, Inc.;2005

2. Yaws, Carl L.; "Yaws' Handbook of Thermodynamic and Physical Properties of Chemical Compounds";

Knovel; 2003;

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 İndustry 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 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 Work load (hour)
Course duration in class	**14**	**3**	**42**
Presentation	1	5	5
Self-study	14	4	56
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midtermexam	1	10	10
Final Examination	1	3	3
Preparation for final exam	1	20	20
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

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

Course Unit Title	Organic chemistry
Course Unit Code	CHEM 2102
Type of Course Unit	Compulsory
Level of Course Unit	2nd year CHEN program
National Credits	0
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	Leyla Z.Vezirova
Name of Lecturer (s)	Leyla Z.Vezirova
Name of Assistant (s)	Tahmina Taghiyeva
Mode of Delivery	Face to Face, Laboratory.
Language of Instruction	English
Prerequisites	CHEM 1201 General Chemistry II
Recommended Optional Program Components	-

Course description:

Historical development of organic chemistry. Classification of organic compounds. Electronic structure of a molecule. Spatial structure of organic compounds. Nomenclature of main classes of organic compounds. Isomerism, obtaining methods, physical and chemical properties of organic compounds. Probable industrial obtaining methods and application fields of organic compounds and their capability to enter into various chemical conversions.

Objectives of the Course:

Students should know more about organic substances, their electronic and molecular structure, isomerism, physical and chemical properties. Students should be able to use all accumulated knowledge for an understanding of chemical processes in the field of petroleum refining, polymers obtaining and organic synthesis.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	interpret the concept of aromaticity and the main properties of aromatic compounds. associate polarization of a bond with electronegativity. understand nucleophile and electrophile groups and their properties. associate different bond types of carbon and its hybrid orbitals. Express the differences between valence bond and molecular orbital approaches. derive mechanism of a reaction.	1,3

2	interpret the reactions and properties of halogen compounds. evaluate effects of atomic properties on acidity and basicity. relate structure of molecule with strength of acidity and basicity. enlighten relationship between acidity constant pKa and an acid-base reaction. Illustrates reactions of ketones, Illustrates preparation methods of aldehydes	1,2,3,4
3	interpret the reactions and properties of alcohols and phenols. interpret reactivity of alkane, alkene and alkyne. design reactions of aliphatic hydrocarbons. prepare alkane, alkene and alkynes using different methods. Recognize the main differences between the acidities of alcohols and phenols. Applies conversion of carboxylic acids to their derivatives on example reactions, Illustrates reactions of carboxylic acid derivatives, Illustrates preparation methods of carboxylic acid derivatives.	2,3
4	interpret the reactions and properties of ethers and epoxides. explain aromaticity concept. Recognize the main differences between open chain ethers and epoxides. interpret inductive and resonance effects on aromatic compounds. write side chain reactions of aromatic compounds.	1,3
5	interpret the reactions and properties of amines. nomenclature alcohol and phenols. write reaction mechanisms of alcohols. write reaction mechanisms of phenols. prepare alcohols. nomenclature ethers and epoxides. write reasonable reactions for ethers. write reasonable reactions for epoxides. write mechanism for the preparation of ethers and epoxides. distinguish aliphatic and aromatic halogenated organic compounds. write preparation methods for the halogenated organic compounds. design reactions of halogenated organic compounds. write different preparation methods for amines. interpret reactivity of aldehydes and ketones.	1,3,4
Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm Exam, 4. Laboratory		

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	5
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	5
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4

4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	5
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	5

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

Course Contents

Week	Chapter	Topics	Exam
1	[1] ch.1, p. 1-39 [2] ch.2, p. 35-65 [3] ch.1, p. 2 -40	Introduction. Classification of organic compounds. Carbon compounds and chemical bonds	
2	[1] ch.2, p. 39-77 [3] ch.2, p. 41 -61	Acids and bases Energy of activation, Transition State Functional groups **Lab: Laboratory Techniques. Safety rules**	
3	[1] ch.1, p. 1-39 [2] ch.3, p. 74-111 [3] ch.3, p. 61 -90	Alkanes and Cycloalcanes, Nomenclature of organic compounds	
4	[1] ch.4, p. 125-155 [3] ch.4, p. 103 - 126	Alkenes and Alkynes Geometric and stereo isomerism. **Lab: Distillation** Distillation is the method of choice for the purification of a liquid (the most often). The main objectives of a distillation are: - the elimination of impurities (by definition there are few because otherwise they are secondary products). - the separation of a mixture of several constituents, in order to recover each of them pure.	

		- obtaining distillation fractions, each corresponding to a range of determined distillation (e.g. oil).	
5	[1] ch.9, p. 332-342	Electrophilic reactions mechanisms	
6	[1] ch.5, p. 165-211 [3] ch.12, p. 396 - 422	Nucleophilic substitution reactions mechanisms Aldehydes and ketones, Aromatic aldehydes and ketones Carboxylic acids, Esters, Acylhalides and Amides **Lab: Chemical separation of mixtures** it consists of temporarily modifying, by a simple chemical reaction, the chemical function of one (and if possible, only one at a time) of the constituents of the mixture, so that after modification this compound is easily separable from the others by a physical method (solubility for example).	
7			Midterm
8	[1] ch.3, p. 77-122	Reactions of alkenes and alkynes. **Lab: Recrystallization** Purpose: Recrystallization is the method of choice for the purification of a solid. Principle: This technique is based on the solubility difference of a compound in a solvent or a mixture of solvents depending on the temperature.	
9	[1] ch.6, p. 213-244 [3] ch.1, p. 2 -16	Alcohols and ethers. Radicalic reactions	
10	[1] ch.14,15, p. 493-545	Aromatic compounds. Aromatic electrophilic and nucleophilic reactions, Aromatic nitro compounds, Phenols **Lab: Importance of Stoichiometry** The Claisen-Schmidt reaction corresponds to the synthesis of alfa-beta-unsaturated ketones by the condensation of an aromatic aldehyde with a ketone. Today's reaction can lead theoretically to 2 products A and B. Nevertheless, in the experiment the experimental conditions are optimized in order to preferentially obtain either the compound A or the compound B. The objective of this experiment is to determine the compound that you form.	
11	[1] ch., p. 657-700 [3] ch.12, p. 396 - 437	Aldehydes and ketones, Aromatic aldehydes and ketones	
12	[1] ch.19, p. 713 - 750 [3] ch.14, p. 468 - 485	Carboxylic acids, Esters, Acylhalides and Amides, heteroatom. **Lab: Chromatography** The purpose of this lab is to acquaint you with the two most common adsorption chromatography techniques: thin layer chromatography and column chromatography	
13	[2] ch.26, p. 1073-1107	Biomolecules,Amino acids, peptides and proteins Aromatic acids and amines.	

14	[1] ch.31, p. 1077-1093	Makromolecules. Polymers adn Polymerization Diazo and azo compounds. Organometallic and hetero-organic compounds. **Lab: Final reports**	
15	[1] ch.30, p. 1057-1077	Pentamerous heterocyclic compounds containing a heteroatom. Hexamerous heterocyclic compounds containing a heteroatom.	
16			Final

Recommended Sources

TEXTBOOK(S)

1. Robert T. Morrison and Robert N. Boyd, Organic Chemistry (6th edition) Prentice-Hall of India in 2002.
2. William H. Brown, Thomas Pooh, Introduction to organic chemistry, Wiley; (January 12, 2010)

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	10%	
Laboratories	20%	
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 İndustry University for undergraduate studies

Course Policies

- Attendance of the course is mandatory.
- Material presented in the lecture as well as assigned readings will be included in testing.
- 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**	**3**	**42**
Self-study	14	4,5	63
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	11	11
Final Examination	1	3	3
Preparation for final exam	1	30	30

Preparation for Presentation	1	14	14
Total Workload			**180**
Total Workload/30(h)			**180/30**
ECTS Credit of the Course			**6**

Chemical engineering (CHEN) program, “Foreign languages-2” department

Course Unit Title	Exposition and Argumentation
Course Unit Code	EXP 2101

Type of Course Unit	Compulsory
Level of Course Unit	2nd year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	0
Practice (hour/week)	3
Laboratory (hour/week)	0
Year of Study	2
Semester when the course unit is delivered	3
Course Coordinator	Sevil G. ALIYEVA
Name of Lecturer (s)	-
Name of Assistant (s)	-
Mode of Delivery	Seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

English 2101 is an exposition and argumentative writing course with readings and research in various writing genres. This course examines the rhetorical and practical elements of writing effective arguments. It focuses on methods of organization, analysis, research skills, and the production of short argumentative and expository essays. Students prepare and submit paragraphs of the following types: textual analysis, research paper, and argumentative essay. Exposition and Argumentation provides students with the rhetorical foundations that prepare them for the demands of academic writing. In general, students will be working with sources of various kinds to make claims about issues that are up for debate and to design documents that will appeal to readers. They will also practice different ways of approaching writing assignments, including ways of gathering sources, taking notes and finding patterns, and producing documents that meet different goals. This course will develop rhetorical sensitivity by responding to the other students' writing and by using the teacher's and their peer's suggestions. It will also improve critical thinking through reading, writing, and discussion, and will attend to basic research skills. Additionally, this course examines and practices academic conventions of word usage, sentence structure and variation, and paragraph formation.

Course Objectives:

EXP 2101 is aimed to:

- Demonstrate critical thinking and critical reading strategies;
- Learn basic rhetorical principles to strengthen the effectiveness of written work;
- Adapt writing to different audiences, purposes, and contexts;
- Build written invention strategies, such as observing, brainstorming, associating, drafting;
- Practice a variety of revision and editing techniques for written content, structure and style;
- Create direct grammatically correct sentences;
- Write for varied purposes informing, analyzing, and arguing;
- Demonstrating a clear and effective writing style, write coherent, cohesive, and clear paragraphs;
- Plan, draft, revise, edit, and proofread argumentative essays;

- Use evidence to effectively support argumentative claims or theses.

Learning Outcomes

	At the end of the course the student will be able to:	Assessment
1	Read, plan, draft, review, collaborate, revise, rewrite, reread, edit, and proofread argumentative essays	2,4
2	Read, write, and think critically	1,4
3	Write coherent, cohesive, and clear paragraphs	1,2,4
4	Use key rhetorical concepts through analysing and composing a variety of texts	1,2,3,4
5	Understand genre conventions for structure, paragraphing, tone, and mechanics	1,2,3,4
6	Avoiding plagiarism, apply citation conventions systematically in their own work	2,4
7	Use evidence and reasoning to effectively support argumentative claims or theses	1,2,3,4
8	Write an organized logical argument	1,3,4
9	Use structures, including grammar, punctuation, and spelling, through practice in composing and revising	1,3,4

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	1
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	2
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	2
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	2
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	2
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	2
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	5

8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	5
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	2

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

Course Contents

Week	Chapter	Topics	Exam
1	[2] Chapter:1 pp.3-13	Peculiarities of academic writing and reading. Genre, audience, and purpose.	
1	[2] Chapter 1 pp.21-29	Thinking critically. Using evidence and reasoning. Making claims. Idea mapping. Practice activity.	
2	[2] Chapter 5 pp.82-124	Rhetorical reading. Reading and note-making. Practice activity.	
3	[3] Chapter 1 pp.3-15	The demands of writing. Organization. Sentence Structure. Practice activity.	
3	[3] Chapter 1 pp.16-18	Pre-writing stage. Organizing the writing. Writing an effective topic sentence. Outlining. Practice activity.	
4	[1] Chapter 1 pp.2-17	Types of Expository Writing. Paragraph Structure. Organization of a paragraph. Writing Assignment.	
5	[1] Chapter 1 pp.18-38	Logical division of ideas. Coherence. Transition signals. Practice activity.	
5	[3] Chapter 1 pp.18-22	Writing a rough draft. Punctuation rules. Revising and Editing. Peer Review. Writing Assignment.	
6	[3] Chapter 3 pp.39-54;	Evaluating and Using Sources. Avoiding plagiarism.	

7	[3] Chapter 4 pp.60-75	Descriptive writing. Spatial Order Signals. Writing Assignment.	
7	[3] Chapter 5 pp.94-99	Process writing. Transition Signals for Chronological Order. Writing Assignment.	
8			Midterm Exam
9	[1] Chapter 4 pp.56-75	Essay Organisation. Logical Division of Ideas. Transitions between paragraphs. Practice activity.	
9	[1] Chapter 4 pp.75-80	Planning an Essay. Essay Outlining. Writing Assignment.	
10	[1] Chapter 6 pp.94-100	Cause/effect writing. Organization for Cause/Effect Order. Practice activity.	
11	[1] Chapter 6 pp.101-110	Cause/Effect Signal Words and Phrases. Writing Assignment.	
11	[1] Chapter 7 pp.111-116	Comparison/Contrast writing. Organization of Comparison/Contrast Essays. Practice activity.	
12	[1] Chapter 7 pp.116-126	Comparison and Contrast Signal Words. Writing Assignment.	
13	[2] Chapter 15 pp.384-416	Problem/Solution writing. Proposing a solution. Writing Assignment.	
13	[1] Chapter 9 pp. 142-146	Making and Structuring an Argument. Identifying a topic and writing a thesis statement. Writing Assignment.	
14	[1] Chapter 9 pp.146-150	Writing an Argumentative Essay. Essay Outlining. Practice activity.	
15	[1] Chapter 9 pp.151-160	Writing Assignment: Writing an Argumentative Essay.	

16			Final Exam

Recommended Sources

Course book:

1. Writing Academic English, Fourth Edition (The Longman Academic Writing Series)
2. Ramage, Bean, and Johnson The Allyn & Bacon Guide to Writing, Brief Edition, (2017)
3. Alice Oshima, Ann Hogue Introduction to Academic Writing, third edition; Pearson Longman, (2007),

Reading Materials:

- George Bishop, Jr., James A. Solan (2005), Introduction to Academic Writing & Reading, Baku
- Matthew Allen (2004), Smart thınkıng skılls for crıtıcal understandıng and wrıtıng, second edition
- Stephen Bailey (2006), Academic Writing, A Handbook for International Students, second edition, Routledge
- Everythings an Argument with Readings 6th edition by Andrea A. Lunsford, John J. Ruszkiewicz, Keith Walters

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	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 Guidelines for Undergraduate Studies

Course Policies

- Attendance of the course is mandatory.
- In order for you (and your classmates) to be successful in this course, you must submit all of your work on time. This is especially important because so much of your grade depends on giving feedback and revising based on the feedback you receive.
- Drafts for peer review and peer review letters cannot be submitted after the class period they are due (i.e. they receive a zero), unless you've made arrangements with the lecturer.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Azerbaijan State Oil and Industry 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
Tutorials	14	1	14
Self-study	14	3,5	49
Midterm Examinations	1	3	3
Preparation for midterm exams	1	9	9
Final Examination	1	3	3
Preparation for final exam	1	20	20
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

Chemical engineering (CHEN) program, "General and applied mathematics" department

Course Unit Title	Elementary Differential Equations
Course Unit Code	MATH 2101

Type of Course Unit	Compulsory
Level of Course Unit	2nd year of CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	1
Year of Study	2
Semester when the course unit is delivered	3
Course Coordinator	Rzayev Ramin
Name of Lecturer (s)	Rzayev Ramin
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	MATH 1201 Calculus for Engineers II
Recommended Optional Program Components	-

Course description:

Differential Equations are the language in which the laws of nature are expressed. Understanding properties of solutions of differential equations is fundamental to much of contemporary science and engineering. The study of differential equations is a beautiful application of the ideas and techniques of calculus to our everyday lives. It could be said that calculus was developed mainly so that the fundamental principles that govern many phenomena could be expressed in the language of differential equations. The course tends to focus on techniques rather than on concepts due to the difficulty in conveying the beauty of the subject in the traditional course on differential equations, because the number of equations that can be treated by analytic techniques is very limited. The differential equations course is one of the few undergraduate courses where it is possible to give students a glimpse of the nature of contemporary mathematical research. One of the major approaches adopted in this course is qualitative. Students are expected to be able to visualize differential equations and their solutions in many geometric ways. For instance, we readily use slope fields, graphs of solutions, vector fields, and solution curves in the phase plane as tools to gain a better understanding of solutions. Students are also asked to become adept at moving among these geometric representations and more traditional analytic representations. Since differential equations are readily studied using the computer, numerical techniques are also emphasized. There are many computer-based tools to investigate the behavior of solutions of differential equations both numerically and graphically. Even if students can find an explicit formula for a solution, they often need to work with the equation both numerically and qualitatively to understand the geometry and the long-term behavior of solutions.

Objectives of the Course:

Introducing and classifying the differential equations and using analytical and numerical method to solve them while showing their applications.

Learning Outcomes

At the end of the course the student will be able to		**Assessment**
1	demonstrate comprehension and understanding in the topics of the course through symbolic, numeric, and graphic methods;	

		3
2	classify differential equations by order, linearity, and homogeneity;	3
3	solve first order linear differential equations both numerically and analytically;	3
4	solve linear equations with constant coefficients;	3
5	use separation of variables to solve differential equations;	3
6	solve exact differential equations;	3
7	use variation of parameters to solve differential equations;	3
8	use the method of undetermined coefficients to solve differential equations;	2
9	determine whether a system of functions is linearly independent using the Wronskian;	1
10	model real-life applications using differential equations;	2
11	use power series to solve differential equations;	1
12	use Laplace transforms and their inverses to solve differential equations;	1
13	solve systems of linear differential equations using matrix techniques and eigenvalues;	3
14	use numerical methods to solve first-order and higher-order differential equations;	3
15	use technology when appropriate and know the limitations of technology;	2
16	use deductive reasoning and critical thinking to solve problems;	1
Assessment Methods: 1. Final Exam, 2. Independent works 3. Midterm exam		
Course's Contribution to Program		
		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	5
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	3
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4

4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	3
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment	2
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	2
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	2
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	2
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	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 P1-p29	Introduction to Differential Equations, Theory and its application in modern science, Classification of Differential Equations	
2	[2] Chapter 9 P543-p551	First-Order and Simple Higher-Order Differential Equations , Integrating factor and separable equations, Boundary Conditions, Introduction to Bernoulli and Ricatti equation. **Seminar 1:** Harmonic Oscillator, RL and RC circuit	
3	[1] Chapter 3 P137-p158	Theory of Higher-Order Linear Differential Equations, Second order ODE, Characteristic equation, Homogenous vs Non Homogenous ODE, the Wronskian.	
4	[1] Chapter 3 P158-p167	Theory of Higher-Order Linear Differential Equations (continued), Repeated roots, Singular points, Simple higher order ODEs **Seminar 2:** Parachute example, Decay of population, Damped Harmonic oscillator	
5	[2] Chapter 9 P565-p574	Applications of Linear Differential Equations, Series Solution-Frobenius Method,	
6	[2] Chapter 9 P578-p592	More on Series Solution, Singularity, Linear Dependence and Independence, Special Functions	

		Seminar 3: Newton's law in viscous environment, Initial and Boundary conditions,	
7			Midterm
8	[3] Chapter 5 P217-p239	More on special functions, Orthogonal vs. non orthogonal function, Legendre Polynomials, Dirac Delta Function **Seminar 4:** Orthogonality in vectors and polynomials, Gamma and beta functions, Application in special functions	
9	[1] Chapter 7 P309-p324	Integral Transform, Laplace transform, Step functions, Solution of initial value problems,	
10	[1] Chapter 7 P359-p398	Systems of Linear Differential equation, Review from Linear Algebra, Homogenous linear system with constant coefficients **Seminar 5:** Matrices and Determinants, Eigenvalue, Solving Coupled Springs	
11	[1] Chapter 10 P596-p604	Fourier Series, Orthogonally, Kronecker delta, the Euler-Fourier Formula, Examples from wave and heat equation	
12	[1] Chapter 10 P589-p595	Partial Differential Equation in detail, Classification and order, Helmholtz eq, Wave equation **Seminar 6:** Wave equations for the string, 2D wave equation,	
13	[1] Chapter 10 P643-p652	Partial Differential equations part 2, Laplace equation, separation in Cartesian and non-Cartesian coordinates	
14	[4] Chapter 10 P324-p338	Numerical solution of Differential equations, Different methods and their features, Advantage and disadvantages of different approaches, Computing considerations **Seminar 7:** Algorithmic taylor expansion for sine and cosine, Verlet integration, Rounding error.	
15	[4] Chapter 10 P3338-p350	Numerical solution of Differential equations-Part 2, Taylor method, Ruge-Kutta and Hamming improvement on older techniques, General discussions on Computing methods	
16			Final

Recommended Sources

TEXTBOOK(S)

1-W.Boyce, R.DiPrima, Elementary Differential Equations and Boundary value Problems, Wiely edition. 2010

2-G.Arfken, H.Weber-Mathematical methods for Physicists Sixth Edition, Elsevier-, 2005

3-F.Byron, R.Fuller-Mathematics of Classical and Quantum Physics, Dover Publication-1970

4-S-Salleh,et al, Computing for Numerical Methods Using Visual C++-John Wiley and Sons 2007

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Independent works	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**
Independent works	10	1	10
Self-study	14	4	56
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			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

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

Course Unit Title	Technical English I
Course Unit Code	ENGL 2101

Type of Course Unit	Compulsory
Level of Course Unit	2nd year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	0
Practice (hour/week)	3
Laboratory (hour/week)	0
Year of Study	2
Semester when the course unit is delivered	3
Course Coordinator	Minira M. Aghahuseynova
Name of Lecturer (s)	Minira M. Aghahuseynova
Name of Assistant (s)	-
Mode of Delivery	Seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

In the framework of this course students continue to acquire new language knowledge and skills and improve existing. The lexical aspect of speech: The lexical minimum of graduates at the Technical English is at least 500 lexical units. The expansion of the vocabulary of students is due to the use of special terms, international lexis vocabulary, new meaning of known words.

The grammatical aspect of speech: Students continue to learn and improve the skills of recognizing and using in speech previously studied grammatical structures: infinitive and infinitive turns, absolute constructions, passive voice, gerund, modal verbs, articles.

Objectives of the Course:

To give students Knowledge of English in the field of Technical means, industrial technology and also contribute to the development of student's abilities to use English as a means of communication in the technical business.

-To motivate leaners to acquire listening and speaking skills in both formal and informal context.

-To focus on question forms and to make them understand the importance of using question tags and also the functional use of transformation of sentences.

-To improve their reading habit and to train them in critical and analytical reading.

-To equip them to write for academic as well as work place context

-To enable students to face interviews.

For realization of this goal it is supposed to solve the following tasks:

-to give students the terminology of selected fields

-to develop skills of translation, attracting and annotation of technical texts

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Understand the concepts relating to Chemical Engineering in English.	1
2	The basic difficulties of translation at the level of vocabulary and grammar	1,2,3
3	The rules for translating scientific-technical and patent literature	1,3
4	Use intelligent, bilingual dictionaries and other reference literature to solve translation problems	1,2,4

5	Quickly find in the text certain information (digital indicators, facts, characteristics)	2,3
6	Recognize in the text complex grammatical structures, the use of which is characteristic of science-popular literature, edit the text in native language	1,2,3
7	Work with the listened/ read text: determine the topic, predict the content of the text on the title, the key words, to establish a logical sequence of basic facts.	1,3,4
8	Carry out information search, including with the help of computer facilities, to enter into a dialogue and also participate in a collective discussion of problems.	3

Assessment Methods: 1. Presentation, 2.Midterm, 3. Seminars,4.final exam

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	5
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	4
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	4
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	3
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	5
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	2

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

Course Contents

Week	Chapter	Topics	Exam
1	[1] Ch.1	Overview of Chemistry education. Listening, reading and scanning, writing, speaking and representing, difference between hearing and listening, listening to informal conversation.	
2	[1] Ch.2	History of chemistry. Listening, reading and scanning, writing, speaking and representing, difference between hearing and listening, listening to informal conversation.	
3	[1] Ch.3	Chemical Process industry. Listening, reading and scanning, writing, speaking and representing, difference between hearing and listening, listening to informal conversation.	

4	[1] Ch.4	Revision and development. Units 1 and 3	
5	[1] Ch.5	Matter in the universe. Listening, reading and scanning, writing, speaking and representing, difference between hearing and listening, listening to informal conversation.	
6	[1] Ch.6	Why is water so important? Listening, reading and scanning, writing, speaking and representing, difference between hearing and listening, listening to informal conversation.	
7			Midterm
8	[1] Ch.7	The importance of laboratory experiments. Listening, reading and scanning, writing, speaking and representing, difference between hearing and listening, listening to informal conversation.	
9	[1] Ch.8	Revision and development. Units 5 and 6.	
10	[1] Ch.9	Organic chemistry. Listening, reading and scanning, writing, speaking and representing, difference between hearing and listening, listening to informal conversation.	
11	[1] Ch.10	The age of polymers. Listening, reading and scanning, writing, speaking and representing, difference between hearing and listening, listening to informal conversation.	
12	[1] Ch.11	Revision and development. Units 7 and 8.	
13	[1] Ch.12	Man and his environment. Listening, reading and scanning, writing, speaking and representing, difference between hearing and listening, listening to informal conversation.	
14	[1] Ch.13	Science and its future. Listening, reading and scanning, writing, speaking and representing, difference between hearing and listening, listening to informal conversation.	
15	[1] Ch.14	Revision and development. Units 9 and 10.	
16			Final

Recommended Sources

TEXTBOOK(S)

1. Califford A. Whitcomb, Leslie E. Whitcomb Effective interpersonal and team communication skills for engineers.1st edition, Wiley, 2008.
3. Carmen Bombardó Solés Marta Aguilar Pérez Clàudia Barahona Fuentes, Technical Writing A Guide for Effective Communication, Edicions UPC, 2007.

Assessment

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

Quiz	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 Workload(hour)
Course duration in class	**14**	**3**	**42**
Presentation	1	10	10
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	7	7
Final Examination	1	3	3
Preparation for final exam	1	20	20
Self-study	14	4	56
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

Chemical engineering (CHEN) program, "Industrial economy and management" department

Course Unit Title	Professional practice and ethics
Course Unit Code	CHEM 2201
Type of Course Unit	Compulsory
Level of Course Unit	2nd year of CHEN program

National Credits	0
Number of ECTS Credits Allocated	4
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	-
Year of Study	2
Semester when the course unit is delivered	4
Course Coordinator	Samira Mammadova
Name of Lecturer (s)	Samira Mammadova
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description: It is essential for professionals in any field to have an understanding of the ethical problems and principles in their field. But anyone, no matter what their job, must deal with many other professions as well. Part of professional ethics is the understanding of the ethics of other professions: how they interact and what can be expected from them as correct ethical behaviour. In turn, any professional will benefit from a critical scrutiny of their own ethics by those from other professions. The general principles of professional ethics will be examined, as well as the distinctive problems of the different fields.

Objectives of the Course:

Students should know more about the nature of a profession, professional codes of ethics, confidentiality, whistle-blowing, the responsibility of business to the environment, uses and abuses of human research, and animal ethics in research.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Ability to engage in informed critical reflection on the nature of professionalism and ethical challenges inherent in professionalism	3,5
2	Knowledge of prominent normative ethics frameworks – consequentialist, deontological, virtue, and contractualism	1,2,3,4,5
3	Awareness of types of ethical challenges and dilemmas confronting members of a range o media, police, law, medicine, research)	f profess2i,o3ns (business,
4	Ability to relate ethical concepts and materials to ethical problems in specific professions and professionalism	5
5	Ability to research appropriate material in relation to set questions in writing essays meeting the highest standards of rigor and clarity.	1,3,5

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Seminars , 4. Midterm Exam, 5. Lectures

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	2
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	2
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	2
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	2
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	2
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	5
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	4
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	5
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	5

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

Course Contents

Week	Chapter	Topics	Exam
1	[1] Ch.1	Introduction. Introduction to ethics. Authority theories, intuitionist theories, egoist theories, consequentialist theories, and deontological theories, feminist ethics.	
2	[2] Ch.2	Perspectives on professional ethics. Professional practice	
3	[2] Ch.2,3	What is the profession? Just following the rules? The Ordinariness of Professional Ethics The Excuses That Make Professional Ethics Irrelevant	
3	3	Employee rights. Codes of professional ethics and conduct	
4	3,4	Meaning of planning Planning Values/ Foundations of Public Planning (utilitarianism; libertarianism; communitarianism) Palnning ethics . Planning values	
5	5	Planning values	Quiz

6	5,6	Request for proposals. (RFP)	
7	6	How to respond to an RFP. How to build a proposal.	
			Midterm
8	7	Professional and Research ethics	
9	8	Typology of ethical dilemmas	
10	8	Ethics and Leadership	
11	9	Creating an Ethical organizational culture	
12	9	Creating an Ethical organizational culture	
13	10	Computer Misuse	
14	10	Computer Misuse. Privacy and data protection	Quiz
15	11	Law , Law. Informing Clients About Limits to Confidentiality. Two Concepts of a Lawyer in an Adversary System Education. Democratic education. Ethics and Educator/Student Relationships Education	
16			Final

Recommended Sources

TEXTBOOK(S)

1. John Rowan & Samuel Zinaich, Jnr. Ethics for the Professions. Wadsworth. 2003
2. Joan C. Callahan, Ethical issues in professional life, Oxford University Press, 1988
3. Alan H. Goldman, The moral foundations of professional ethics, Rowman and Littlefield, 1988
4. Ruth F. Chadwick, (ed.) Ethics and the professions, Avebury, 1994
5. Justin Oakley, Dean Cocking, Virtue ethics and professional roles. Cambridge University Press, 2001

Assessment

Attendance	-	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	-	
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	6	6
Self-study	14	4	46
Tutorials	14	0,5	7
Midterm Examination	1	3	3
Preparation for midterm exam	1	7	7
Final Examination	1	3	3
Preparation for final exam	1	11	11
Total Workload			**120**
Total Workload/30(h)			**120/30**
ECTS Credit of the Course			**4**

Course Unit Title	Chemical Engineering Thermodynamics I
Course Unit Code	CHEM2202
Type of Course Unit	Compulsory
Level of Course Unit	2nd year CHEN 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	4
Course Coordinator	Professor Baghiyev Vagif Lachin
Name of Lecturer (s)	Professor Baghiyev Vagif Lachin
Name of Assistant (s)	Taghiyeva Tahmina Chingiz
Mode of Delivery	Face to Face, laboratory
Language of Instruction	English
Prerequisites	CHEM2101 Chemical engineering material and energy balances
Recommended Optional Program Components	-

Course description:

Introduction to the concept of energy and the laws governing the transfers and transformations of energy. Emphasis on thermodynamic properties and the first and second law analysis of systems and control volumes. Integration of these concepts into the analysis of basic power cycles is introduced.

Objectives of the Course:

The students will be asked to demonstrate their knowledge of the material covered in Thermodynamics I through their mastery of the following course objectives:

1. Introduce basic physical concepts and applications of thermodynamics, and their consequences for engineering processes and operations
2. Familiarize students with the properties of pure substances along with basic principles governing transformations of energy
3. Emphasize the first and second law of thermodynamics
4. Provide an elementary introduction to cycles
5. Introduce the behavior of gas mixtures

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	define thermodynamic concept	1,2,3,
2	Learn the 1st law of thermodynamics and other basic concepts.	1,2,3,4
3	Realize the volumetric properties of pure fluids.	1,2,3,4
4	Learn the heat effects	1,2,3,4
5	Apply the second law on various systems.	1,2,3

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	5

2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	4
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	2
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	2
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	2
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	5
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	2
9	Ability to understand professional, ethical, legal, security issues, and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	5

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

Course Contents

Week	Chapter	Topics	Exam
1	Textbook 1, chapter 2, pp.10-12	Definitions of fundamental concepts of thermodynamics: Thermodynamics and energy, dimensions and units, closed and open systems, forms of energy, state, changes of state and cycles, temperature, zeroth law of thermodynamics, practise	
2	2	Definitions of fundamental concepts of thermodynamics: Thermodynamics and energy, dimensions and units, closed and open systems, forms of energy, state, changes of state and cycles, temperature, zeroth law of thermodynamics, practise **Lab:** Heat of neutralization of strong base with strong acid. The purpose of this work is to determine the heat of neutralization of a strong base by a strong acid. Used equipment - bomb calorimeter	
3	3	1st law of thermodynamics and other basic concepts	
4	3	1st law of thermodynamics and other basic concepts **Lab:** Heat of neutralization of strong base with strong acid. The purpose of this work is to determine the heat of neutralization of a strong base by a strong acid. Used equipment - bomb calorimeter	
5	3	1st law of thermodynamics and other basic concepts	
6	3	Volumetric properties of pure fluids	

		Lab: Heat of dissolution. Purpose of work: determination of integral and calculation of differential heats of dissolution of some highly soluble salts in water. Used equipment - bomb calorimeter	
7	7		Midterm
8	3	Volumetric properties of pure fluids **Lab:** Heat of dissolution. Purpose of work: determination of integral and calculation of differential heats of dissolution of some highly soluble salts in water. Used equipment - bomb calorimeter	
9	3	Heat effects	
10	3	Heat effects **Lab:** Heat of dissolution. Purpose of work: determination of integral and calculation of differential heats of dissolution of some highly soluble salts in water. Used equipment - bomb calorimeter	
11	3	Heat effects	
12	4	2nd law of thermodynamics **Lab:** Heat of dissolution. Purpose of work: determination of integral and calculation of differential heats of dissolution of some highly soluble salts in water. Used equipment - bomb calorimeter	
13	4	2nd law of thermodynamics	
14	4	2nd law of thermodynamics **Lab:** Heat of dissolution. Purpose of work: determination of integral and calculation of differential heats of dissolution of some highly soluble salts in water. Used equipment - bomb calorimeter	
15	4	Exercise	
16			Final

Recommended Sources
TEXTBOOK(S)
1. Howard De Voe, Thermodynamics and Chemistry, Second Edition, Version, 2015, 532 pages.
2. Dinesh Sharma, A Handbook Of Chemical Thermodynamics, Mittal Publications, 2005, 277 pages.

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	10%	
Laboratories	20%	
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**	**3**	**42**
Presentation	1	8	
Tutorials	14	1	14
Self-study	14	5	70
Midterm Examination	1	3	3
Preparation for midterm exam	1	11	11
Final Examination	1	3	3
Preparation for final exam	1	30	30
Total Workload			**180**
Total Workload/30(h)			**180/30**
ECTS Credit of the Course			**6**

Course Unit Title	Technical English II
Course Unit Code	ENGL 2201
Type of Course Unit	Compulsory
Level of Course Unit	2nd year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	0
Practice (hour/week)	3
Laboratory (hour/week)	0
Year of Study	2
Semester when the course unit is delivered	4
Course Coordinator	Narmina Guliyeva
Name of Lecturer (s)	Narmina Guliyeva
Name of Assistant (s)	-
Mode of Delivery	Seminar
Language of Instruction	English
Prerequisites	ENGL 2101Technical English I
Recommended Optional Program Components	-

Course description:

In the framework of this course students continue to acquire new language knowledge and skills and improve existing. The lexical aspect of speech: The lexical minimum of graduates at the Technical English is at least 500 lexical units. The expansion of the vocabulary of students is due to the use of special terms, international lexis vocabulary, new meaning of known words.

The grammatical aspect of speech: Students continue to learn and improve the skills of recognizing and using in speech previously studied grammatical structures: infinitive and infinitive turns, absolute constructions, passive voice, gerund, modal verbs, articles.

Objectives of the Course:

To give students Knowledge of English in the field of Technical means, industrial technology and also contribute to the development of student's abilities to use English as a means of communication in the technical business.

-To motivate leaners to acquire listening and speaking skills in both formal and informal context.

-To focus on question forms and to make them understand the importance of using question tags and also the functional use of transformation of sentences.

-To improve their reading habit and to train them in critical and analytical reading.

-To equip them to write for academic as well as work place context

-To enable students to face interviews.

For realization of this goal it is supposed to solve the following tasks:

-to give students the terminology of selected fields

-to develop skills of translation, attracting and annotation of technical texts

Learning Outcomes		
At the end of the course the student will be able to		Assessment
1	Understand the concepts relating to Chemical Engineering in English.	1
2	The basic difficulties of translation at the level of vocabulary and grammar	1,2,3
3	The rules for translating scientific-technical and patent literature	1,3
4	Use intelligent, bilingual dictionaries and other reference literature to solve translation problems	1,2
5	Quickly find in the text certain information (digital indicators, facts, characteristics)	2,3
6	Recognize in the text complex grammatical structures, the use of which is characteristic of science-popular literature, edit the text in native language	1,2,3
7	Work with the listened/ read text: determine the topic, predict the content of the text on the title, the key words, to establish a logical sequence of basic facts.	1,3
8	Carry out information search, including with the help of computer facilities, to enter into a dialogue and also participate in a collective discussion of problems.	1,2,3
Assessment Methods: 1. Presentation, 2.Midterm, 3.Final exam		

Course's Contribution to Program		
		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	5
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	4
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	4
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	3
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	5

8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	2

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

Course Contents

Week	Chapter	Topics	Exam
1	[1] Unit 1	**Technology in use** Describing technical functions and applications Explaining how technology works	
2	[1] Unit 1	**Technology in use** Emphasizing technical advantages Simplifying and illustrating technical explanations	
3	[1] Unit 2	**Materials technology** Describing specific materials Categorising materials Specifying and describing properties Discussing quality issues	
4	[1] Unit 3	**Components and assemblies** Describing component shapes and features Explaining and assessing manufacturing techniques Explaining jointing and fixing techniques Describing positions of assembled components	
5	[1] Unit 4	**Engineering design** Working with drawings Discussing dimensions and precision	
6	[1] Unit 4	**Engineering design** Describing design phases and procedures Resolving design problems	
7			Midterm
8	[1] Unit 5	**Breaking point** Describing types of technical problem Assessing and interpreting faults	
9	[1] Unit 5	**Breaking point** Describing the causes of faults	

		Discussing repairs and maintenance	
10	[1] Unit 6	**Technical development** Discussing technical requirements Suggesting ideas and solutions	
11	[1] Unit 6	**Technical development** Assessing feasibility Describing improvements and redesigns	
12	[1] Unit 7	**Procedures and precautions** Describing health and safety precautions Emphasising the importance of precautions Discussing regulations and standards Working with written instructions and notices	
13	[1] Unit 8	**Monitoring and control** Describing automated systems Referring to measurable parameters Discussing readings and trends Giving approximate figures	
14	[1] Unit 9	**Theory and practice** Explaining tests and experiments Exchanging views on predictions and theories Comparing results with expectations Discussing causes and effects	
15	[1] Unit 10	**Pushing the boundaries** Discussing performance and suitability Describing physical forces Discussing relative performance Describing capabilities and limitations	
16			Final

Recommended Sources

TEXTBOOK(S)

1. Mark Ibbotson, Cambridge English for engineering. Cambridge University Press 2008
2. Armer Tamzen , Cambridge english for scientists, Cambridge University Press 2011
3. Bonamy David, Jacques C., Technical english 1A. Student`s book and workbook, Pearson Longman 2008
4. Glendining H. Eric, McEwan John, Oxford english for information technology. Cambridge University Press 2011

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	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 Workload(hour)
Course duration in class	**14**	**3**	**42**
Presentation	1	8	8
Tutorials	14	1,5	21
Midterm Examination	1	3	3
Preparation for midterm exam	1	7	7
Final Examination	1	3	3
Preparation for final exam	1	20	20
Self-study	14	3,5	49
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

Course Unit Title	Numerical Computing in Chemical and Biochemical Engineering
Course Unit Code	COMP 2201
Type of Course Unit	Compulsory
Level of Course Unit	2nd year of CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	1
Year of Study	2
Semester when the course unit is delivered	4
Course Coordinator	Nigar Ismayilova
Name of Lecturer (s)	Nigar Ismayilova
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	COMP 1201 Computers and chemical engineering
Recommended Optional Program Components	-

Course description:

Numerical analysis continues the long tradition of practical mathematical calculations that is extremely important, for instance, in astronomy, mechanical engineering, applied physics, etc. Much of numerical analysis is concerned with obtaining approximate solutions while maintaining reasonable bounds on errors. Numerical analysis naturally finds applications in all fields of engineering and the physical sciences, but in the 21st century also the life sciences and even the arts have adopted elements of scientific computations. Ordinary differential equations appear in celestial mechanics (planets, stars and galaxies); numerical linear algebra is important for data analysis; stochastic differential equations and Markov chains are essential in simulating living cells for medicine and biology. Before the advent of modern computers numerical methods often depended on hand interpolation in large printed tables. Since the mid-20th century, computers calculate the required functions instead. These same interpolation formulas nevertheless continue to be used as part of the software algorithms for solving differential equations.
The course will develop numerical methods aided by technology to solve algebraic, transcendental, and differential equations, and to calculate derivatives and integrals. The course will also develop an understanding of the elements of error analysis for numerical methods and certain proofs. The course will further develop problem solving skills. The overall goal of the field of numerical analysis is the design and analysis of techniques to give approximate but accurate solutions to various hard problems.

Objectives of the Course:

Introducing Numerical methods and its importance and application in modern science and engineering and employing computers to tackle problems related to this field while discussing the problems and difficulties of different approaches.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Learn the objectives of numerical analysis	3
2	Classification of methods for numerical analysis	3
3	Familiarity with tools for numerical analysis	2
4	Solve real life problems in engineering	2
5	Difficulties and downsides of the approaches	2
6	Simulation and modelling of a specific project related to Chemical engineering	1
Assessment Methods: 1. Final Exam, 2. Independent works 3. Midterm exam		
Course's Contribution to Program		
		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	5
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	3
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	5
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	3
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment	3
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	3
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	5
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	4

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 and 2 , (p1-p10) [1] Chapter 1 (p1-p7)	Approximations and Round-off Errors, The importance of care in the case of floating-point calculations, Examples from science in Geometry and Rocket science. Lack of precision vs. speed and memory.	
2	[1] Chapter 3 and 4 from (p10-p13) [1] Chapter 10 (p610-p618)	Truncation Errors and the Taylor Series, examples from exponential functions and trigonometric functions, memory limitations in different programming languages (C vs. Python) and algorithm designs **Seminar 1:** Integer vs. Floating point arithmetic, Round off errors, Lack of precision	
3	[1] Chapter 10 (p619-p623) [1] Chapter 10 (p327-330)	Additional discussions of Taylor series for the case of trigonometric equations and its application on approximations. General knowledge on Fourier series	
4	[1] Chapter 12 (p36-51) [2] Chapter 6 (p193-201)	Roots of Equations – Open Methods, Bisections and Newton-Raphson methods, Advantages and limitations of each process, Algorithms and Programming tricks **Seminar 2:** Taylor expansion for exponential and trigonometric functions and computer considerations, Roots for Quadratic and Cubic equations-Bisecting in action.	
5	[1] Chapter 6 (p203-206) [2] Chapter 12-14 (p38-57)	Roots of Equations Part 2– Roots of Polynomials, Examples from non-linear equation (Kepler equation), Introducing other methods (secant method and Iterations)	
6	[2] Chapter 2 of (p13-35) [1] Chapter 5 (127-130)	Linear Algebraic Equations – Introductory subjects regarding matrices and vectors, Determinants etc., Computer considerations in modern programming languages (arrays vs. vectors in c++) and leakage of memory Introducing Gauss-Jordan methods **Seminar 3:** Flaws of Bisectioning, Newton-Raphson for non-linear equations, Practical examples of Newton-Raphson (e.g. Phase Diagrams)	
7			Midterm

8	[1] Chapter 5 (131-161) [1] Chapter 32 (p133-149)	Linear Algebraic Equations – Continuing Gauss-Jordan with examples and algorithmic approach. Forward and Backward substitutions and LU factorization	
9	[1] Chapter 5 (p13-p16) [1] Chapter 7 (p227-p231)	Curve Fitting – Interpolation, Lagrange interpolations Error of the Lagrange interpolation Algorithms for Lagrange interpolations **Seminar 4:** Systems of equations, Intersection of two lines, Extension to higher dimensions, Algorithmic approaches to eliminations	
10	[1] Chapter 7 (p227-p234)	Curve-Fitting – Newton and Hermit interpolations Divide-difference method Errors of newton interpolation and algorithms for the Newton interpolation	
11	[2] Chapter 7 (p244-p249) Chapter 8 [2](p267-p270)	Curve-Fitting – Least-Squares Approximation Differentiation and Integration Discretization and errors, central difference for first and second derivatives **Seminar 5:** Forward and Backward substitution in action, Using special types of matrices for elimination, Efficiency considerations.	
12	[1] Chapter 8 (p271-p276)	Differentiation and Integration-part 2 More on errors and discretization related to differentiation Numerical integration and its importance. Trapezium methods and Simpson rules. Considerations on precision and applicability.	
13	[4] Chapter 4 (p155-p161) [1] Chapter 10 (p324-p329)	Considerations on Numerical Integration and Introducing new techniques. Algorithms and implementation in computer Differential equations part 1 Mathematical Backgrounds Initial values and Taylor Series method **Seminar 6:** LU Factorizations, Determinants, Regression for finding polynomials, Examples from Signal Processing.	
14	[2] Chapter 10 (p330-p338)	Differential equations part 2 Euler's method and its limitations. Runge-Kutta of order 2 and order 4 and discussion on its advantages and disadvantages. Speed and memory considerations Modern methods (Corrector-predictor and Hamming's method)	

15	Random parts from ref no 4	Additional topics and perspective of the subjects (Chebyshev polynomials- Sorting and etc.) **Seminar 7:** Differentiation, Discretization and related considerations, Simpson methods for numerical integration	
16			Final

Recommended Sources

TEXTBOOK(S)

1. Atilla Matte, Introduction to Numerical Analysis with C programs, Brooklyn college of Newyork-2014
2. S-Salleh,et al, Computing for Numerical Methods Using Visual C++-John Wiley and Sons 2007
3. G.Thomas et al, Thomas's Calculus, Pearson, 2013
4. G.Thomas , W-Press et al, Numerical Recipes 3rd edition- Cambridge University Press-2007

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Independent works	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	8	8

Self-study	14	3,5	49
Tutorials	14	1,5	21
Midterm Examination	1	3	3
Preparation for midterm exam	1	7	7
Final Examination	1	3	3
Preparation for final exam	1	20	20
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

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

Course Unit Title	Chemical Engineering Thermodynamics II
Course Unit Code	CHEM3101

Type of Course Unit	Compulsory
Level of Course Unit	3rd year CHEN program
National Credits	-
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	-
Laboratory (hour/week)	1
Year of Study	3
Semester when the course unit is delivered	5
Course Coordinator	Baghiyev Vagif Lachin
Name of Lecturer (s)	Baghiyev Vagif Lachin
Name of Assistant (s)	Taghiyeva Tahmina Chingiz
Mode of Delivery	Face to Face, laboratory
Language of Instruction	English
Prerequisites	CHEM 2202 Chemical Engineering Thermodynamics I
Recommended Optional Program Components	-

Course description:

Thermodynamic properties of fluids. Describes fundamental property relation. Numerical practice about solution thermodynamics. Chemical reaction equilibria.

Objectives of the Course:

Students should be able to

1. use thermodynamics to solve problems in solution, phase, and chemical equilibria.
2. select specific equations of state or correlations that are appropriate for treating a given engineering problem.
3. describe the molecular-level phenomena that give rise to solution behavior.
4. compute the equilibrium constant for a given reaction at any temperature.
5. compute the extent of reaction and equilibrium composition of single and multiple chemical reactions.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Will have knowledge about thermodynamic properties of fluids	1,2,3,
2	Will have knowledge about theory of solution thermodynamics	1,2,3,4
3	Will do numerical practice about solution thermodynamics	1,2,3,4
4	obtain some organic substance using initial components and identify it in laboratory conditions.	1,2,3,4
5	Interprets the chemical reaction equilibria	1,2,3

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	5
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	5
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	2

5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	1
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	5
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	2
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	3

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

Course Contents

Week	Chapter	Topics	Exam
1	7,8	Thermodynamic properties of fluids	
2	7,8	Thermodynamic properties of fluids **Lab:** Ebullioscopy. The aim of this work is to determine the molecular weight of tartaric acid by ebullioscopy and, thus, to determine the degree of its purity. Used equipment Landsberg device which consists of a glass vaporizer, a test tube and a Beckmann thermometer	
3	9,10	Solution thermodynamics: Theory	
4	9,10	Solution thermodynamics: Theory **Lab**: Ebullioscopy. The aim of this work is to determine the molecular weight of tartaric acid by ebullioscopy and, thus, to determine the degree of its purity. Used equipment Landsberg device which consists of a glass vaporizer, a test tube and a Beckmann thermometer	
5	9,10	Solution thermodynamics: Theory	
6	9,10	Solution Thermodynamics: Applications **Lab**: Binary solutions. The aim of this work is to build a liquid-vapor equilibrium diagram in the composition-boiling-point coordinates at atmospheric pressure for a binary system consisting of unlimitedly mixing liquids. Used equipment: distillation cube, reflux refrigerator, thermometer and condensate collection pocket.	
7			Midterm
8	9,10	Solution Thermodynamics: Applications **Lab:** Heat of evaporation. The aim of this work is to determine the heat of evaporation of benzene by the dynamic method. The main parts of the installation are: a boiling chamber with a built-in reflux condenser and a thermometer, a heater, a water cooler, a manometer and a vacuum pump.	
9	8,13	Phase Equilibria	
10	8,13	Phase Equilibria **Lab:** Determining of phase distribution constant. Purpose of the work is to determine the distribution coefficient of acetic acid between water and benzene. Used equipment: orbital shaker.	
11	11	Chemical Reaction Equilibria	

12	11	Chemical Reaction Equilibria **Lab:** Reaction rate constant. Purpose of the work is determination of the rate constant and activation energy of the reaction of decomposition the ethylacetate in the presence of hydrogen cations	
13	11	Chemical Reaction Equilibria	
14	12	Chemical Reaction Equilibria **Lab:** Activation energy. Purpose of the work is determination of the rate constant and activation energy of the reaction of decomposition the ethyl acetate in the presence of hydrogen cations. Used equipment is thermostat	
15	12	Chemical Reaction Equilibria	
16			Final

Recommended Sources

TEXTBOOK(S)

1. Howard DeVoe, Thermodynamics and Chemistry, Second Edition, Version , December 2015, 532 pages.
2. Dinesh Sharma, A Handbook Of Chemical Thermodynamics, Mittal Publications, 2005, 277 pages.

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	10%	
Laboratories	20%	
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)
Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class	**14**	**3**	**42**
Presentation	1	5	8
Self-study	14	3,5	49
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	7	7

Final Examination	1	3	3
Preparation for final exam	1	24	24
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

Chemical engineering (CHEN) program, "Petrochemical technology and industrial ecology" department

Course Unit Title	Fundamentals of transport in chemical and biochemical engineering

Course Unit Code	CHEM 3102
Type of Course Unit	Compulsory
Level of Course Unit	3rd year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	1
Year of Study	3
Semester when the course unit is delivered	5
Course Coordinator	Nushaba Gamzayeva
Name of Lecturer (s)	Nushaba Gamzayeva
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar
Language of Instruction	English
Prerequisites	CHEM 2202 Chemical Engineering Thermodynamics I
Recommended Optional Program Components	-

Course description:

The objective of this course it to provide a fundamental understanding of the convection and diffusion process in fluids, and how these determine the rates of transport of mass, heat and momentum. Chemical engineers and biochemical engineers head the research into and development of methods for large-scale production of drugs, inexpensive production of basic chemicals and fuels, and the economic production of advanced materials used in a wide range of areas – including communication, IT, health, and transport. Research into and development of methods for preventing and remedying environmental problems in relation to chemicals in the production, as well as research into and development of methods for sustainable chemical and biochemical energy conversion are also key fields of activity.

Objectives of the Course:

- The goals of this subject are to master the basic principles of mass transfer, by introducing the student to mass transfer from the point of view of transport phenomena followed by macroscopic separation processes. It is the objective of this course to introduce the student to both, a microscopic and macroscopic approach to mass transfer. In a first part, microscopic diffusional processes and the prediction and use of transport processes are discussed. In a second part, the course primarily deals with macroscopic separation processes, including absorption, distillation, in both step (tray) and continuous operation. The second part of the course will lead to equipment design.

Learning Outcomes

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

1	Use the knowledge gained for its sufficient application in research and laboratory work.	1,3
2	Apply knowledge of math, science, engineering, and mass transfer principles to solve process and system problems, including steady and unsteady mass transport.	1,2,3
3	Design a system, component, equipment or process to meet desired mass transport needs.	2,3
4	Identifying, formulating, and solving engineering and mass transfer problems, including continuous and staged contact equipment, and vapor-liquid equilibrium	3
5	understand and implement professional and ethical standards.	1,3

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	4
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	3
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3

9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	4

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

Course Contents

Week	Chapter	Topics	Exam
1	[1] Chap. I	Introduction	
2	[2] Chap. I	Dimensional analysis. Limitations of unit operations approach Seminar I - Dimensional analysis.	
3	[3] Chap. II	Diffusion due to random motion. Estimates of diffusion coefficient from kinetic theory and for turbulent flow.	
4	[3] Chap.III	Steady and unsteady diffusion in one dimension from a flat plate. Equivalence of heat, mass and momentum transport for unsteady one dimensional diffusion. Seminar II - Steady and unsteady diffusion in one dimension from a flat plate	
5	[1] Chap.IV	Steady and unsteady diffusion in one dimension from a flat plate. Equivalence of heat, mass and momentum transport for unsteady one dimensional diffusion.	
6	[2] Chap.III	Steady and unsteady transfer to a cylinder - balances in cylindrical co-ordinates. Seminar III - Steady and unsteady transfer to a cylinder - balances in cylindrical co-ordinates.	
7	[3] Chap.IV	Effect of pressure in fluid flow. Steady and unsteady flow in a pipe. Method of separation of variables.	
8			Midterm
9	[3] Chap.V	Free surface flows down an inclined plane. Combination of convection, diffusion. Seminar IV - Free surface flows down an inclined plane.	
10	[1] Chap.V	Derivation of balance laws for stationary control volumes as partial differential equations for heat, mass and momentum transfer.	
11	[2] Chap V	Balances in cylindrical and spherical coordinates	

		Seminar V - Balances in cylindrical and spherical coordinates	
12	[3] Chap. IV	Diffusion dominated transport in three dimensions. Fourier's law, Fick's law as partial differential equations.	
13	[3] Chap.I	Solution of temperature field in a cube using spherical harmonic expansions. Seminar VI - Solution of temperature field in a cube using spherical harmonic expansions.	
14	[2] Chap.III	Spherical harmonics. Equivalent point charge representations.	
15	[1] Chap.VI	Thermal conductivity of a composite Seminar VII - Thermal conductivity of a composite	
16			Final

Recommended Sources
TEXTBOOK(S)

1. Bird, Stewart and Lightfoot (BSL), Transport Phenomena, Wiley International, 1960.
2. L. G. Leal, Laminar Flow and Convective Transport Processes, Butterworth-Heineman, 1992.
3. G. K. Batchelor, An Introduction to Fluid Dynamics, Cambridge University Press, 1967.

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 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 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	7	7
Self-study	14	4	56
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	9	9
Final Examination	1	3	3
Preparation for final exam	1	19	20
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

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

Course Unit Title	Chemical Engineering Reactor Design
Course Unit Code	ENG3101
Type of Course Unit	Compulsory

Level of Course Unit	3rd year CHEN program
National Credits	-
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	-
Year of Study	3
Semester when the course unit is delivered	5
Course Coordinator	Professor Baghiyev Vagif Lachin
Name of Lecturer (s)	Professor Baghiyev Vagif Lachin
Name of Assistant (s)	-
Mode of Delivery	Face to Face, seminar
Language of Instruction	English
Prerequisites	COMP 2201 Numerical computing in chemical and biochemical engineering
Recommended Optional Program Components	

Course description:

Flow patterns. Non-ideal flow. Dispersion model. Tanks-in-series mode

Objectives of the Course:

To provide a basic understanding of chemical reaction engineering with emphases on the applications of chemical kinetics, thermodynamics, mass and energy balances, and transport phenomena to the design and performance of chemical reactors.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Recognize flow patterns, contacting, and non-ideal flow.	1,2,3
2	Recognize basics of non-ideal flow	1,2,3
3	Apply compartment models.	1,2,3
4	Apply the dispersion model.	1,2,3
5	Apply the tanks-in-series model.	1,2,3
6	Apply the convection model for laminar flow.	1,2,3
7	Have knowledge on earliness of mixing, segregation and RTD.	1,2,3

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	5

2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	5
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	2
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	1
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	3
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	2
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	3

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

Course Contents

Week	Chapter	Topics	Exam
1	4	Introduction to chemical engineering reactor design.	
2	2	Stoichiometry. Limiting reactant. Constant volume systems. Variable volume systems	
3	2,9	Chemical kinetics. Chemical reaction types. Effect of temperature on reaction rate. Chemical Equilibrium.	
4	3	Batch Reactors. Types of reaction. Types of reactor.	
5	5	Order of reaction. Techniques for determination of orders of reaction. Integral technique. Differential technique.	
6	6	General design equation for any reactor	
7			Midterm
8	7	Plug flow reactors (PFR) design equation. PFR in series. PFR in parallel.	
9	9	Continuous stirred tank reactors (CSTR). CSTR design equation. CSTR in series.	
10	6	Autocatalytic Reactions	
11	8	Multiple Reactions	
12	6,7	Design equations. Rate equations for simple, parallel and series reactions.	
13	11	Residence Time Distribution	
14	11	E & F Curves for Ideal Reactors	
15	11	Determination of Conversion.	

16			Final exam

Recommended Sources
TEXTBOOK(S)

1. O. Levenspiel, Chemical Reaction Engineering (3rd ed.) ,Wiley, 1998.
2. A.R. Cooper and G.V. Jeffreys, Chemical Kinetics and Reactor Design, Oliver and Boyd1971.
3. Mark E. Davis, Robert J. Davis, Fundal11entals of Chel11ical Reaction Engineering, McGraw Hill,2002, 368 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 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**	**3**	**42**
Presentation	1	10	10
Tutorials	14	1	14
Self-study	14	3,5	49
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			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

Chemical engineering (CHEN) bachelor program, "Industrial economy and management" department

Course Unit Title	Principles of Microeconomics and Macroeconomics

Course Unit Code	ECON 3101
Type of Course Unit	Compulsory
Level of Course Unit	3rd year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	-
Year of Study	3
Semester when the course unit is delivered	5
Course Coordinator	Samira K. Mammadova
Name of Lecturer (s)	Samira K. Mammadova
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

Introductory course that provides a basic understanding of microeconomic principles. Analyzes the economic factors influencing decisions made at the individual level, after evaluating resources, costs, and tradeoffs. Macroeconomics course is an exploration of the factors that impact the overall performance of economies. The course focuses on public policies helping and hindering the achievement of intended outcomes, such as reducing unemployment or increasing trade.

Objectives of the Course:

Students should identify how individual economic agents make rational choices given scarce resources, and explain how to optimize the use of resources at hand. Students should be able to use all accumulated knowledge for an understanding of key macroeconomic concerns, including national income accounting, saving and investment, and market forces.

Learning Outcomes:

At the end of the course the student will be able to		Assessment
1	analyze and apply the mechanics of demand and supply for individuals, firms, and the market;	2, 3
2	identify the characteristics of various market structures, namely, perfectly competitive markets, non-competitive markets, and imperfectly competitive markets, and compare and contrast their operations;	2, 3
3	describe the determinants of total output and the ways to measure nominal Gross Domestic Product (GDP) as well as real GDP;	1, 2, 3

4	describe and differentiate among full employment and unemployment, the three forms of unemployment, and the two forms of inflation;	1, 2
5	analyze a government's roles in the economy; evaluate how a government uses its fiscal policy and monetary policy to influence key variables in order to achieve economic growth, price stability, full employment, and other goals.	1, 2

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterms

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	3
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	1
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	1
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issuesin chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	1
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	4
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	3

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

Course Contents

Week	Chapter	Topics	Exam
1	[1,2]	Foundation of Microeconomics. • Theories, Principles, and Models • Individual's and Society's Economizing Problem • Production Possibilities and The Circular Flow Models • Characteristics of the Market System	
2	[2] pp. 31-35[2]	Competitive markets: Demand and Supply. • Demand, Law of Demand, Determinants of Demand, Changes in Demand	

		• Supply, Law of Supply, Determinants of Supply, Changes in Supply • Market Equilibrium, Rationing Function of Prices, Efficient Allocation, Changes in Supply, Demand, and Equilibrium **Seminar:** Demand and Supply analysis; Determining Market equilibrium; Determining Efficient allocation	
3	[2] pp. 220, 223, 224[2]	Elasticity • Price Elasticity of Demand, The Price-Elasticity Coefficient and Price Elasticity and the Total-Revenue Curve, Determinants of Price Elasticity of Demand • Price Elasticity of Supply: The Market Period, Price Elasticity of Supply: The Short Run, Price Elasticity of Supply: The Long Run • Cross Elasticity and Income Elasticity of Demand **Seminar**: Determining Price Elasticity of Demand, Cross and Income Elasticity; Deriving Market, Short Run and Log Run periods graphs of Supply Elasticity.	
4	[2] pp.231-234[2]	Consumer Behavior • Law of Diminishing Marginal Utility, Total Utility and Marginal Utility • Theory of Consumer Behavior, Consumer Choice and the Budget Constraint, Utility-Maximizing Rule • Utility Maximization and the Demand Curve, Income and Substitution Effects **Seminar:** Calculating set of product combination maximizing utility; Deriving Budget Line graphs	
5	[2] pp.248-252[2]	The Costs of Production. • Explicit and Implicit Costs, Accounting Profit and Normal Profit, Economic Profit, Law of Diminishing Returns • Short-Run Production Costs: Fixed, Variable, and Total Costs. • Per-Unit, or Average, Costs Marginal Cost • Long-Run Production Costs, Firm Size and Costs, The Long-Run Cost Curve, Economies and Diseconomies of Scale, Minimum Efficient Scale and Industry Structure **Seminar:** Reviewing TC,TFC,TVC,ATC,AFC,AVC and MC; Graphing Short and Long Run ATC.	
6	[2] pp.260-262[2]	Market Structure: Competitive and Non-competitive Markets • Four Market Models; Pure Competition: Characteristics and Occurrence, Profit-Maximizing Case, Loss-Minimizing Case, Shutdown Case • Profit Maximization in the Short Run: Total-Revenue– Total-Cost Approach and Marginal-Revenue–Marginal-Cost Approach; • Barriers to Entry, Economies of Scale / Legal Barriers to Entry: Patents and Licenses / Ownership or Control of Essential Resources / Pricing and Other Strategic Barriers to Entry • Monopolistic Competition Relatively Large Number of Sellers Differentiated Products, Easy Entry and Exit, Advertising, Monopolistically Competitive Industries • Oligopoly: A Few Large Producers, Homogeneous or Differentiated Products, Control over Price, but Mutual Interdependence, Entry Barriers, Mergers, Oligopolistic Industries Consider This: Creative Strategic Behavior	

		Seminar: Calculating Maximum Profit base to: TR-TC, MR-MC approaches; Graphical defining of Economic Profit, Loss, Shutdown conditions.	
7	[2]	The Demand for Resources. • Marginal Productivity Theory of Resource Demand, Marginal Revenue Product, Rule for Employing Resources, Market Demand for a Resource • Determinants of Resource Demand, Changes in Productivity / Changes in the Prices of Other Resources • Optimal Combination of Resources, The Least-Cost Rule, The Profit-Maximizing Rule	
8			Midterm
9	[2]	Foundation of Macroeconomics. • Performance and policy • Modern economic growth • Uncertainly, Expectations and Shocks • Categorizing Macroeconomic Models Using Price Stickiness	
10	[2] pp. 73 [2]	Macroeconomics: Goals, Measures, and Challenges • Gross Domestic Product • The Expenditures Approach • The Income Approach • Nominal GDP versus Real GDP **Seminar:** Determining Ig, Xn, GDP, Corporate profits, NDP, NI and PI	
11	[2] pp. 86 [2]	Unemployment and Inflation • Unemployment • Meaning, Measurement, Types, and Redistribution Effects of Inflation **Seminar:** Determining actual and potential GDP and GDP gap. Calculation nominal and real income and rate of inflation.	
12	[2] pp. 95-96 [2]	Basic Macroeconomic Relationships • The Income-Consumption and Income-Saving Relationships • The Interest-Rate–Investment Relationship • The Multiplier Effect **Seminar:** Calculating MPC, MPS, APC, APS; Deriving Consumption and Saving graphs.	
13	[2]	Aggregate Economic Activities and Fluctuations • Consumption, Saving and Investment • Changes in Equilibrium GDP and the Multiplier • Open economy condition • Equilibrium versus Full-Employment GDP	
14	[2]	Fiscal Policy • Expansionary Fiscal Policy • Contractionary Fiscal Policy • Evaluating Fiscal Policy	
15	[2]	Monetary Policy • The Functions of Money • The Components of the Money Supply • Interest rates • Tools of Monetary Policy • Monetary Policy, Real GDP, and the Price Level	
16			Final

Recommended Sources:
TEXTBOOK(S)

1. McConnell, Campbell R. Brue, Stanley L. Flynn, Sean, economics: principles, problems, and policies, twenty-first edition, McGraw-Hill Higher Education, 2018

2. William B. Walstad, Robert C. Bingham Study Guide to Accompany Economics, McGraw-Hill,2002

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 ASOİU 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	9	9
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	9	9
Final Examination	1	3	3
Preparation for final exam	1	18	18
Self-study	14	4	56
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

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

Course Unit Title	Chemical Process Materials

Course Unit Code	CHEM 3103
Type of Course Unit	Compulsory
Level of Course Unit	3 rd year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	-
Year of Study	3
Semester when the course unit is delivered	5
Course Coordinator	Leyla Z.Vezirova
Name of Lecturer (s)	Leyla Z. Vezirova
Name of Assistant (s)	-
Mode of Delivery	Face to Face.
Language of Instruction	English
Prerequisites	PHYS 1101 Engineering physics 1
Recommended Optional Programme Components	-

Course description:

Seminar to highlight the classification, properties, selection, and processing of engineering materials that may includepolymers, electronic materials, biomaterials, and nanomaterials. Students will research related topics for presentationand discussion. The student will understand how materials affect their lives and make living easier through technological transforming processes, and the selection process involved with applying a material to an application. Students will learn safe practices in using various tools and machines that touch a wide range of materials.

Objectives of the Course:

This material processing course is designed to give the leaner a wide overview of materials and processes used to transform them. This course focuses on the classifying, properties, and processes of materials and the selection of those materials to be used in applications. Learners should be concerned with processes and materials used in metals, woods, plastics, ceramics, and composites. This course demonstrates unchanging processes used on different materials, as well as specific processes used on certain materials. This course also offers selection process of the use of materials in different applications. Special attention is given to safety in the work shop environment. Suggested teaching time is one semester on instruction. Major activities include reports, analysis of materials, hands on projects, minor hands on projects, and safe techniques used to process materials.

LearningOutcomes

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

1	Identify the universal systems model as it relates to material processing technologies.	1,3
2	Differentiate the methods used by humans to procure raw materials from the earth to be later made into production materials.	1,2,3
3	Analyze the various materials used in production and identify the differences and similarities of each.	2,3
4	Explain the different properties that materials may exhibit and the importance of such differences.	1,2,3
5	Select a metal and match it to its appropriate classification in the metal family Show the different natural and synthetic polymers.	1,3
Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm Exam		
Course's Contribution to Program		
		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	4
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	3
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	5
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	2
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		
CourseContents		

Week	Chapter	Topics	Exam
1	[2] ch. 1, p.1-49	**Introduction to Engineering materials .** Science of materials behavior **.** **Raw Material Procurement** Harvesting/refining • Plants • Animals **Extracting/refining** • Land • Air Water	
2	[3] ch. 1, p.1-23	Manufacturing Management Materials selection Production Materials **Seminar: Introduction to Engineering materials .** **Manufacturing Management , Materials selection** **Production Materials .**	
3	[3] ch. 2, p.23-49	**Material and Design Considerations in** Manufacturing Material classifications	
4	[2] ch. 8, p.341-380	**Ceramics and Glasses** Production Materials Applications • Traditional • Innovative Comparative characteristics • Physical • Mechanical • Chemical • Thermal • Electrical • Acoustical • Optics Environmental • **Seminar: Ceramics and Glasses**	
5	[1]ch.C, p. 219-277	**Polymers** • Historical development • Sources of raw materials • Material classifications o Thermoplastics o Thermosets **Applications** • Traditional Innovative **Comparative characteristics** • Physical • Mechanical • Chemical • Thermal • Electrical • Acoustical • Optics	

		• Environmental	
6	[1]ch.C, p. 277-290	**Forest products** • Historical development • Sources of raw materials **Material classifications** • Solid wood products • Wood composition • Chemically derived • Tree extractive products **Seminar: Polymers**	
7			Midterm
8	[1]ch.C, p. 277-290	**Forest products** **Applications** • Traditional • Innovative **Comparative characteristics** • Physical • Mechanical • Chemical • Thermal • Electrical • Acoustical • Optics Environmental	
9	[2] ch. 4, p.97-220	**Metals** ▪ Historical development ▪ Sources of raw materials ▪ Material classifications • Ferrous • Nonferrous **Applications** • Traditional • Innovative **Comparative characteristics** • Physical • Mechanical • Chemical • Thermal • Electrical • Acoustical • Optics • Environmental **Seminar: Forest products, Metals**	
10	[2] ch.9, p.349-411	**Composite materials** • Historical development • Sources of raw materials • Material classification of components • Resin matrix • Fiber Reinforcements **Applications**	

		• Traditional • Innovative **Comparative characteristics** • Physical • Mechanical • Chemical • Thermal • Electrical • Acoustical • Optics Environmental	
11	[2]ch.10, p. 411-447	**Magnetic materials** **Other production materials** • Plant and animal derivatives • Industrial chemicals • Pharmaceuticals • Electronic related • Textiles **Seminar: Composite materials, Magnetic materials**	
12	[3] ch.3, p.117-155	**Manufacturing processes** • Separating • Shearing • Applications/examples • Techniques • Comparative effectiveness **Chip removal** • Applications/examples • Techniques • Comparative effectiveness **Non-traditional** • Applications/examples • Techniques • Comparative effectiveness	
13	[3] ch.3, p.117-155	**Processing Materials** Combining **Mechanical fastening** • Applications/examples • Techniques • Comparative effectiveness **Bonding** • Applications/examples • Techniques • Comparative effectiveness **Mixing** • Applications/examples • Techniques • Comparative effectiveness **Coating** • Applications/examples • Techniques • Comparative effectiveness	

		Seminar: Manufacturing processes, Processing Materials	
14	[3] ch.3, p.117-155	**Processing Materials** **Forming** **Casting/molding** • Applications/examples • Techniques • Comparative effectiveness **Compressing/stretching** • Applications/examples • Techniques • Comparative effectiveness **Conditioning** • Applications/examples • Techniques • Comparative effectiveness **Impacts of Material Processing** **Personal** • Lifestyle change • Health and safety • Career implications • Technological dependency **Economic** • Individual profit/loss • Organizational profit/loss **Societal** • Global interdependence • Resource management • Standard of living **Environmental** • Value judgments Techniques of reclaiming/disposing	
15	[2] ch.11, p.447-495	**Nanomaterials** • Fabrication of semiconductor nanowires • Fabrication of metal nanowires • Electrochemical fabrication of metal nanowires • Magnetic materials and devices **Seminar: Nanomaterials**	
16			Final Exam

Recommended Sources
TEXTBOOK(S)

1. D.R.H Jones, Engineering Materials Volume 2, Butterworth-Heinemann, 2008
2. Michael F. Ashby, Robert W. Messler, Rajiv Asthan Engineering materials and processing Butterworth-Heinemann;2013
3. Creese, R , Introduction to manufacturing processes and materials. Marcel Dekker. (1999).

Assessment

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

Seminars	0%	
MidtermExam	20%	WrittenExam
FinalExam	50%	Written-Oral Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Academic Regulations of Azerbaijan State Oil and İndustry University for undergraduate studies

CoursePolicies

- 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)	TotalWorkload(hour)
Coursedurationinclass	**14**	**3**	**42**
Presentation	1	9	9
Self-study	14	1	14
Tutorials	14	1	14
MidtermExamination	1	3	3
Preparation for midterm exam	1	8	8
Final Examination	1	3	3
Preparation for final exam	1	20	20
TotalWorkload			**150**
TotalWorkload/30(h)			**150/30**
ECTS Credit of the Course			**5**

Chemical engineering (CHEN) program, "Petrochemical technology and industrial ecology" department

Course Unit Title	Separation in chemical and biochemical engineering
Course Unit Code	ENG 3202
Type of Course Unit	Compulsory
Level of Course Unit	3rd year CHEN program
National Credits	0
Number of ECTS Credits Allocated	6
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	-

Year of Study	3
Semester when the course unit is delivered	6
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	CHEM 3101Chemical Engineering Thermodynamics-2
Recommended Optional Program Components	-

Course description:

This course serves as an introduction to the overview to separation processes, fundamental principles of separation operations for the recovery of products from biological and chemical processes, distillation, distillation methods, novel separation methods, membrane separation processes, chromatography, adsorption, absorption, extraction, liquid-liquid extraction and other processes. Students will understand the principles of mass transfer and the characteristics of staged processes. A successful outcome of this course will result in the students ability to design equilibrium staged chemical processes.

Objectives of the Course:

Although separations have been an integral part of chemical engineering education for many years, the recent emergence of industries such as biotechnology and nanotechnology have significantly increased the demand for chemical engineers well schooled in the fundamentals of separation processes. The objective of this senior course is to familiarize the chemical engineering students with the fundamental principles of Separation Processes. We will examine both equilibrium controlled separation processes as well as separation processes that involve both mass transport and equilibrium considerations. In order to probe the key concepts in depth, the course will focus primarily on distillation, adsorption, extraction and membranes. However throughout the course, a wide variety of separation processes will be brought to the student's attention to broaden the discussion. In particular, examples from biotechnology will be used to illustrate key concepts. In addition to teaching the fundamental principles involved in these unit operations, the course will also introduce the students to specific subtleties associated with a wide variety of separation processes both old and new. In class problems will be used throughout the course to deepen the students' understanding of the material. Computer instruction will be employed throughout the course to illustrate important characteristics of these separation systems.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	apply knowledge of this course in research and laboratory work.	1,2
2	explain the role of separation operations in the chemical and biochemical industries.	1,2,3
3	fully understand key concepts of separation processes	1,2,3
4	explain the major differences between chemical and biochemical separation processes.	1,2,3
5	identify, formulate, and solve complex engineering problems	1,2
6	understand the concept of sequencing of separation operations, particularly distillation	1,2
7	explain main principles of separation processes	1,2,3
8	understand the basic principles of various membrane processes	1,2

Assessment Methods: 1. Final Exam 2. Midterm Exam 3. Presentation

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	4

2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	3
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issuesin chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	2
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	4
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	4

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.	**Separation processes.** The role of separation operations in the chemical and biochemical industries. Industrial chemical processes. Basic separation techniques.	
2	Book I. Chap. 1.	**Separation processes** Separation by phase addition. Separation by barriers. Separation by solid agents. Separation factor. Introduction to bioseparations. Bioprocess. Bioproducts. Bioseperation steps. **Seminar 1.** Separation processes	
3	Book I Chap.2	**Thermodynamics of separation operations** Thermodynamic laws. Energy, entropy, and availability balances around a separation process. Phase equilibria.	
4	[1] Chap.2	**Thermodynamics of separation operations** Vapor-liquid equilibrium. Thermodynamic description of vapor–liquid equilibrium. Raoult's law. Fugacity, activity, fugacity and activity coefficient. K-values. **Seminar 2.** Thermodynamics of separation operations	
5	[1] Chap.3	**Mass transfer** Relationship between mass transfer and phase equilibrium. Concept of equilibrium. Mass transfer. Ficks law of diffusion.	
6	[1] Chap.6	**Absorption process.**	

		The differences among physical absorption, chemical absorption and stripping. Equipment for vapour-liquid separations. **Seminar 3.** Absorption process.	
7	[3]. Chap.9	**Distillation and stripping.** Process distillation and stripping. Batch distillation. Boling point and equilibrium diagrams. Theory of distillation. Continuous distillation.	
8			Midterm
9	[II] Chap. 2	**Flash distillation.** Distillation. Basic method of flash distillation. Form and sources of equilibrium data. Binary flash distillation. **Seminar 4.** Distillation process.	
10	[I] Chap. 7	**Distillation of binary mixtures.** Binary distillation. Equipment and design considerations. Design and analyses factors. McCabe-Thiele Method.	
11	[3]. Chap. 10 Book I Chap. 8	**Extraction.** Extraction principle. Extraction process. **Liquid-liquid extraction.** Liquid-liquid extraction. Equipment for solvent extraction. Mixer-Settlers. **Seminar 5.** Extraction. Liquid-liquid extraction.	
12	[1] Chap. 8	**Liquid-liquid extraction.** Centrifugal extractors. General design considerations. Advantages and disadvantages of different extraction equipment. Extraction of bioproducts.	
13	[1] Chap. 14	**Membrane separations** Membrane processes. Industrial membrane separation processes. **Seminar 6.** Membrane separations	
14	Book I Chap. 14	**Adsorption process.** Industrial application of sorption operations. Sorbents. Adsorbents.	
15	[1] Chap. 14,16	**Chromatography** Sorbents for chromatography. Types of chromatography. **Leaching and Washing** Leaching (liquid-solid extraction).Equipment for leaching. **Seminar 7.** Adsorption process.	
16			Final

Recommended Sources

TEXTBOOK

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, Prentice Hall;2011
3. Uttam Ray Chaudri, Fundamentals of petroleum and petrochemical engineering, CRC Press, 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 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	18	18
Self-study	14	4	56
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	30	30
Total Workload			**180**
Total Workload/30(h)			**180/30**
ECTS Credit of the Course			**6**

Chemical engineering (CHEN) program, "Petrochemical technology and industrial ecology" department

Course Unit Title	Chemical Engineering laboratory-1
Course Unit Code	LAB 3201
Type of Course Unit	Compulsory
Level of Course Unit	3rd year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5

Theoretical (hour/week)	1
Practice (hour/week)	-
Laboratory	2
Year of Study	3
Semester when the course unit is delivered	6
Course Coordinator	Hamzayeva Nushaba
Name of Lecturer (s)	Hamzayeva Nushaba
Name of Assistant (s)	
Mode of Delivery	Face to Face, Laboratory
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

A first introduction to the processes and apparatuses of chemical industry. A brief survey of the process and apparatuses of chemical industry, focusing on the classification of process and apparatuses, types of heat-exchangers, reactors, furnaces, material and thermal balances.

Objectives of the Course:

During orientation you can expect to:

- Learn more about your academic program
- Learn about why Chemical engineering lab. and how to be familiar with that since
- Schedule your first set of classes
- Meet faculty advisors, and current state students
- Interact with fellow incoming students
- Learn how to Ask Questions.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Use the knowledge gained for its sufficient application in research and laboratory work.	1,3
2	Apply knowledge of math, science, engineering, and mass transfer principles to solve process and system problems, including steady and unsteady mass transport.	1,2,3

3	Design a system, component, equipment or process to meet desired mass transport needs.	2,3
4	Identifying, formulating, and solving engineering and mass transfer problems, including continuous and staged contact equipment, and vapor-liquid equilibrium	3
5	understand and implement professional and ethical standards.	1,3

Assessment Methods: 1. Final Exam, 2. Presentation, 3 midterm exam

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	4
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	3
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	4

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. I	Hydrostatics. Differential equilibrium equation of Eyler **Lab work: Safety rules**	
2	Book II Chap. I	**Lab work: Safety rules**	
3	Book III Chap. II	Hydrodynamics. Motion regimes of flow **Lab work: Reverse Osmosis** The choice of procedure depends on the properties of the substances that are to be removed from the water. Mechanical procedures remove undissolved substances (solids). On the other hand, solutes can be removed with biological or physical/chemical methods.	
4	Book III Chap.III	**Lab work: Reverse Osmosis** The choice of procedure depends on the properties of the substances that are to be removed from the water. Mechanical procedures remove undissolved substances (solids). On the other hand, solutes can be removed with biological or physical/chemical methods.	
5	Book I Chap.IV	Heterogen systems and methods of its separation **Lab work: Reverse Osmosis** ENVIRONMENT Contaminants are transported and transformed in the hydrosphere (water), atmosphere (air) and pedosphere (soil). Water, soil and air are described as environmental compartments and are connected to each other by to the global water cycle. Additionally, the ENVIRONMENT area includes the training area of waste.	
6	Book II Chap.III	**Lab work: Reverse Osmosis** ENVIRONMENT Contaminants are transported and transformed in the hydrosphere (water), atmosphere (air) and pedosphere (soil). Water, soil and air are described as environmental compartments and are connected to each other by to the global water cycle. Additionally, the ENVIRONMENT area includes the training area of waste.	
7	Book III Chap.IV	Filtration processes. Filtrating apparatuses **Lab work: Reverse Osmosis** ENVIRONMENT Contaminants are transported and transformed in the hydrosphere (water), atmosphere (air) and pedosphere (soil). Water, soil and air are described as environmental compartments and are connected to each other by to the global water cycle. Additionally, the ENVIRONMENT area includes the training area of waste.	

8			Midterm
9	Book III Chap.V	Separation under centrifugal force. Centrifuges cyclones and hydrocyclonis **Lab work: Reverse Osmosis** ENVIRONMENT Contaminants are transported and transformed in the hydrosphere (water), atmosphere (air) and pedosphere (soil). Water, soil and air are described as environmental compartments and are connected to each other by to the global water cycle. Additionally, the ENVIRONMENT area includes the training area of waste.	
10	Book I Chap.V	**Lab work: Fluidised bed formation** In fluidised beds, granular solid matter is held in suspension by a fluid flowing through it. As a result, the solid matter takes on the character of a liquid. This relates both to its fluid-mechanical and its thermodynamic properties. A fluidised bed is a layer of fine granular solid matter (mass) that is loosened by a fluid flowing through it to such an extent that the particles of solid matter are free to move within certain limits. The layer of solid material takes on similar properties to a fluid.	
11	Book II Chap V	Heat exchange processes. Heat transfer. **Lab work: Fluidised bed formation** In fluidised beds, granular solid matter is held in suspension by a fluid flowing through it. As a result, the solid matter takes on the character of a liquid. This relates both to its fluid-mechanical and its thermodynamic properties. A fluidised bed is a layer of fine granular solid matter (mass) that is loosened by a fluid flowing through it to such an extent that the particles of solid matter are free to move within certain limits. The layer of solid material takes on similar properties to a fluid.	
12	Book III Chap. IV	**Lab work: Fluidised bed formation** In fluidised beds, granular solid matter is held in suspension by a fluid flowing through it. As a result, the solid matter takes on the character of a liquid. This relates both to its fluid-mechanical and its thermodynamic properties. A fluidised bed is a layer of fine granular solid matter (mass) that is loosened by a fluid flowing through it to such an extent that the particles of solid matter are free to move within certain limits. The layer of solid material takes on similar properties to a fluid.	
13	Book III Chap.I	Types of tubular heaters. Classification of tubular furnaces. **Lab work: Fluidised bed formation**	

		In fluidised beds, granular solid matter is held in suspension by a fluid flowing through it. As a result, the solid matter takes on the character of a liquid. This relates both to its fluid-mechanical and its thermodynamic properties. A fluidised bed is a layer of fine granular solid matter (mass) that is loosened by a fluid flowing through it to such an extent that the particles of solid matter are free to move within certain limits. The layer of solid material takes on similar properties to a fluid.	
14	Book II Chap.III	**Lab work: Revision for all lab works**	
15	Book I Chap.VI	Types of tubular heaters. Classification of tubular furnaces. **Lab work: Revision for all lab works**	
16			Final

Recommended Sources
TEXTBOOK(S)

- 1. Bird, Stewart and Lightfoot (BSL), Transport Phenomena, Wiley International, 1960.
- 2. L. G. Leal, Laminar Flow and Convective Transport Processes, Butterworth-Heineman, 1992.
- 3. G. K. Batchelor, An Introduction to Fluid Dynamics, Cambridge University Press, 1967.

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	10%	
Laboratory	20%	
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.
- 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
Tutorials	14	1,5	21
Self-study	14	3,5	49
Midterm Examination	1	3	3
Preparation for midterm exam	1	8	8
Final Examination	1	3	3
Preparation for final exam	1	19	19
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

Chemical engineering (CHEN) program, "General and applied mathematics" department

Course Unit Title	Applied Engineering Statistics
Course Unit Code	MATH 3201
Type of Course Unit	Compulsory
Level of Course Unit	3rd year of CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2

Practice (hour/week)	1
Year of Study	3
Semester when the course unit is delivered	6
Course Coordinator	Nigar Ismayilova
Name of Lecturer (s)	Nigar Ismayilova
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	MATH 1201 Calculus for engineers II
Recommended Optional Programme Components	-

Course description:

In this course the principles of Statistics and probability will be delivered with the emphasize on its application in science and will put effort on using modern programming languages in order to carry the investigation on data analyse.

Objectives of the Course:

Enabling students to master the principles of statistics and apply them to the problems of Chemical Engineering using computer.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Have general understanding of statistics and probability and their application in different branches of science	3
2	Getting the Math and Computer skills to tackle the problems of statistics	2
3	Be capable of Data science and analyze related to the field of engineering and use modern technology in order to solve real life problem.	1

Assessment Methods: 1. Final Exam, 2. Independent works, 3.Midterm

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	5
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	4
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	5

4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	3
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment	3
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	1
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	2
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	2
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	4

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

Course Contents

Week	Chapter	Topics	Exam
1	[1] Chapter one, p1-p25	Basic Concepts in Statistics, its importance in modern science and discussion of mathematical backgrounds and prerequisites:	
2	[1] p27-p35	Basic Concepts from Probability Theory, set theory and mathematical theorems on the subjects: **Seminar 1:** Sets and lists in Python, Mathematical tools for Gaussian Distribution, Simple examples on Random Events	
3	[1] Chapter one , p27-p35 and [1] Chapter 0 (p1-p39)	Basic Concepts from Probability Theory (continued), Embedding probability in computer (python) and discussion on modelling	
4	[1] Chapter one , p45-p55	Additional Topics in Probability, Random variables and Introduction to Distributions, **Seminar 2:** Die example, Simulation of Die and Coin in Computer, Averaging and Probability of Union and Intersection	
5	[3] Chapter 6	Additional Topics in Probability (continued), More on Distributions and examples from real life	

6	[3] Chapter one, p107-p137	Sampling Distributions, Discreet vs. Continuous Distribution, Discussing Bernoulli Distribution, Poisson Distribution, Normal, Lognormal and Multinomial distributions **Seminar 3:** Different Distributions in Experiments, Averaging in Continuous Distributions, Math tools for Computing Gaussian Integrals	
7			Midterm
8	[3] Chapter one, p142-p155	Continuous Distribution and Discussing Uniform Distributions and Gamma Distributions: **Seminar 4:** Factorials, Newtonian Binomial, Permutations and Combinatorics	
9	[1] Chapter one , p27-p40	Point Estimation , Interval Estimation and Bayesian Estimation, Discussion of Conditional Probability and Bayes theorem	
10	[2,5]	Design of Experiment, Modelling with computers and algorithms for counting , simulations using python **Seminar 5:** Integration by Parts for Gamma Functions, Relations between Gamma and Beta Functions, Relations to Factorials	
11	[2].	Additional topics on Modelling and simulation in python, libraries and math tools. Intro to Linear Regression	
12	Chapter 0 of Reference No 2, p371-p378	Linear Regression in details, Fitting to quadratics and coping with approximate data. Relation to Linear Algebra **Seminar 6:** Regression and Interpolation, Examples from Polynomial Calculation, More on Combinatorics, Using Computers on Counting	
13	Chapter 4 and 5 of Reference No 4 (p35-p50) Selected parts from Reference No 2	Miscellaneous topics on Statistics(1) including variance and its analysing, Additional computer tools	
14	From General resources (including Reference no 5)	Miscellaneous topics on Statistics (2) including Mass Function, PDF (Probability Density Function and etc.) **Seminar 7:** Examples from Chemistry and Physics, Handling Results with Big Sampling Space, Regularizations, Intro to Data Mining	

15	Chapter 14 of Reference No 4 (p155-p163)	Perspectives and issues on statistical math and its applications. Relation to other fields of science	
16			Final

Recommended Sources

TEXTBOOK(S)

1. Prasanna Sahoo.Probability and Mathematical statistics. University of Louisville , 2013
2. Philip Klein, Coding the Matrix, Newtonian Press , 2013
3. R.Feynman, R.Leighton, M.Sands, Feynman Lectures on Physics Vol.1
4. Deborah Rumsey. Statistics Essentials for Dummies. Wiely Publishing edition, 2010.
5. Dimitri Nesteruk, Statistics Foundations, Understanding Probability and Distributions, Pluralsight,2000

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Independent works	20%	
Quiz	10%	
Seminars (Quizzes)	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**
Independent works	10	1	10
Self-study	14	3,5	49
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	20	20
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

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

Course Unit Title	Chemical Process Design I
Course Unit Code	CHEM 3201
Type of Course Unit	Compulsory
Level of Course Unit	3ndyear CHEN program

National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	0
Year of Study	3
Semester when the course unit is delivered	6
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	ENG 3101 Chemical Engineering Reactor Design
Recommended Optional Programme Components	-

Course description:

Chemical Engineering Design is a complete course text for students of chemical engineering. Written for the Senior Design Course, and also suitable for introduction to chemical engineering courses, it covers the basics of unit operations and the latest aspects of process design, equipment selection, plant and operating economics, safety and loss prevention. It is a cours that students will want to keep through their undergraduate education and on into their professional lives.

Objectives of the Course:

- Identify, formulate, and solve complex engineering problems
- Design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability, apply modern design methods for this purpose. (Realistic constraints and conditions may include factors such as economic and environmental issues, sustainability, manufacturability, ethics, health, safety issues, and social and political issues, according to the nature of the design.)
- Design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems
- Devise, select, and use modern techniques and tools needed for engineering practice; employ information technologies effectively

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	do individual and overall mass balance by choosing boundaries of a physical system.	1,3
2	do individual and overall mass balance in a system having recycle	1,2,3
3	do block and pictorial flow diagrams	2,3

4	prepare flow diagrams having piping and instrumentation	3
5	select the most appropriate method for production	1,3

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	5
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	5
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	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	Introduction to design	
2	[1] Chapter 3	Utilities and energy efficient design. Fired heat, steam, hot oil and heat transfer fluids, cooling water. **Sem:** Discussion on the topic of public utilities and energy-efficient design. Heat, steam, hot oil and heat carriers, cooling water are burned.	
3	[1] Chapter 3	Utilities and energy efficient design. Refrigeration,water, compresed air, cooling air, nitrogen,	
4	[1] Chapter 3	Energy balance in a process. Energy recovery, heat exchange, waste-heat boilers. High –temprerature reactors **Sem:** Discussion on the topic energy balance in a process	
5	[1] Chapter 3	Energy balance in a process. Heat pumps. High- pressure process steams. Liquids and solids wastes.	
6	[1] Chapter 4	Process simulation. Process simulation programs. Selection of physical property models. **Sem:** Discussion on the topic heat pumps. High- pressure process steams. Liquids and solids wastes. Process simulation.	
7			Midterm
8	[1] Chapter 2	Diagrams for understanding Chemical Processes: BFD, PFD, P&ID(Preparing of flowsheets involving piping and instrumentation) , 3-D Representation of a process, Preparing of flowsheets and CHEM-CAD application **Sem:** practical work: Preparation for technological schemes, including pipelines and instrumentation), 3-D Process presentation, Preparation for technological schemes and the use of CHEM-CAD	
9	[1] Chapter 2	The structure and synthesis of process flow diagrams	
10	[1] Chapter 5	Hierarchy of process design, Batch versus continous process, Input/output structure, Recycle structure, general structure of separating system, heat exchanger net work and profit margin	

		Sem: survey: Hierarchy of process design, batch and continuous processes, input / output structure, recycling structure, general structure of the separation system, net heat exchanger operation and profit margin	
11	[1] Chapter 5	Understanding Process conditions:conditions of special concern for the operation of separation and reactor systems, and other equipments.Analysis of important process conditions	
12	[1] Chapter 5	Piping&Intrumentation:P&ID,Valveselection,Pumps and compressors,mechanical design of piping, pipe size selection, control and instrumentation, alarms, safetyand interlocks **Sem:** Understanding Process conditions:conditions of special concern for the operation of separation and reactor systems, and other equipments.	
13	[1] Chapter 8	Cost calculation in process design steps and optimisation.	
14	[1] Chapter 8	Cost calculation in process design steps and optimization **Sem**: Cost calculation in process design steps and optimization	
15	[1] Chapter 8	Cost calculation in process design steps and optimisation	
16			Final

Recommended Sources

TEXTBOOK(S)

1. Kindle Edition. Gavin Towler, R. K. Chemical Engineering Design: Principles, Practice and Economics of Plant and Process Design 2nd Edition, Sinnott, 2008, p. 1245

2. R.K. Sinnott, Chemical Engineering Design: Chemical Engineering, Elsevier, 2005. p 1056

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminar	0%	
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 İndustry 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 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**
Preparation for Presentation	1	9	9
Self-study	14	4	56
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midtermexam	1	10	10
Final Examination	1	3	3
Preparation for final exam	1	18	18
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

Chemical engineering (CHEN) program, "Control and system engineering" department

Course Unit Title	Chemical engineering process dynamics and control
Course Unit Code	ENG 4101

Type of Course Unit	Compulsory
Level of Course Unit	4nd year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	0
Year of Study	4
Semester when the course unit is delivered	7
Course Coordinator	Aygun A.SAFAROVA
Name of Lecturer (s)	Aygun A.SAFAROVA
Name of Assistant (s)	-
Mode of Delivery	Face to Face, , Seminar.
Language of Instruction	English
Prerequisites	ENG 3101 Chemical engineering reactor design
Recommended Optional Program Components	-

Course description:

Process structure. The structure of chemical processes as the object of control. Features and criteria for the analysis of the dynamics of chemical processes. Basis of the theory of identification concepts. . The issue of identification. İdentification of the process. Analysis of mathematical modeling methods of control objects. Optimal control. Basic concepts and optimization criteria. The methods of optimal control.

Objectives of the Course:

Students should know more about various modeling methods , especially experimental and statistical methods and their applications. Students should be able to use all accumulated knowledge for an understanding dynamic modeling techniques, computer skills of modeling systems.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	gain knowledge about various modeling techniques and their application areas;	1,2,3
2	adopt the methods of creating analytical models of typical technological objects;	1,2,3
3	to give information about mathematical modeling methods by experimental-statistical methods;	1, 2
4	get acquainted with dynamic modeling techniques;	1,2
5	adopting modeling algorithms;	1,3
6	to gain theoretical knowledge on mathematical contributions of optimization of typical chemical technological processes	2

7	to achieve the solution of algorithms that provide optimal regimes for chemical-technological processes	1,3

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	4
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	3
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	5
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	4
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	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, pp.3-5-	The content and objectives of the course. Introduction to Controls. Process. Control Background. The Objectives of Control.	
2	[1,3]	The Control Loop. Process variables. Measured variables. Manipulated variables. Automatic control. **Seminar 1:** Definitions of the Elements in a Control Loop	

	chapter 1,2 pp.5-8, pp5-10		
3	[3] chapter 3, pp.12-16	Closed and open control loops. Primary elements/Sensors. Ttransmitters. Recorders. Controllers.	
4	[4] chapter 3, pp. 20-24,	Principles of Control Systems . Control Modes. The forms of control available in Process Control:. Feed Forward. The feedback control loop **Seminar 2:** Feedback control	
5	[4] chapter 4, pp. 32-34	Advanced process control. Adaptive Control. Predictive Control. Feedback correction. Intelligent Control	
6	[5] chapter 1, pp.1—7	Identification of Dynamic Systems. Basic sequence of the identification. Properties of identification. Tasks and Problems for the Identification of Dynamic Systems **Seminar 3:** Theoretical and Experimental Modeling .	
7	[5] chapter 1, pp.12-15	Typical identification methods. Mathematical Modeling. Describe the Process. Identify Process Objectives and Constraints.	
8			Midterm
9	[5] chapter 13, pp.369-373, 377-379.	Statistical Analysis for Chemical Process Control. Statistics and Probability Background. Basic statistics. Linear Regression. **Seminar 4:** Experimentally statistical modeling methods	
0	[6], chapter 1, pp.2-6	Introduction to optimization.. Statement of an optimization problem. Objective function . Classification of optimization problems.	
11	[6], chapter 2, pp.29-35	Unconstrained optimization. The gradient method. Newton's method. Comparison between Newton's method and the gradient method. Gradient method for optimal control of non-stationary technological processes **Seminar 5** : Formulation of the optimization problem	
12	[6], chapter 3, pp.55-59	Nonlinear programming methods: introduction. Sequential and exact methods. Sequential augmented Lagrangian functions. . multi-stage non-stationary petrochemical processes Lagrangian method for determining optimal regimes of the hydrator block of the technological process of propylene glycol production	
13	[7], chapter 1, pp.2-4-	Discrete control: Bellman equations. Dynamic programming. Dynamic programming method for optimal regimes of chemical technological processes **Seminar 6** : Classification of optimal process control systems:	
14	[7], chapter 2, pp.4-8	Continuous control: Hamilton-Jacobi-Bellman equations. Innite-horizon formulations.	
15	[7], chapter 3, pp.9-11	Global optimization. Deterministic methods. Pontryagins maximum principle. Maximality principle for optimal control of non-stationary processes. **Seminar 7:** Optimal process control with nonlinear objective function	

16			Final

Recommended Sources

TEXTBOOK(S)

1. George Stephanopoulos, Chemical Process Dynamics and Controls Book I. The University of Michigan Chemical Engineering, PTR Prentice Hall, 2006.
2. Peter WoolfChemical Process Dynamics and Controls Book I.I. The University of Michigan Chemical Engineering Process Dynamics and Controls Open Textbook. 2007.
3. P.W. Murrill,Instrumention & Control. Fundamentals of Control. International Society of Automation,2006
4. Industrial Automation. IDC Engineering Pocket Guide 1st Edition. 2008
5. Rolf Isermann, Marco Munchhof. Identification of Dynamic Systems, Springer, 2011
6. A. Astolfi. Optimization. An ,introduction , Revision , 2006
7. Emanuel Todorov, Optimal Control Theory, University of California San Diego. 2006.

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**	**3**	**42**
Presentation	1	7	7
Self-study	14	4	56
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	20	20
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

Chemical engineering (CHEN) program, "Petrochemical technology and industrial ecology" department

Course Unit Title	Chemical Engineering laboratory-2
Course Unit Code	LAB 4101

Type of Course Unit	Compulsory
Level of Course Unit	4th year of CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	1
Practice (hour/week)	-
Laboratory	2
Year of Study	4
Semester when the course unit is delivered	7
Course Coordinator	Sultanova Gulnara
Name of Lecturer (s)	Sultanova Gulnara
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Laboratory
Language of Instruction	English
Prerequisites	LAB3201 Chemical Engineering laboratory-1
Recommended Optional Program Components	-

Course description:

A first introduction to the processes and apparatuses of chemical industry. A brief survey of the process and apparatuses of chemical industry, focusing on the classification of process and apparatuses, types of heat-exchangers, reactors, furnaces, material and thermal balances.

Objectives of the Course:

During orientation you can expect to:

- Learn more about your academic program
- Learn about why Chemical engineering lab. and how to be familiar with that since
- Schedule your first set of classes
- Meet faculty advisors, and current state students
- Interact with fellow incoming students
- Learn how to Ask Questions.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Use the knowledge gained for its sufficient application in research and laboratory work.	1,3
2	Apply knowledge of math, science, engineering, and mass transfer principles to solve process and system problems, including steady and unsteady mass transport.	1,2,3

3	Design a system, component, equipment or process to meet desired mass transport needs.	2,3
4	Identifying, formulating, and solving engineering and mass transfer problems, including continuous and staged contact equipment, and vapor-liquid equilibrium	3
5	understand and implement professional and ethical standards.	1,3

Assessment Methods: 1. Final Exam, 2. Presentation, 3 midterm exam

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	4
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	3
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	4

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. I	Processes of mass exchange **Lab work: safety rules.** These rules are designed to ensure that all work done in the laboratory will be safe for you and your fellow students. In addition to the rules listed here, your institution may have a set of rules that you will be asked to read and to sign as evidence that you have read them.	
2	Book II Chap. I	**Lab work: Temperature controller** Control technology is now an integral part of nearly all areas of engineering. In process control engineering, we differentiate between open and closed loop control. The difference between the two terms is explained below: Open control loop is a process in a system in which an output variable is rigidly influenced by an input variable. This is based on the principles of the system.	
3	Book III Chap. II	Distillation processes and its types **Lab work: Temperature controller** Control technology is now an integral part of nearly all areas of engineering. In process control engineering, we differentiate between open and closed loop control. The difference between the two terms is explained below: Open control loop is a process in a system in which an output variable is rigidly influenced by an input variable. This is based on the principles of the system.	
4	Book III Chap.III	**Lab work: Temperature controller** Control technology is now an integral part of nearly all areas of engineering. In process control engineering, we differentiate between open and closed loop control. The difference between the two terms is explained below: Open control loop is a process in a system in which an output variable is rigidly influenced by an input variable. This is based on the principles of the system.	
5	Book I Chap.IV	Rectification process. Material and thermal balances of rectification process Lab work: **Temperature controller** Control technology is now an integral part of nearly all areas of engineering. In process control engineering, we differentiate between open and closed loop control. The difference between the two terms is explained below: Open control loop is a process in a system in which an output variable is rigidly influenced by an input variable. This is based on the principles of the system.	Midterm
6	Book II Chap.III	**Lab work: Temperature controller** Control technology is now an integral part of nearly all areas of engineering. In process control engineering, we differentiate	

		between open and closed loop control. The difference between the two terms is explained below: Open control loop is a process in a system in which an output variable is rigidly influenced by an input variable. This is based on the principles of the system.	
7	Book III Chap.IV	Process of absorption. Scheme of currents in absorber **Lab work: Temperature controller** Control technology is now an integral part of nearly all areas of engineering. In process control engineering, we differentiate between open and closed loop control. The difference between the two terms is explained below: Open control loop is a process in a system in which an output variable is rigidly influenced by an input variable. This is based on the principles of the system.	
8			Midterm
9	Book III Chap.V	Absorption process. Methods realization of adsorption process **Lab work: Adsorption** The CE 583 device is part of the 2E - ENERGY & ENVIRONMENT product range. ENERGY The ENERGY product range includes devices from the subject area of renewable energy. Examples include photovoltaic, solar thermal and hydrodynamic power. ENVIRONMENT Contaminants are transported and transformed in the hydrosphere (water), atmosphere (air) and pedosphere (soil). Water, soil and air are described as environmental compartments and are connected to each other by to the global water cycle. Additionally, the ENVIRONMENT area includes the training area of waste.	
10	Book I Chap.V	**Lab work: Adsorption** The CE 583 device is part of the 2E - ENERGY & ENVIRONMENT product range. ENERGY The ENERGY product range includes devices from the subject area of renewable energy. Examples include photovoltaic, solar thermal and hydrodynamic power. ENVIRONMENT Contaminants are transported and transformed in the hydrosphere (water), atmosphere (air) and pedosphere (soil). Water, soil and air are described as environmental compartments and are connected to each other by to the global water cycle. Additionally, the ENVIRONMENT area includes the training area of waste.	
11	Book II Chap V	Extraction process. Methods of carrying-out of extraction	

		Lab work: Adsorption The CE 583 device is part of the 2E - ENERGY & ENVIRONMENT product range. ENERGY The ENERGY product range includes devices from the subject area of renewable energy. Examples include photovoltaic, solar thermal and hydrodynamic power. ENVIRONMENT Contaminants are transported and transformed in the hydrosphere (water), atmosphere (air) and pedosphere (soil). Water, soil and air are described as environmental compartments and are connected to each other by to the global water cycle. Additionally, the ENVIRONMENT area includes the training area of waste.	
12	Book III Chap. IV	**Lab work: Adsorption** The CE 583 device is part of the 2E - ENERGY & ENVIRONMENT product range. ENERGY The ENERGY product range includes devices from the subject area of renewable energy. Examples include photovoltaic, solar thermal and hydrodynamic power. ENVIRONMENT Contaminants are transported and transformed in the hydrosphere (water), atmosphere (air) and pedosphere (soil). Water, soil and air are described as environmental compartments and are connected to each other by to the global water cycle. Additionally, the ENVIRONMENT area includes the training area of waste.	
13	Book III Chap.I	Drying process. Types of drying processes **Lab work: Adsorption** The CE 583 device is part of the 2E - ENERGY & ENVIRONMENT product range. ENERGY The ENERGY product range includes devices from the subject area of renewable energy. Examples include photovoltaic, solar thermal and hydrodynamic power. ENVIRONMENT Contaminants are transported and transformed in the hydrosphere (water), atmosphere (air) and pedosphere (soil). Water, soil and air are described as environmental compartments and are connected to each other by to the global water cycle. Additionally, the ENVIRONMENT area includes the training area of waste.	
14	Book II Chap.III	**Revision all lab works**	
15	Book I Chap.VI	Drying process. Types of drying processes	

		Revision all lab works	
16			Final

Recommended Sources
TEXTBOOK(S)

- 1. Bird, Stewart and Lightfoot (BSL), Transport Phenomena, Wiley International, 1960.
- 2. L. G. Leal, Laminar Flow and Convective Transport Processes, Butterworth-Heineman, 1992.
- 3. G. K. Batchelor, An Introduction to Fluid Dynamics, Cambridge University Press, 1967.

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	10%	
Laboratory	20%	
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**	**3**	**42**
Presentation	1	10	10
Tutorials	14	1	14
Self-study	14	4	56
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			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

Chemical engineering (CHEN) program, "Industrial safety and labour protection" department

Course Unit Title	Chemical Process Safety
Course Unit Code	**CHEM 4101**

Type of Course Unit	Compulsory
Level of Course Unit	4th year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	0
Year of Study	4
Semester when the course unit is delivered	7
Course Coordinator	Amina Huseynova
Name of Lecturer (s)	Amina Huseynova
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	ENG 3101 Chemical Engineering Reactor Design
Recommended Optional Program Components	-

Course description:

The main focus of the course will be issues involving safety, health and loss prevention in the chemical process industry. You will be introduced to safety hardware, sources and prediction of toxic releases, potential harmful effects of chemicals in the workplace, as well as hazard identification. Awareness of these and other safety concerns will be raised so you can develop effective strategies for analyzing and evaluating the safety of chemical processes to reduce operating hazards.

Objectives of the Course:

It is reasonable to conclude that the growth of an industry is also dependent on technological advances. This is especially true in the chemical industry, which is entering an era of more complex processes: higher pressure, more reactive chemicals, and exotic chemistry. More complex processes require more complex safety technology. Many industrialists even believe that the development and application of safety technology is actually a constraint on the growth of the chemical industry. As chemical process technology becomes more complex, chemical engineers will need a more detailed and fundamental understanding of safety. The primary objective of this course is to present the important technical fundamentals of chemical process safety. The emphasis on the fundamentals will help the student and practicing scientist to understand the concepts and apply them accordingly. This application requires a significant quantity of fundamental knowledge and technology.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	To obtain an understanding about how chemicals affect us physically and how hazards can be quantified.	1,2,3
2	To learn the basics of laboratory and plant safety procedures	1

3	To learn about the release of chemicals and how to model it	1,2,3
4	To understand the causes, effects and prevention of fires and explosions	1
5	To gain an appreciation of the use and sizing of pressure relief valves	1
6	To integrate class material with other chemical engineering areas and develop an awareness of laboratory and plant safety.	1,2,3

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	3
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	3
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	3
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	4
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	3
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	5
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	3

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

Course Contents

Week	Chapter	Topics	Exam
1	[1] Chapter1	Introduction to Chemical process safety. Safety programs. Accepable risk.	

	p.p.1-32		
2	[2] Chapter4 p.p.37-55	Legislative basis of safety at work. Law, regulations and standards. **Seminar1**. Safety programs. Accident and loss statistics.	
3	[1] Chapter3 p.p.78-110	Occupational Health and Industrial Hygiene. Anticipation and Identification. Evaluation and control.	
4	[1] Chapter8 p.p.384-418	Classification of hazards at work place. Chemical hazards. Controlling reactive hazards. **Seminar2.** Commitment, Awareness, and Identification of Reactive Chemical Hazards	
5	[1] Chapter11 p.p.505-538	Identification of chemical hazards. Process Hazards Checklists.	
6	[1] Chapter12 p.p.549-588	Risk Assessment. Review of Probability Theory. Event Trees. Fault trees. **Seminar3.** Hazards and Operability Studies	
7			Midterm
8	[1] Chapter6 245-274	Flammability Characteristics of liquids and Vapours. The Fire Triangle. Distinction between Fires and Explosions **Seminar4** Flammability Characteristics of Liquids, Gases and Vapours. Flammability Limit Dependence on Temperature and on pressure.	
9	[2] Chapter16 p.p.285-324	*Fire protection and preventions. Causes of fires. Improving Fire protection and prevention.*	
10	[2] Chapter17 p.p.325-336	Explosions and explosives. Explosion hazards. Dust explosions **Seminar5.** Causes of fire and explosions.	
11	[1] Chapter7 p.p.333-350	Static Electricity. Fundamentals of static charge.	
12	[1] Chapter7 p.p.356-363	Controlling Static Electricity. General Design Methods To Prevent Electrostatic **Seminar6.** Static electricity and its controlling methods	
13	[2] Chapter28 p.p.513-536	Personal Protective Equipment. Hearing protection. Respiratory protection. Hand, finger and arm protection.	
14	[1] Chapter13 p.p.598-613	Process Safety Strategies. Managing Safety. Designs for Process Safety **Seminar7** Procedures—Safety Reviews and Accident Investigations	
15	[1] Chapter 14 p.p.621-646	Case Histories. Tank Car Loading Explosion. Ethylene Oxide Explosion. Training within Universities.	

16			Final

Recommended Sources

1. D.A. Crowl and J.F. Louvar, Chemical Process Safety: Fundamentals with Applications, 2nd Edition, Prentice, 2002.
2. Brauer, R., Safety and Health for Engineers, 2nd Edition, John Wiley & Sons, 2006.

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 Guidelines of Azerbaijan State University of Oil and Industry 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**	**3**	**42**
Presentation	1	10	10
Self-study	14	4	56
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	8	8
Final Examination	1	3	3
Preparation for final exam	1	18	18
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

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

Course Unit Title	Chemical Process Design II
Course Unit Code	CHEM 4102

Type of Course Unit	Compulsory
Level of Course Unit	4nd year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	0
Year of Study	4
Semester when the course unit is delivered	7
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	CHEM 3201 Chemical Process Design I
Recommended Optional Program Components	-

Course description:

Chemical Engineering Design is a complete course text for students of chemical engineering. Written for the Senior Design Course, and also suitable for introduction to chemical engineering courses, it covers the basics of unit operations and the latest aspects of process design, equipment selection, plant and operating economics, safety and loss prevention. It is a course that students will want to keep through their undergraduate education and on into their professional lives.

Objectives of the Course:

- Identify, formulate, and solve complex engineering problems
- Design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability, apply modern design methods for this purpose. (Realistic constraints and conditions may include factors such as economic and environmental issues, sustainability, manufacturability, ethics, health, safety issues, and social and political issues, according to the nature of the design.)
- Design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems
- Devise, select, and use modern techniques and tools needed for engineering practice; employ information technologies effectively

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Know safety and loss prevention. Do reactor design.	1,3
2	Do equipment selection, specification and design.	1,2,3

3	Design separation columns (Distillation, Absorption and Extraction). Design heat exchangers. Design heat exchangers.	2,3
4	Do costing and project evaluation.	3
5	Know plant site/place selection, ethics and professionalism	1,3

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	4
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	5
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3

10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	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 6	Materials of construction: material and mechanical properties, corrosion resitance,selection of corrosion resistance, material costs, commonly used materials, design for material corrosion reistance	
2	[1] Chapter 7	Design information and data: sources of information and manufacturing processes, accuracy, prediction of physical properties, phase equilibrium data **Sem:** Materials of construction. Design information and data	
3	[1] Chapter 10	Safety and loss prevention: Materials and process hazards,analysis of product and proses safety, failure mode effect analysis, pressure relief	
4	[1] Chapter 18	Utilizing experience based principles to confirm the suitability of a process design: technical heuristics and short cut methods Equipment selection, spesification and design: separators,size reduction and enlergement, mixing equipment,transport and storage of materials, reactors **Sem:** Safety and loss prevention. Utilizing experience based principles to confirm the suitability of a process design.	
5	[1] Chapter 18	Utilizing experience based principles to confirm the suitability of a process design: technical heuristics and short cut methods Equipment selection,spesification and design: separators,size reduction and enlergement, mixing equipment,transport and storage of materials, reactors	
6	[1] Chapter	Equipment selection ,spesification and design: separators,size reduction and enlergement, mixing equipment,transport and storage of materials, reactors **Sem:** Equipment selection ,spesification and design: separators,size reduction and enlergement, mixing equipment,transport and storage of materials, reactors.	
7			Midterm

8	[1] Chapter	Equipment selection,spesification and design: separators,size reduction and enlergement, mixing equipment,transport and storage of materials, reactors **Sem:** Equipment selection ,spesification and design: separators,size reduction and enlergement, mixing equipment,transport and storage of materials, reactors.	
9	[1] Chapter	Tools for process performance evaluation: analysis of systems Reactor performance: production of desired product,thermodynamics and kinetics,heattranfer in the reactor	
10	[1] Chapter	Tools for process performance evaluation: analysis of systems Reactor performance: production of desired product,thermodynamics and kinetics,heattranfer in the reactor **Sem:** Tools for process performance evaluation.	
11	[1] Chapter 17	Separation Colums (distilation, absorption and extraction): continuous distialtion, distialtion variables, binary and multi systems, plate efficieny, packed colums, solvent extraction	
12	[1] Chapter 17	Separation Colums (distilation, absorption and extraction):continuous distialtion, distialtion variables, binary and multi systems, plate efficieny, packed colums, solvent extraction **Sem:** Separation Colums , distilation, absorption and extraction.	
13	[1] Chapter 15	Heat exhangers and design, CHEM-CAD applications	
14	[1] Chapter 15	Heat exhangers and design **Sem:** Heat exhangers and design.	
15	[1] Chapter 15	Plant site selection, sitelayout, environmental considerations, environmental regulations, and pollution prevention during design	
16			Final

Recommended Sources

TEXTBOOK(S)

1. Gavin Towler (Author), R. K. Sinnot, tChemical Engineering Design: Principles, Practice and Economics of Plant and Process Design 2nd Edition, Kindle Edition. 2008, P. 1245
2. R.K. Sinnott , Chemical Engineering Design: Chemical Engineering, Wiley; 2005. P 1056

Assessment

Attendance	0%	At least 75% class attendance is compulsory

Presentation	20%	
Quiz	10%	
Seminar	0%	
Midterm Exam	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 İndustry 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 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	6	6
Self-study	14	4	56
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for rmidterm exam	1	10	10
Final Examination	1	3	3
Preparation for final exam	1	20	20
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

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

Course Unit Title	Molecular chemical engineering
Course Unit Code	ENG 5001
Type of Course Unit	Elective
Level of Course Unit	year CHEN program

National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	0
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Leyla Z.Vezirova
Name of Lecturer (s)	Leyla Z.Vezirova
Name of Assistant (s)	-
Mode of Delivery	Face to Face, seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

This course covers molecular-level engineering and analysis of chemical processes. The use of chemical bonding, reactivity, and other key concepts in the design and tailoring of organic systems are discussed in this class. Specific class topics include application and development of structure-property relationships, and descriptions of the chemical forces and structural factors that govern supramolecular and interfacial phenomena for molecular .

Objectives of the Course:

Key aspects of chemical engineering involve the use and manipulation of intermolecular interactions in the liquid and solid state. This course provides an introduction to these concepts of molecular design and self assembly from a chemical perspective. The basic principles of covalent and ionic bonding, intermolecular interactions, and hydrogen bonding, and the roles of these forces in the final properties of liquids and solids will be discussed. This course emphasizes the ability to control and manipulate familiar macroscopic properties of chemical systems by molecularly engineering the "active" components. Emphasis will be placed on the understanding of the nature of chemical and intermolecular forces and the ability to molecularly design new materials systems based on the required property, ease of synthesis, and typical engineering constraints (cost, environmental factors, etc.). Discussions of the interplay between molecular structure and properties such as crystallization, (bio)adhesion, and friction provide examples of the paradigms of molecular design. The application of this understanding to chemical engineering problems in areas such as biomaterials, nanostructured organic materials, electro-optical materials, colloids, and surface science will be discussed.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	An understand core aspects of applied chemistry relevant to engineering, including electrochemistry, inorganic chemistry, materials chemistry, organic chemistry, physical chemistry, polymer chemistry and supramolecular chemistry..	1,3

2	An understand the relationship between molecular design motifs, supramolecular assembly and system functionality in various biomedical, environmental and energy devices.	1,2,3
3	Grasp current research topics in molecular engineering with relevance to healthcare, environment, energy and materials.	2,3
4	Build an understanding of macromolecules and how smart molecular design and assembly can provide material systems with unprecedented control over the resulting nanoscopic architecture and functionality.	2,3
5	Select the most appropriate method for production	1,3
Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm exam		
Course'sContributiontoProgram		
		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	5
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	5
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	5
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	3

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)			
Course Contents			
Week	Chapter	Topics	Exam
1	[2] ch.1,2, p. 3-27	Course Introduction, Perspective on Intermolecular Interactions and Relevance to Application. Molecular Interactions: Influence on Macroscopic Properties	
2	[2] ch.3,4, p. 31-67	Review of Chemical Structures and Trends Polar and VanderWaal Interactions **Seminar: Course Introduction, Molecular Interactions: Influence on Macroscopic Properties. Review of Chemical Structures and Trends Polar and VanderWaal Interactions**	
3	[2] ch.13, p. 260-288	Dielectric Constants - Origin and Importance Solvation, Solvent Design, Solute Partitioning Chelation and Co-solvents	
4	[2] ch.14, p. 288-312	Chelation and Co-solvents Solvation of Large Molecules - Polymer Solubility **Seminar: Dielectric Constants - Origin and Importance. Solvation of Large Molecules - Polymer Solubility**	
5	[1] ch.7,8 p. 257-319 [1] ch.7, p. 257-285	Block Copolymers - Ordered Nanophases Introduction to Solid State and Intermolecular Interactions Surfaces of Solids	
6	[2] ch.16, p. 341-370	Molecular Crystals Hydrogen Bonding in the Solid State Molecular Recognition and Self Assembly **Seminar: Introduction to Solid State and Intermolecular Interactions Surfaces of Solids. Molecular Recognition and Self Assembly**	
7			Midterm
8	[1] ch.7, p. 257-285 [1] ch.9, p. 328-347	Surfaces of solids. Liquid Crystalline Systems - Thermotropic Liquid Crystalline Systems - Lyotropic and Bio Examples Micellar Systems Micellar Systems (cont.) Micellar Systems (cont.) / Applications	
9	[1] ch.13, p. 465-497	Introduction to Liquid / Solid Interactions Wetting, Flotation and Detergency **Seminar: Surfaces of solids. Liquid Crystalline Systems – Thermotropic**	
10	[2] ch.15, p. 312-317 [1] ch.12, p. 431-460	Fundamentals of Adhesion Fruction, Lubrication and Adhesion	
11	[1] ch.11, p. 390-422	Adsorbtion from solution Molecular Adsorption Friction **Seminar: Fundamentals of Adhesion. Molecular Adsorption. Friction**	
12	[1] ch.15, p. 537-563	Polymer Adsorption / Adhesion to Surfaces Polymer Surface Modification / Surface Engineering	

13	[1] ch.15, p. 537-563	Macromolecular Surface Modification / Surface Engineering **Seminar: Polymer Adsorption / Adhesion to Surfaces. Macromolecular Surface Modification / Surface Engineering**	
14	[3] ch.4, p. 161-200	Organic Monolayers (SAMs) Organisation of porphyrins in monolayers and monolayer assemblies	
15	[3] ch.5, p. 207-250	Bio Applications of Organic Monolayers / Bioadhesion Other Applications of Surface Modification **Seminar: Organic Monolayers (SAMs). Bio Applications of Organic Monolayers**	
16			Final Exam

RecommendedSources
TEXTBOOK(S)

1. Adamson, Arthur W., and Alice P. Gast. Physical Chemistry of Surfaces. 6th ed. New York, NY: Wiley-Interscience, 1997. ISBN: 9780471148739.
2. Israelachvili, Jacob N. *Intermolecular and Surface Forces: With Applications to Colloidal and Biological Systems*. 2nd ed. Burlington, MA: Academic Press, 1992.
3. DietmarMobius,Reinhard_Miller, Organized Monolayers and Assemblies: Structure, Processes and Function, One press, 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 Azerbaijan State Oil and İndustry 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.
- 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	8	8
Self-study	14	3,5	49
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	12	10
Final Examination	1	3	3
Preparation for final exam	1	22	20
Total Workload			**150**
Total Work load/30(h)			**150/30**
ECTS Credit of the Course			**5**

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

Course Unit Title	Biochemical separations and laboratory
Course Unit Code	CHEM 5001
Type of Course Unit	Elective
Level of Course Unit	___year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5

Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Leyla Z.Vezirova
Name of Lecturer (s)	Leyla Z.Vezirova
Name of Assistant (s)	-
Mode of Delivery	Face to Face, seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:
The goal of this course is to provide an insightful overview of the fundamentals of downstream processing for biochemical product recovery. Through reading assignments and homework sets, emphasis is given to fundamental modes of recovery and purification that the scientist and engineer are most likely to encounter in the laboratory and in industrial settings. However, guest lectures by distinguished researchers from both academia and industry in the field of biochemical engineering are also used to demonstrate new concepts and emerging technologies that are likely to benefit biochemical product recovery in the future.

Objectives of the Course:
Familiarity with some of the general aspects of process control and development, as well as general knowledge of chemical engineering principles including thermodynamics, chemical kinetics and transport processes, will be necessary for success in this course. Knowledge of mathematics, especially differential equations and basic statistics (i.e. the normal probability distribution) is necessary for dealing with the engineering aspects of the course. It is expected that students will be proficient in the use of Microsoft® Excel for spreadsheet calculations that are necessary for the completion of many homework assignments.

LearningOutcomes

At the end of the course the student will be able to		Assessment
1	Make energy, entropy, and availability balances around a separation process.	1,3
2	Understand the usefulness of equilibrium ratios (K-values and partition coefficients) for liquid and vapor phases.	1,2,3
3	DeriveK-value expressions in terms of fugacity coefficients and activity coefficients.	1,2,3
4	Explain phase equilibria in terms of Gibbs free energy, chemical potential, fugacity, fugacity coefficient, activity,and activity coefficient.	1,3
5	Identify a buffer suited to maintain activity of a biological species at a target pH and evaluate effects of tempera-ture, ionic strength, solvent and static charge on pH, and effects of pH on solubility.	1,3

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	3

2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	4
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	4
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	5

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

Course Contents

Week	Chapter	Topics	Exam
1	[1] ch.1, p. 2-180 [2] ch.1, p. 2-35	Separation Processes, Introduction to Bioseparations Strategies for Biochemical Process Synthesis	
2	[2] ch.2, p. 35-85	Thermodynamics of Separation Operations Biochemical Processing Overview, Biotechnology Applications. **Seminar: Strategies for Biochemical Process Synthesis, Biochemical Processing Overview, Biotechnology**	
3	[2] ch.9, p. 359-413	Approximate Methods for Multicomponent, Multistage Separations .Cell Disruption	
4	[3] ch.1, p. 4-39	Solid-Liquid Separation: Solid/liquid separation equipment selection , Centrifugation **Seminar: Approximate Methods for Multicomponent, Multistage Separations . Cell Disruption, Solid-Liquid Separation:**	
5	[1] ch.4, p.333-400	Chromatography (column chromatography processes)	
6	[1] ch.5, p.416-485	Chromatography (affinity chromatography) Protein Refolding **Seminar:Chromotography**	

7			Midterm
8	[3] ch.1, p. 4-39	Solid-Liquid Separation: Filtration	
9	[2] ch.3, p. 500-650 [3] ch.4, p. 140-190	Separations by barriers and solid agents Membrane and Filtration Applications **Seminar: Solid-Liquid Separation: Filtration**	
10	[3] ch.6, p. 239-316	Rotary Vacuum Filtration	
11	[2] ch.16,17,18 p. 650-730	Separations that involve a solid phase **Seminar: Separations that involve a solid phase. Seperation that involve a solid phase.**	
12	[2] ch.17, p. 670-730	Crystallization, Desublimation, and Evaporation	
13	[1] ch.2, p. 65-156	Separations by phase addition or creation Adsorption and Stripping of Dilute Mixtures **Seminar: Adsorption and Stripping of Dilute Mixtures**	
14	[2] ch.19, p. 730-790	Mechanical separation of phases Mechanical Separations in Biotechnology	
15	[2] ch.15, p. 568-650	Ion Exchange and Electrophoresis **Seminar: Ion Exchange and Electrophoresis**	
16			Final

Recommended Sources
TEXTBOOK(S)

1. Frederick Dechow. Separation and Purification Technicues in Biotechnology, Wiliam,1989
2. J.D._Seader,_Ernest J. Henley,D. Keith_Roper Seperation processes principes, Wiley,2008
3. Stephen_Tarleton,_Richard Wakeman Solidliquid seperation, Elsevier,2005

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	0%	
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 İndustry 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.
- 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)	TotalWorkload(hour)
Courseduration in class	**14**	**3**	**42**
Self-study	14	4	56
Tutorials	14	1	14
MidtermExamination	1	3	3
Preparation for midtermexam	1	9	9
FinalExamination	1	3	3
Preparation for final exam	1	21	21
Preparation for presentation	1	7	7
TotalWorkload			**150**
TotalWorkload/30(h)			**150/30**
ECTS Credit of the Course			**5**

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

Course Unit Title	Introduction to Biomedical Engineering
Course Unit Code	CHEM 5002
Type of Course Unit	Elective
Level of Course Unit	year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2

Practice (hour/week)	1
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Leyla Z.Vezirova
Name of Lecturer (s)	Leyla Z.Vezirova
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

Introduction to Biomedical engineering applies engineering and science principles and methodologies to the analysis of biological and physiological problems and to the delivery of health care. Biomedical engineering encompasses a range of fields of specialization including bioinstrumentation, bioimaging, biomechanics, biomaterials, and biomolecular engineering. This course will provide an introduction to the interdisciplinary field of biomedical engineering. The molecular, cellular, physiological and engineering principles that govern the field will be covered. Applications will include biomaterials, tissue engineering, biomechanics, bioimaging, bioinstrumentation, bio-nanotechnology and artificial organs. Prerequisite: Junior standing or above.

Objectives of the Course:

Students should know more about biomedical engineering and how the development of technology, devices and instrumentation can enhance the quality and precision of health care for disease diagnosis, treatment, and prevention. Students should be able to use all accumulated knowledge for an understanding fundamental principles used by biomedical engineers in biomechanics, biomedical imaging and signal processing, cellular and molecular biology, biomaterials and tissue engineering, biomedical device design.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Explain and discuss what biomedical engineering is and what biomedical engineers do in their professional activities.	1,3
2	Understand fundamental principles used by biomedical engineers in biomechanics, biomedical imaging and signal processing, cellular and molecular biology, biomaterials and tissue engineering, biomedical device design.	1,2,3
3	Understand living systems/mechanisms through a systems approach.	1,2
4	Identify similarities and differences between engineering systems and living systems and between engineers and life scientists .	3
5	Increase their proficiency in oral and written communications	1,2,3

Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm exam		
Course's Contribution to Program		
		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	4
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	3
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	4
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	3
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		
Course Contents		

Week	Chapter	Topics	Exam
1	[1] – ch. 1,2 p. 1-22, 32-39 [2] – ch.1.p. 16-32	What is biomedical engineering. Biomolecular principles: atoms, molecules, macromolecules	
2	[1] – c. 3, p. 82-126	Nucleic acids/ Gene. DNA technology and biomedical applications **Seminar: Nucleic acids/ Gene. DNA technology and biomedical applications**	
3	[1] – c. 1,2 p. 1-22, 32-39	Molecular dogma of biology.RNA technology	

4	[1] – ch. 4 p. 141-168	Proteins/ Enzymes. Clinical applications of proteins and enzyme **Seminar: Molecular dogma of biology.RNA technology, Proteins/ Enzymes. Clinical applications of proteins and enzyme**	
5	[1] – ch. 5 p. 169-200	Cellular structure and function. Cell-cell interactions and signaling	
6	[2] – ch. 3 p. 76-130	Cell growth/differentiation/proliferation/apoptosis/death **Seminar: Cellular structure and function. Cell-cell interactions and signalling, Cell growth/ differentiation/ proliferation/ apoptosis/ death**	
7			Midterm
8	[1] – ch. 12 p. 432-460	Cell culture technologies and biomedical engineering.	
9	[1] – ch. 7 p. 247-280 [2] – ch. 11 p. 668-730	Fundamentals of signaling in biological systems and implications for biomedical engineering Engineering principles in biomedicine Engineering balances **Seminar: Cell culture technologies and biomedical engineering, Fundamentals of signaling in biological systems and implications for biomedical engineering**	
10	[1] –ch. 13p. 472-500 [2] – ch. 10p. 610-662	Engineering principles in biomedicine. Engineering balances.	
11	[1] – ch. 8 p. 300-330	Circulatory systems. Removal of molecules from the body **Seminar: Engineering principles in biomedicine. Engineering balances. Circulatory systems. Removal of molecules from the body**	
12	[1] – ch. 10 p. 361-380	The newest applications of research and technology for the development of the next generation of lab devices. Mechanical properties of materials	
13	[2] – ch. 5p. 220-250	Mechanical properties of the cell. Practical Example. Mechanical properties of the tissues and organs. Biomaterials. Biohybrid artificial organs **Seminar: Mechanical properties of the cell, The newest applications of research and technology for the development of the next generation of lab devices.**	
14	[1] – ch. 14,16 p.507-530, 572-595	Engineering and immunity. Biomedical engineering and cancer. Systems biology and biomedical engineering. Biotechnologies for biomedical engineers	
15	[1] – ch. 12p. 432-460 [2] – ch. 6p. 274-349	Bioimaging Image processing and analysis. Drug delivery. Tissue engineering. Nanobiotechnology for biomedical engineering **Seminar: Engineering and immunity. Biomedical engineering and cancer. Systems biology and biomedical engineering. Nanobiotechnology for biomedical engineering.**	
16			Final Exam

Recommended Sources

TEXTBOOK(S)

1. W. Mark Saltzman,Biomedical Engineering: Bridging Medicine and Technology, Yale University (Cambridge Texts in Biomedical Engineering), 2009
2. John Enderle, Joseph Bronzino, Introduction to Biomedical Engineering – Third Edition, Elsevier, 2007

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 İndustry 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.
- 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
Tutorials	14	1	14
Self-study	14	3,5	49
Midterm Examination	1	3	3
Preparation for midterm exam	1	10	10
Final Examination	1	3	3
Preparation for final exam	1	21	21
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

Chemical engineering (CHEN) program, "Petrochemical technology and industrial ecology" department

Course Unit Title	Biochemical reactors and laboratory
Course Unit Code	CHEM 5003
Type of Course Unit	Elective
Level of Course Unit	
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2

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

Course description:

Biochemical reactors (BCRs) are engineered treatment systems that use an organic substrate to drive microbial and chemical reactions to reduce concentrations of metals, acidity, and sulfate in MIWs. The ITRC Biochemical Reactors for Mining-Influenced Water technology guidance (BCR-1, 2013) and this associated Internet-based training provide an in-depth examination of BCRs; a decision framework to assess the applicability of BCRs; details on testing, designing, constructing and monitoring BCRs; and real world BCR case studies with diverse site conditions and chemical mixtures.

Objectives of the Course:

- The goals of this subject are Describe a BCR and how it works

Identify when a BCR is applicable to a site

Use the ITRC guidance for decision making by applying the decision framework

Improve site decision making through understanding of BCR advantages, limitations, reasonable expectations, regulatory and other challenges

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	1,3,4
2	Ability to execute, coordinate, implement and substantiate laboratory processes while carrying out the experiments,	1,3,4
3	Ability to obtain and extract chemical compounds using standard methods and syntheses.	1,2,3,4

4	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling and design of chemical engineering systems.	1,3,4
5	Ability to analyze and interpret data using statistical methods.	1,3,4
6	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering.	1,3
7	Abilityto carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	1,3
8	Ability to choose and use existing technologies, materials in chemical engineering while undertaking project tasks and solving these issues.	1,2,3,4
9	must be able to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	3,4
10	must be able to design systems, components, nodes, and processes that meet the requirements, taking into account natural limitations such as economics, ecology, and social aspects.	1,2,3,4
Assessment Methods: 1. Final Exam, 2. Presentation, 3- Seminar, 4-Midterm		
Course's Contribution to Program		
		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	4
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	3
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4

7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	

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

Course Contents

Week	Chapter	Topics	Exam
1	[1] CHAP.II	Introduction to the subject	
2	[2] Chap.III	Preliminary appasal of a reactor project Seminar I - Preliminary appasal of a reactor project	
3	[3] Chap.III	Homogeneous and heterogeneous reactors	
4	[3] CHAP.VI	Batch reactors and continuous reactors Seminar II - Batch reactors and continuous reactors	
5	[2] CHAP.V	Variations in contacting pattern – semi-batch operation	
6	[1] Chap.VII	Influence of heat of reaction on reaction type Seminar III - Influence of heat of reaction on reaction type	
7	[3] Chap.IV	Chemical equilibria and chemical kinetics	
8			Midterm
9	[2] Chap.VII	Calculation of equilibrium conversion Seminar IV - Calculation of equilibrium conversion	
10	[2] Chap. VI	Ultimate choice of reactor of reactor conditions	
11	[1]	Influence of temperature. Activation energy	

	Chap.VIII	Seminar V	
12	[1] Chap.IV	Rate equations for constant-volume batch reactors	
13	[1] Chap.VII	Experimental determination of kinetic constants Seminar VI - Experimental determination of kinetic constants	
14	[3] Chap.V	General material and thermal balances	
15	[2] Chap.IX	Calculation of reaction time Seminar VII- Calculation of reaction time	
16			Final

Recommended Sources
TEXTBOOK(S)

1. J.F.Richardson, D.G., Peacock, Chemical&biochemical reactors & process control.Pearson,2000

2.Smith, J. Chemical Engineering Kinetics. 3rd ed. New York, NY: McGraw-Hill, 1981.

3.Bailey, J. E., and D. F. Ollis. Biochemical Engineering Fundamentals. 2nd ed. New York, NY: McGraw-Hill, 1986.

4.A. Ollis. Biochemical Engineering Fundamentals. 2nd ed. New York, NY: McGraw-Hill, 1986. ISBN: 9780070032125.

Assessment

Attendance	-	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	-	
Laboratories	-	
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	8	8
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	9	9
Final Examination	1	3	3
Preparation for final exam	1	18	18
Self-study	14	4	56
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

Chemical engineering (CHEN) program, "Industrial safety and labour protection" department

Course Unit Title	Bioprocess Safety
Course Unit Code	**CHEM 5004**
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2

Practice (hour/week)	1
Laboratory (hour/week)	0
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Amina Huseynova
Name of Lecturer (s)	Amina Huseynova
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

Biological hazards (biohazards) present the Occupational Health and Safety (OHS) professional with complex challenges. Many and varied biohazards may result from workplace exposure to organisms, or substances produced by organisms, that threaten human health. You will be introduced to safety hardware, sources and prediction of toxic releases, potential harmful effects of biological hazards in the workplace, as well as hazard identification. The course provides the introductory framework to the practices and principles to working with infectious biological agents. Focus is placed on an introduction to infectious agents, assessment of biological hazards and risks, overview of laboratory safety, risk mitigation via personal protective equipment and biosafety cabinets, program management, and biosafety guidelines and regulations.

Objectives of the Course:

The field of biotechnology is developing very rapidly and needs skilled engineers with bioprocess engineering background to design, build, control, and operate bioreactors and fermenters. This course provides students with basic concepts and prepares them to meet the challenges of the new and emerging biotechnology industry.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	*Obtainanunderstandingabout howbiological hazards affectusphysicallyand how hazards can be quantified.*	1,2,3
2	Identify certain diseases caused by prions, viruses, bacteria, fungi and parasites	1
3	Understand what the risk factors are when working with a biological agent	1,2,3
4	Understand how an infection can be prevented by modifying the agent or how it is handled	1,2,3
5	Know why personal protective equipment (PPE) is used, and what PPE is appropriate for the work area	1,2
6	Understand when a risk group may not correspond to the biosafety level of a facility	1,2

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	3
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	3
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	3
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	4
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	3
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	5
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	3

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

Course Contents

Week	Chapter	Topics	Exam
1	[2] Chapter1 p.p.1-15	Introduction to biosafety. The Need for Bioprocess Safely Management Systems.	
2	[1] Chapter4 p.p.37-79	Legislative basis of safety at workplace. Laws, regulations and standards. **Seminar1.** Bioprocess Engineering Information Transfer and Management Practices	
3	[2] Chapter 2 p.p.17-20	An overview of the bioprocessing industry. Bioprocessing's History	
4	[2] Chapter2 p.p.22-45	The bioprocess lifecycle. General Biosafety Recommendations for Large Scale Work **Seminar2.** Development Phase: Laboratory and Pilot Plant	

5	[1] Chapter26 p.p.483-497	Biohazards. Kinds of biohazard agents.	
6	[2] Chapter3 p.p.48-54	Bioprocessing safety management practices. Develop and Document a System to Manage Bioprocess Safety Hazards. **Seminar3.** Collect Bioprocess Hazard Information. Identify Bioprocess Safety Hazards	
7			Midterm
8	[2] Chapter3 p.p.54-67	Existing Management Systems. Establishing a Bioprocess Safety Management System **Seminar 4.** Select a Management System Model Based Upon Your Needs. Identifying the Elements that Apply to Your Operations	
9	[2] Chapter3 p.p.67-69	Biosafety Training for the Workforce	
10	[2] Chapter3 p.p.69-76	Investigating incidents. A Generic Procedure for Initial Biohazard Incident Response **Seminar5 .** Applying Behavior-Based Safety to Bioprocesses	
11	[2] Chapter4 p.p.79-80	Key Considerations for Assessing Risk to Manage Bioprocess Safety	
12	[2] Chapter4 p.p.80-85	Bioprocess risk assessment. Three Types of Assessment. **Seminar6.** Types of bioprocess risk assessment	
13	[1] Chapter28 p.p.513-536	Personal Protective Equipment. Hearing protection. Respiratory protection. Hand, finger and arm protection.	
14	[2] Chapter5 p.p.89-115	Bioprocess design considerations. Heating, Ventilation, and Air Conditioning Aspects **Seminar7.** Physical Plant Design. Building and site security.	
15	[2] Chapter5 p.p.116-143	Bioprocess unit operations. General equipment design considerations.	
16			Final

Recommended Sources

1. Brauer, R., Safety and Health for Engineers, 2nd Edition, John Wiley & Sons, 2006.
2. A John Wıley, Guidelines for Process Safety in Bioprocess Manufacturing Facilities. Center for Chemical Process Safety & sons, inc., publication. Institute of Chemical Engineers, Inc. (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 Guidelines of Azerbaijan State University of Oil and Industry 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**	**3**	**42**
Presentation	1	8	8
Self-study	14	4	56
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	20	20
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

Chemical engineering (CHEN) program, "Social disciplines" department

Course Unit Title	History of Azerbaijan
Course Unit Code	HIST 5001
Type of Course Unit	Elective
Level of Course Unit	_ year CHEN program
National Credits	0
Number of ECTS Credits Allocated	4
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	0
Year of Study	
Semester when the course unit is delivered	

Course Coordinator	Tahir R. JAFIYEV
Name of Lecturer (s)	Tahir R. JAFIYEV
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

This course will cover History of Azerbaijan since ancient periods till nowadays, focusing on political, economic, military, agrarian, etnic, demografic processes which happened in the history of Azerbaijan nation.

Objectives of the Course:

The course is intended to instill a sense of patriotism, to expand and deepen students' knowledge of the history and historical analysis as well as provide them with the ability to critically read the sophisticated literature of the discipline and understand . We will focus on acquiring by them the skills of objective assessment of historical issues. The main objective of the course is delivering to students problems:

- of formation of Azerbaijan nation
- historical stages of statehood of Azerbaijan
- nowadays socio-political, economical prosperity of Azerbaijan

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Understand the historical processes on History of Azerbaijan happened from ancient period to nowadays theoretically	1,2,3
2	Critically analyze and evaluate the historical processes in given definit period of history	2
3	Critically analyze and evaluate the historical processes in Ancient and Middle Ages	3
4	Read historical literature	1,2,3

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering	2

2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	2
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	3
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	4
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	3
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	3
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyse the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	4
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	4

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

Course Contents

Week	Chapter	Topics	Exam
1	[1] 1,2,3,4. p.13- 61	Ancient Azerbaijan Theoretical, methodological issues and sources of Azerbaijan history. Prehistoric period in the territory of Azerbaijan. Tribal units and initial state formations in the territory of Azerbaijan. Ancient states in the territory of Azerbaijan.Mannea.Azerbaijan as part of the Median and Achamanid Empire. The state of Atropatena. Ancient Albania.	
2	[1] 5,6. p.62-138	Azerbaijan in the 3rd - in the 9th centuries Azerbaijan in the early middle ages, as part of the Sassanian Empire. Early feudalism relations in Azerbaijan, occupation of Azerbaijan by Sassanids, culture and religion. Spreading of Christianity in Albania. Azerbaijan as part of Arabic Caliphate. spread of Islam. Arab-Khazar wars. Resettlement and tax policy. Administration. Explanation of Khurramid's movement.	
	[1] 1,2,3,4. p.13- 61	**Seminar topic**: Ancient Azerbaijan Theoretical, methodological issues and sources of Azerbaijan history. Prehistoric period in the territory of Azerbaijan. Tribal units and initial state formations in the territory of Azerbaijan. Ancient states in the territory of Azerbaijan.Mannea.Azerbaijan as part of the Median and Achamanid Empire. The state of Atropatena. Ancient Albania.	
3	[1]	Azerbaijan in Renascence epoch (the 9th - in the early of the 13th centuries)	

	7,8. p.139-181	The formation of Azerbaijan nation. Feudal States of Azerbaijan in IX-first half of XI centuries. Independent feudal states - Shirvanshahs, Sajjids, Salarids, Shaddadids, Ravvadids. The Seljug Empire. The State of Atabegs.Azerbaijan in the period of developed feudalism.	
4	[1] 9,10,11. p.182-235	Azerbaijan in 13^{th}-15^{th} centuries Mongol rule in Azerbaijan. Timurid State. Shirvanshahs State in XIV-XV centuries. Feudal states of Azerbaijan in the XV century. The states of Jalairi, Karakoyunlu and Aghgoyunlu, Shirvanshahs.	
	[1] 7,8. p.139-181	**Seminar topic**: Azerbaijan in Renascence epoch (the 9^{th} - in the early of the 13^{th} centuries) The formation of Azerbaijan nation. Feudal States of Azerbaijan in IX-first half of XI centuries. Independent feudal states - Shirvanshahs, Sajjids, Salarids, Shaddadids, Ravvadids. The Seljug Empire. The State of Atabegs.Azerbaijan in the period of developed feudalism.	
5	[1] 12,13,14. p.252- 325	Azerbaijan Safavid State (16^{th}-17^{th} centuries) Establishment of Safavids state. İnternal and foreign policy of Shah İsmail I. The reign period of Shah Tahmasib I. Safavids-Ottoman wars and Azerbaijan. Socio-economic life of Azerbaijan in XVI century. Fight for liberation against the Ottoman. The reign of Shah Abbas I and his reforms. Ottoman-Safavids wars in the first half of XVII century. Istanbul II (Sarab) and Marand, Gasry-Shirin treaties.	
6	[1] 15. p.334-344	Azerbaijan in the first half of 18^{th} century The social-political situation in Azerbaijan after signing of Gasri-Shirin treaty (1639). Popular uprising against Safavid rule or its policies. Dividing the territory of Azerbaijan between Russia, Ottoman Empire and Safavid. Becoming of Nadir khan the main figure of these processes. Afshar as one of the Turkic tribes. Nadir's personality and his coming to the throne. His victories, raids, establishing of Empire. The political situation after his assassination.	
	[1] 12,13,14, 15. p.252- 325 p.334-344	**Seminar topic**: Azerbaijan Safavid State (16^{th}-18^{th} centuries) Establishment of Safavids state. İnternal and foreign policy of Shah İsmail I. The reign period of Shah Tahmasib I. Safavids-Ottoman wars and Azerbaijan. Socio-economic life of Azerbaijan in XVI century. Fight for liberation against the Ottoman. The reign of Shah Abbas I and his reforms. Ottoman-Safavids wars in the first half of XVII century. Istanbul II (Sarab) and Marand, Gasry-Shirin treaties. The social-political situation in Azerbaijan after signing of Gasri-Shirin treaty (1639). Popular uprising against Safavid rule or its policies. Dividing the territory of Azerbaijan between Russia, Ottoman Empire and Safavid. Becoming of Nadir khan the main figure of these processes. Afshar as one of the Turkic tribes. Nadir's personality and his coming to the throne.	
7	[1] 16. p. 345-382	The Azerbaijani khanates The khanates of Northern Azerbaijan. Foreign policy. Socio-economy life in this period. Foreign states aspirations to establish their dominion in the Caucasus. Aga Mahammad Shah Gacar's attacks.	
8			Midterm
9	[1] 17,18.	Azerbaijan in 19^{th} century	

	p.383-404	Division of Azerbaijan territories between Russia and Iran. Treaty of Gulistan (1813). The second Russian-Iran war. Turkmenchay Treaty (1828). Resettlement policy. Northern Azerbaijan in 30-50th years of XIX century. Forming of military-curfew regime. Uprisings against this governance system and liquidation of it. Reforms of 40-60th years. Formation of capitalist relations. Peasantry reform of 1870.Oil industry.Culture.	
	[1] 17,18. p.383-404	**Seminar topic**: Azerbaijan in 19th century Division of Azerbaijan territories between Russia and Iran. Treaty of Gulistan (1813). The second Russian-Iran war. Turkmenchay Treaty (1828). Resettlement policy. Northern Azerbaijan in 30-50th years of XIX century. Forming of military-curfew regime. Uprisings against this governance system and liquidation of it. Reforms of 40-60th years. Formation of capitalist relations. Peasantry reform of 1870.Oil industry. Development of oil monopolies.Culture.	
10	[1] 19,20. p.405-421	Azerbaijan in the first decades of 20th century Impact of I Russian revolution(1905-1907) to the political process in Azerbaijan. Sosial-democratic organization “Hummet”. Activity of Azerbaijan intelligency on formation of national consciousness. Armenian-Muslim slaughter in 1905-1906. National parties as “Difai”, “Ittifag-ul-Muslimin”, “Mudafia”, “Musavat”. All-Russian Congresses. Participation of deputies from Azerbaijan in State Dumas of Russian Empire. Azerbaijan in the interests of world countries during WW I. Heroes of war. Tendency of democratization after the February revolution (1917). Activities of Transcaucasian Comissariat and Seym. Baku Soviet attempts on weakening the social base of Musavat party. Replacing the idea of territorial autonomy by the idea of Independence.	
11	[1] 21. p.422- 431	The Azerbaijan Democratic Republic Proclamation of the ADR. The state construction and foreign policy of ADR. Invasion of XI Red army.	
	[1] 21. p.422- 431	**Seminar topic**: The Azerbaijan Democratic Republic Proclamation of the ADR. The state construction and foreign policy of ADR. Invasion of XI Red army.	
12	[1] 22. p.432 - 450	Azerbaijan in the 20s and 30s of the 20th century The Soviet state construction in Northern Azerbaijan. The political groups and discrepancy in the leadership of Azerbaijan. The formation of MKAO (Mountainous or Nagorno Karabakh Autonomous Oblast) and Nakhichevan ASSR (Autonomous Soviet Socialist Republic). Soviet National Policy in Azerbaijan, bloody repressions of 30s years. Policy of industrialization and collectivization. Religion and cultural revolution	
13	[1] 23. p.451 - 461	Azerbaijan during World War II (1939-1945) Participation of Northern Azerbaijan in World War II, science and culture. Formation of national divisions, population of the Az.SSR at the battle and home fronts, role of Baku oil.	

		S.C.Pishavari. National government and its reforms. Tabriz State University. Clash of foreign interests in Iran. Suppression of National Liberation Movement of Southern Azerbaijan. Political immigrants from S.Azerbaijan.	
	[1] 23. p.451 - 461	**Seminar topic**: Azerbaijan during World War II (1939-1945) Participation of Northern Azerbaijan in World War II, science and culture. Formation of national divisions, population of the Az.SSR at the battle and home fronts, role of Baku oil. S.C.Pishavari. National government and its reforms. Tabriz State University. Clash of foreign interests in Iran. Suppression of National Liberation Movement of Southern Azerbaijan. Political immigrants from S.Azerbaijan.	
14	[1] 24. p.462-470	Azerbaijan in the years after World War II. Socio-economic development and political conditions in Northern Azerbaijan (1946-1991) Socio-economic development and political conditions in Northern Azerbaijan. New industrial cities, strengthening of strong political situation, deportation of Western azerbaijanis from their homeland by Soviet leadership in 40-50s years XX century. The leadership of 1954-1959 years in Azerbaijan (Imam Mustafayev, Sadiq Rahimov, Mirza Ibrahimov). Vali Akhundov (1959-1969) and Haydar Aliyev as the first secretary of Central Committee of Azerbaijan Communist Party (1969-1982).	
15	[1] 25. p.471-503	The Independent Azerbaijan Republic Sounding ideas of independence from Freedom Square. Black January. The Constitutional Act of the 18th October of 1991, legal-democratic state building, about reforms, struggle for the strengthening of Independence of the Republic of Azerbaijan, successful relations with foreign countries.Oil strategy.	
	[1] 25. p.471-503	**Seminar topic**: The Independent Azerbaijan Republic Sounding ideas of independence from Freedom Square. Black January. The Constitutional Act of the 18th October of 1991, legal-democratic state building, about reforms, struggle for the strengthening of Independence of the Republic of Azerbaijan, successful relations with foreign countries.Oil strategy.	
16			Final

Recommended Sources

TEXTBOOK(S)

1. Ismail bey Zardabli. The history of Azerbaijan. (from ancient times to the present day), London, 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 Azerbaijan State Oil and Industry University 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 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	7	7
Tutorials	14	1	14
Self-study	14	3,5	49
Midterm Examination	1	3	3
Preparation for midterm exam	1	10	10
Final Examination	1	3	3
Preparation for final exam	1	18	18
Total Workload			**120**
Total Workload/30(h)			**120/30**
ECTS Credit of the Course			**4**

Chemical engineering (CHEN) program, "Management and economy of energy and petrochemical areas" department

Course Unit Title	Energy Economics
Course Unit Code	ECON 5001
Type of Course Unit	Elective
Level of Course Unit	__year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	1

Laboratory (hour/week)	0
Year of Study	
Semester when the course unit is delivered	
Course Coordinator	Rashid A. JABRAILOV
Name of Lecturer (s)	Rashid A. JABRAILOV
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

Energy demand and energy supply. Energy policies. Distribution of energy resources and its use around the world. Energy market structure. Energy pricing and taxation. Factors that influence energy prices. Energy demand analysis and forecasting the demand. Renewable energy. Energy and the environment. Future of energy markets. Global energy challenges.

Objectives of the Course:

The course is intended to lead students to an appreciation of the role of the energy industry in the global economy and the issues associated with managing resource based economies. The main objective of the course is to help students to understand:

- the potential role of energy resources to fulfill our energy demand
- forecasting our future energy demand
- how energy markets operate
- issues of resource management

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	theoretically and empirically describe the demand and supply of energy, and how these interact in a market.	1,2,3
2	analyze the effects of energy and environmental policies on the supply and demand of different types of energy	1,2,
3	understand the need for government policies in various energy markets.	3
4	Make simple forecast about energy demand and use demand analysis models	1,2
5	Describe current energy market trends and relate current conditions to historical markets	2,3

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

Course's Contribution to Program		
		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering	2
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	2
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	3
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	4
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	3
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	3
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyse the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	4
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	4
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)		

Course Contents

Week	Chapter	Topics	Exam
1	[1] chapter 2, pp.2-5	Introduction to Energy Economics	
2	[1] 1	Energy supply and energy demand	
3	[1] 2	Energy policy of the Republic of Azerbaijan	
4	[1]	World distribution of oil resources and production.	

	3	Seminar 1:	
5	[1] 3,4	Energy market structure: Oil , OPEC, world oil and energy security	
6	[1] 4,5	Price formations in competitive markets, energy pricing	
7	[1] 4,5	Energy Taxes, Subsidies, and Social Welfare Market Structure.	
8			Midterm
9	[1] 6	Forecasting the demand for oil and gas	
10	[1] 6	Energy demand analysis models	
11	[1] 7	Renewable Energy: types, market structures and pricing, impact at grid level, energy storage as the future of renewables	
12	[1] 8	Risk management in oil and gas industry.	
13	[1] 8,9	Energy and the environment: Climate change, impact on energy markets.	
14	[1] 11	Future of international energy markets: market forces and government intervention	
15	[1] 12	Global energy challenges	
16			Final

Recommended Sources

TEXTBOOK(S)

1. Subhes C. Bhattacharyya. Energy Economics: Concepts, Issues, Markets and Governance. Springer 2011, 645 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 Industry University 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 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
Tutorials	14	1	14
Self-study	14	4	56
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			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

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

Course Unit Title	Structure and Properties of the Polymers
Course Unit Code	CHEM 5006
Type of Course Unit	Elective
Level of CourseUnit	-
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2

Practice (hour/week)	1
Laboratory (hour/week)	0
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	PhD Narmina Guliyeva
Name of Lecturer (s)	PhD Narmina Guliyeva
Name of Assistant (s)	-
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

Plastics are very broad category of materials. They include most elastomers (such as rubber), adhesives (such as epoxies and acrylics), fibers (such as Nylon and Polyesters), and traditional engineering plastics. Plastics is more common name for Polymers. Polymers have been under development since the eighteenth century. In the last few decades, polymers have been replacing other materials in an increasing number of products. It is therefore important for modern materials engineers to understand the fundamental concepts of engineering polymers and be able to select, modify, and develop the proper polymer for a certain performance.

Objectives of the Course:

The main objective is to introduce polymers as an engineering material and emphasize the basic concepts of their nature, production and properties. Polymers are introduced at three levels; namely, the molecular level, the micro level, and macro-level. Through knowledge of all three levels, student can understand and predict the properties of various polymers and their performance in different products. The course also aims at introducing the students to the principles of polymer processing techniques and considerations of design using engineering polymers.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Polymers from the Molecular viewpoint including basic concepts in organic chemistry, polymerization processes, thermoplastics and thermosets, and copolymers.	1,3,4
2	Know the structure of polymeric substances	1,2,3,4
3	List the types of polymerization reactions	1,2,3
4	Know the structure and physical properties of polymers	1,3
5	Be able to synthesize polymers	1,3,4

Assessment Methods: 1. Final Exam, 2. Presentation, 3.Midterm, 4. Laboratory		
Course's Contribution to Program		
		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	4
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	3
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in	3

	accordance with relevant laws, regulations, standards, methods and guidelines.		
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)			
Course Contents			
Week	Chapter	Topics	Exam
1	Textbook 1 Chapter 1,2	History of polymers. Structure of macromolecules. Stereochemistry of polymers.	
2	Textbook 1 Chapter 2	Polymeric solids and their properties: macromolecular conformation in the amorphous phase, molecular orientation, glass transition, polymeric crystals, crystallization processes, mechanical properties of amorphous and semi-crystalline polymers. Sem: History of polymers. Structure of macromolecules. Stereochemistry of polymers.	
3	Textbook 1 Chapter 2	Polymeric solids and their properties: polymer structure – property relationships, crystalline and amorphous combinations/	
4	Textbook 1 Chapter 3	Molecular weight of polymers: solubility, average molecular weight values, osmometry, small-angle x-ray scattering, mass spectrometry, viscometry. Sem: Polymeric solids and their properties: polymer structure – property relationships, crystalline and amorphous combinations/	
5	Textbook 1 Chapter 4	Electric properties: theory, electric measurements, optical property tests, chemical resistance, spectronic characterization of polymers, thermal analysis,thermal property tests, flammability	
6	Textbook 1 Chapter 4	Surface characterization,amorphous region determinations,particle size, measurement of adhesion Sem: Electric properties: theory, electric measurements, optical property tests, chemical resistance, spectronic characterization of polymers, thermal analysis,thermal property tests, flammability	
7			Midterm

8	Textbook 1 Chapter 5	Rheology and physical tests Rheology, typical stress–strain behavior, stress–strain relationships, specific physical tests Sem : Electric properties: theory, electric measurements, optical property tests, chemical resistance, spectronic characterization of polymers, thermal analysis,thermal property tests, flammability	
9	Textbook 1 Chapter 5	Rheology and physical tests Rheology, typical stress–strain behavior, stress–strain relationships, specific physical tests	
10	Textbook 1 Chapter 10	Naturally occurring polymers Polysaccharides, cellulose, cellulose-regenerating processes, esters and ethers of cellulose, starch, other polysaccharides Sem : Naturally occurring polymers Polysaccharides, cellulose, cellulose-regenerating processes, esters and ethers of cellulose, starch, other polysaccharides	
11	Textbook 1 Chapter 10	Naturally occurring polymers Proteins, nucleic acids,naturally occurring polyisoprenes,polymer structure, genetic engineering, DNA profiling	
12	Textbook 1 Chapter 11	Inorganic-organic polymers, inorganic reaction mechanisms, condensation organometallic polymers, coordination polymers, addition polymers, sol-gel Sem : Naturally occurring polymers Proteins, nucleic acids,naturally occurring polyisoprenes,polymer structure, genetic engineering, DNA profiling	
13	Textbook 1 Chapter 12	Inorganic polymers, silicates, silicon dioxide (amorphous), silicon dioxide (crystalline forms)—quartz forms,silicon dioxide in electronic chips, polymeric carbon—diamond,polymeric carbon—graphite,ceramics	

14	Textbook 1 Chapter 13	Fillers and reinforcements for polymers, theory of the effect of fillers, fillers, reinforcements, coupling agents, composites, nanocomposites Sem : Inorganic polymers, silicates, silicon dioxide (amorphous), silicon dioxide (crystalline forms)—quartz forms,silicon dioxide in electronic chips, polymeric carbon—diamond,polymeric carbon—graphite,ceramics	
15	Textbook 1 Chapter 14	Plasticizers, stabilizers, flame retardants, and other additives, plasticizers, antioxidants, heat stabilizers, ultraviolet stabilizers, flame retardants, flame-retardant mechanisms, colorants, curing agents, antistatic agents (antistats), chemical blowing agents, compatibilizers	
16			Final

Recommended Sources

TEXTBOOK(S)

1. Charles E. Carraher, Jr. Sixth Edition, Polymer Chemistry p.902
2. N.G. McCrum, C.P. Buckley, C.B. Bucknall - *Principles of Polymer Engineering*, Oxford Science Publications, second edition, 1997
3. Structure and Properties of Polymers by Pingsheng He, Alpha Science Intl Ltd (September 30, 2013)

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 İndustry University

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	24	24
Self-study	14	1	14
Tutorials	14	2	28
Midterm Examination	1	3	3
Preparation for midterm exam	1	12	12
Final Examination	1	3	3
Preparation for final exam	1	24	24
Total Workload			**150/30**
Total Workload/30(h)			**5**
ECTS Credit of the Course			**5**

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

Course Unit Title	Introduction to nanomaterials
Course Unit Code	CHEM 5007
Type of Course Unit	Elective
Level of Course Unit	year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	1

Laboratory (hour/week)	0
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	-
Recommended Optional Program Components	-

Course description:

Introduction to nanomaterials. Methods of synthesis of nanomaterials. Nanomaterials characterization. Properties and applications of nanomaterials. Nanosheets. Nanofibers. Metal nanoparticles. Ceramic nanoparticles. Polymer nanoparticles. Carbon nanostructures

Objectives of the Course:

Students will acquire knowledge on classification and general knowledge on different types of nanomaterials, general up to date methods of fabrication of nanomaterials, the most important physical methods applied for characterization of nanomaterials, properties of nanomaterials which makes them stand out of macromaterials of the same composition caused by nanodimensions, metal, ceramic and polymer nanostructure, nanocomposites. They will acquire skills to solve the problems connected with production and application of nanomaterials in industry.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Apply concepts of physical and colloidal chemistry to solve the most important problems which arise during nanomaterial research	1,,3
2	Clearly understand the organization of nanomaterials research. Be able to apply this knowledge in order to conduct research	3
3	Know and distinguish fields of industry where different types of nanomaterials are and can be applied and know the trends of cutting edge nanomaterial research.	1,3
4	Knowing main physical methods used for characterization of nanomaterials. Clearly understand their main physical principles. Be able to choose appropriate physical method of characterization for certain type of nanomaterial.	1,3,
5	Being able to find information necessary for conducting any field of nanomaterial research	2

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	3

2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	2
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	1
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	3
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	2
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	2

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

Course Contents

Week	Chapters [books]	Topics	Exam
1	[2] 1,2	Introduction to nanomaterials. History of nanomaterials science and appication.Classification.	
2	1,2,3 [1] 1,2,3[3]	Science behind nanomaterials:Colloidal foundations of nanomaterials	
3	1,2,3 [1] 1,2,3[3]	Science behind nanomaterials:Colloidal foundations of nanomaterials	
4	5,6,7 [1] 4[2]	Fabrication of Nanomaterials	
5	5,6,7 [1] 4 [2]	Fabrication of nanomaterials	
6	4[1],12[2]	Nanomaterials charachterization	
7	4[1],12[2]	Nanomaterials charachterization	
8			Midterm
9		Properties and applications of nanomaterials	

10	7,8,9,10,11[2]	Properties and applications of nanomaterials	
11	7,8,9,10,11[2]	Metal nanostructures: synthesis, structure and application	
12	7,8,9,10,11[2]	Ceramic nanostructures: synthesis, structure and application	
13	7,8,9,10,11[2]	Polymer nanostructures: synthesis, structure and application	
14	7,8,9,10,11[2]	Carbon nanostructures, Nanotubes, Nanosheets	
15	2(2)	Nanocomposites	
16			Final exam

Recommended Sources

TEXTBOOK(S)

1. Zhen Guo, Li Tan, Fundamentals and Applicationsof Nanomaterials, ARTECH HOUSE, 2009.

2. Dieter Vollath, Nanomaterials: An Introduction to Synthesis, Properties, and Applications-2nd edition/,Wiley-VCH Verlag GmbH & Co. KGaA,2013

3. Gerardo Palazzo, Colloidal foundations of nanoscience- Debora Berti, Elsevier, 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 Azerbaijan State Oil and Industrial University for Undergraduate Studies

Course Policies

- 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**	**3**	**42**
Presentation	1	10	10
Tutorials	14	1	14
Self-study	14	4	56
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			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

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

Course Unit Title	Environmental chemodynamics
Course Unit Code	CHEM 5009
Type of Course Unit	Elective
Level of Course Unit	year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	1

Laboratory (hour/week)	0
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	-
Recommended Optional Program Components	-

Course description:

This course will supply the student with an understanding of the processes that control the movement of organic and inorganic contaminants in the atmosphere, hydrosphere and lithosphere. With this understanding we will then consider the monitoring and prediction of the environmental behavior of some potentially toxic contaminants in biotic and abiotic matrices. The course material will provide the student with historical perspective and awareness of historical and current problems through examples. The key outcome will be an understanding of methods and models to predict the fate of chemicals released to the environment. The course will be of interest to students interested in environmental sciences, specifically to toxicology students, so that they can conduct exposure predictions and assessments as part of the overall risk assessment process. The course is designed to compliment existing courses in environmental risk assessment and toxicology.

Objectives of the Course:

I. Present the fundamental mechanisms of physical, chemical, and biological interactions underlying environmental processes.
II. Present the fundamental principles applied in the analysis, design, modeling, and operation of engineered and natural solutions for environmental engineering.
III. Expose students to the complex interaction between environmental problems and the needs of society..

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Describe environmental chemodynamics and transport.	1,2,3
2	Describe abiotic transformations of chemicals.	1,2, 3
3	Identify the characteristics of quantitative toxicology.	1,2,3
4	Describe the origin and occurrence of smog and acid rain.	1,2,3
5	Explain earth's energy balance and the greenhouse effect.	1,2
6	Identify major greenhouse gases.	1,2
7	Explain the food chain and bioaccumulation of substances.	1,2
8	Describe the classes, exposure and risks of the major chemical carcinogens.	1,2

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

Course's Contribution to Program

		CL

1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	3
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	2
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	1
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	5
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	2
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	2

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

Course Contents

Week	Chapters (books')	Topics	Exam
1	1	Introduction, Overview, Error In Measurement Of Environmental Quantities, Chemical Concentrations, Activities, Mass Balance, Sources, Sinks, System Characterization	
2	2	Basic Environmental Chemical Principles	
3	3	The Fugacity Approach to Mass Transport and MTCs	
4	4	Flux Equations for Mass Transport Processes across Interfaces	
5	5	Estimating Molecular Diffusivities in Environmental Media	
6	6	Deposition from the Atmosphere toWater and Soils with Aerosol Particles and Precipitation	
7	7	Mass Transfer between the Atmosphere and Plant Canopy Systems	
8			Midterm
9	8	Mass Transfer within Surface Soils.	

10	10	Deposition and Resuspension of Particles and the Associated. Chemical Transport across the Sediment–Water Interface	
11	12	Diffusive Chemical Transport acrossWater and Sediment Boundary Layers	
12	13	Bioturbation and Other Sorbed-Phase Transport Processes in Surface Soils and Sediments	
13	15	Dispersion and Mass Transfer in Groundwater Near-Surface Geologic Formations	
14	16	Dust Resuspension and Chemical Mass Transport from Soil to Atmosphere	
15	19	Chemical Dynamics in Urban Areas	
16			Final exam

Recommended Sources

TEXTBOOK(S)

1. Louis J. Thibodeaux, Environmental Chemodynamics: Movement of Chemicals in Air, Water, and Soil, 2nd Edition, CRC Press, 1996, 624 Pages

2. Louis J. Thibodeaux, Donald Mackay. Handbook of chemical mass transport in the environment, CRC Press, 2011, 596 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 State Oil and Industrial University for Undergraduate Studies

Course Policies

- 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**	**3**	**42**
Presentation	1	9	9
Tutorials	14	1	14
Self-study	14	4	56

Midterm Examination	1	3	3
Preparation for midterm exam	1	8	8
Final Examination	1	3	3
Preparation for final exam	1	17	17
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

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

Course Unit Title	Chemical Technologies-1
Course Unit Code	CHEM 5009
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	-
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2

Practice (hour/week)	1
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Tahmina C. Taghiyeva
Name of Lecturer (s)	Tahmina C. Taghiyeva
Name of Assistant (s)	-
Mode of Delivery	Lectures, Face to Face, Seminar.
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

The subject "Chemical technologies-1" includes general, physico-chemical and technological fundamentals of production processes, technologies and properties of the main types of materials and products of the silicate industry, metal, technical gases and salts production.

Objectives of the Course:

The purpose of studying the subject "Chemical technologies-1" is to teach students in the field of production processes, technology and properties of the main types of materials and products of the silicate industry; the format of students practical and research skills of the properties of raw materials and finished products and to train specialists to manage these industries

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	have an extended knowledge on individual technologies in silicate and other inorganic materials industry	1, 3
2	keep abreast with the scientific literature, new technologies and new developments	2, 3
3	maintain and control industrial or chemical processes and assist with their design using chemical engineering principles	2, 3
4	understand physico-chemical fundamentals of production processes of the silicate industry and other inorganic materials such as salts, metal and technical gases	1, 2
5	research the properties of raw materials	1, 2, 3

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	4
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	2

3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	2
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	5
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	4
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	3

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

Course Contents

Week	Chapter	Topics	Exam
1	[2], chapter 3, p. 195-196 [2], chapter1, p. 657-662	Production of technical oxygen and nitrogen. Raw material. Technology of the process and technological parameters. Importance of oxygen and nitrogen, their application as raw materials for chemical productions.	
2	[1] , chapter 5, p. 129-139 [2] , chapter 2, p. 596-597	Manufacturing of synthesis gas, water gas by stream conversion of methane; production of carbon dioxide. ***Seminar 1:*** *Technical gases (synthesis gas, water gas). Nitrogen, oxygen, their production, chemical properties and application.*	
3	[1] , chapter 6, p. 175-178 [2] , chapter 3, p. 196-202	Manufacturing of hydrogen and synthesis of ammonia, its application. Raw material. Technology of the process and technological parameters. Application of ammonia, its perspectives for the future.	
4	[1] , chapter 6, p. 185-190 [2] , chapter 3, p. 45-46	Production of urea. Raw materials, process technology, technological parameters. Application of urea.	

		Seminar 2: *Fields of application of urea; raw materials for manufacturing of ammonia. Fertilizers.*	
5	[5], p. 50-54	Manufacturing of elementary Ca and Si. Raw material. Technology of the pr and technological parameters. Calcium silicide.	
6	[2], chapter 9, p. 755-757	NaCl production from rock salt and lake deposited salt. Raw material. Technology of the process and technological parameters. ***Seminar 3:*** *Miscellaneous calcium compounds. Salts, sources of NaCl.*	
7			Midterm exam
8	[2],, chapter 5, p. 80-86	Production of bromine and iodine. Raw material. Technology of the process and technological parameters. ***Seminar 4:*** *Chemical properties of Si, Br, I; their production and fields of application.*	
9	[2], chapter 5, p. 89-90	Aluminum manufacturing. Raw material. Technology of the process and technological parameters. Duralumin.	
10	[3], chapter 18, p. 299-324	Gold and silver production. Raw material. Technology of the process and technological parameters. ***Seminar 5:*** *Sources of precious metals. Metallurgy. Production of alumo-silicate catalyst.*	
11	[4], chapter 7, p. 295-297	Manufacturing of cast iron and ferrosilicium alloys. Raw material. Types of cast iron. Characteristics of the iron-casting process. Blast furnace. The difference between cast iron and steel. Cast iron and the future.	
12	[2], chapter 7, p.712-727 [5], p. 1-7, 331-334	Cement. Concrete manufacturing. Raw material. Technology of the process and technological parameters. ***Seminar 6:*** *Ferrous metals, their manufacturing and application. Blast furnace. Cement and concrete manufacturing. Colored cements.*	
13	[2],, chapter 7, p. 727-728; [5], p. 191-193	Production of gypsum binders. Raw material. Technology of the process and technological parameters.	
14	[2], chapter 8, p. 735-753 [5], p. 193-195	Glass manufacturing. Composition of glass. Different kinds of glass. Raw material. Technology of the process and technological parameters. ***Seminar 7:*** *Methods of glass manufacture. Gypsum binders, gypsum plasters.*	
15	[2],, chapter 6, p. 691-711	Ceramics production. Raw material. Technology of the process and technological parameters.	

16			Final exam

Recommended Sources

TEXTBOOK(S)

1. Jacob A. Moulıjn Mıchıel Makkee Annelıes E, Chemical Process Technology. Second Edition.. Van Diepen, 2013
2. Georgo T.Austin, Chemical Technology III. Fifth edition. Elsevier,1969
3. Rose T.K.,The precious metals comprising gold, silver and platinum,
4. Coulson and Richardson's, Chemical engineering design. Fourth edition, Butterworth-Heinemann, 1999
5. Ivan Odler, Special inorganic cements. Modern concrete technology. CRC Press,1656

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**	**3**	**42**
Presentation	1	10	10
Self-study	14	4	56
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			**150**

Total Workload/30(h)	**150/30**
ECTS Credit of the Course	**5**

Chemical engineering (CHEN) program, "Petrochemical technology and industrial ecology" department

Course Unit Title	**Chemical technologies-2**
Course Unit Code	CHEM 5010
Type of Course Unit	Elective
Level of Course Unit	
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	1

Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
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:

Information about the refining of oil and gas products, the stabilization methods, the study of their physicochemical properties, the heat, optical, electrical, physicochemical and other properties, the processing of oil in atmospheric and atmospheric-vacuum installations, used raw materials and the quality characteristics of used raw materials and ready products, the characteristics and application of petroleum, kerosene, diesel fuel and mineral oil fractions obtained from different processing installations, thermal, thermocatalytic processes- pyrolysis, catalytic reforming, catalytic cracking, hydrocracking and alkylation processes. 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 petroleum refining to review how a variety of physical processes and chemical reactions in separate refinery units are integrated to process compliant fuels and materials.

Objectives of the Course:

This course will present an overview of the modern, integrated petroleum refinery, its feedstocks, product and the processes employed to convert crude oil and intermediate streams into finished products. Hydrocarbon chemistry, crude oil properties and fuel product quality will be discussed. Each refining process will be presented, covering operating description and conditions, feedstock and catalyst selection, product yields, and the relationship between process parameters, unit performance and product output and properties. This course provides major insights into both primary and secondary processes like Atmospheric Distillation, Vacuum Distillation, Catalytic Cracking, Hydrocracking, Catalytic Reforming, Coking, Visbreaking in a typical refinery The impact of each process on environmental regulations and pollution control is also discussed.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	explain the origin of crude oil, its recovery, processing, transportation, physicochemical properties and classification of crude oil.	1,2
2	use the formulas to determine the main parameters of oil and oil products**.**	1,2
3	identify key characteristics and variables of crude oil and other gas and liquid feed streams for refineries.	1,2,3
4	explain refinery operations.	1,2,3
5	understand catalytic cracking, catalytic reforming, coking and alkylation principles	1,2
6	understand pollution control requirements.	1,2
7	use petroleum refining terminology.	1,2,3

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	4

2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	3
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issuesin chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	3
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	4
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	4

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	**Introduction.** Introduction to petroleum refinery. Characterization of crude oil. Composition of crude oil. Hydrocarbon Groups. Complex Hydrocarbons. Non-Hydrocarbons or Hetero-Atomic Compounds. Physical properties. Origin of hydrocarbons. Crude conditioning and storage.	
2	[1]. Chap.2	**Petroleum products and test methods.** Crude oil analyses. Domestic fuels. Liquified petroleum gas. Kerosene. Automotive fuels. Octane number. Diesel fuels. Cetane number. **Seminar 1.** Introduction to petroleum refinery. Petroleum products and test methods.	
3	[1]. Chap.2	**Petroleum products and test methods.** Additives. Aviation fuels. Furnace fuels. Lubricating oils. Carbon black feed stock. Bitumen. Petroleum coke.	
4	[1]. Chap.3	**Processing operation in petroleum refinery.** Crude oil receiving. Desalting of crude oil. Distillation and stripping. Atmospheric distillation. Atmospheric distillation unit. **Seminar 2.** Processing operation in petroleum refinery. Atmospheric distillation. Atmospheric distillation unit.	
5	[1]. Chap.3	**Processing operation in petroleum refinery.** Vacuum distillation. Vacuum distillation unit. Solvent extraction. A furfural extraction unit	
6	[2].	**Processes in oil refinery**	

	Chap.3	Propane deasphalting process**.** Propane deasphalting unit. **Seminar 3.** Vacuum distillation. Vacuum distillation unit. Solvent extraction. A furfural extraction unit.	
7	[2]. Chap.3	**Processes in oil refinery** Thermal processes. Visbreaking. Schematic of the visbreaking process.	
8			Midterm
9	[2]. Chap.3	**Processes in oil refinery** Delayed Coking. Schematic of the delayed coking process. Flexicoking. Schematic of the Flexicoking process. **Seminar 4.** Processes in oil refinery. Thermal processes.	
10	[2]. Chap.3	**Processes in oil refinery** Catalytic Processes. Octane and Cetane Numbers. Catalytic Cracking. Cracking Mechanism. Catalysts for Catalytic Cracking. Product Distribution. Scheme of the catalytic cracking unit.	
11	[2]. Chap.3	**Processes in oil refinery** Catalytic Reforming. Reactions and Thermodynamics. Feed Pretreatment. Reforming Processes. Scheme of the reforming process. Reactors. **Seminar 5.** Processes in oil refinery. Catalytic Cracking process.	
12	[2]. Chap.3	**Processes in oil refinery** Alkilation. Reactions. Processes Using Liquid Acids as Catalyst. Schematic of alkylation with sulfuric acid.	
13	[2]. Chap.3	**Processes in oil refinery** Hydroprocessing. Hydrotreating. Reactions and Thermodynamics. Processes. Trickle bed reactor. Simplified flow scheme of hydrotreating involving a trickle bed reactor. Environment. Hydrocracking. Reactions and Thermodynamics. Reactor. Hydrocracking process. **Seminar 6.** Processes in oil refinery.Hydroprocessing. Hydrotreating.	
14	[2]. Chap.4	**Production of Light Alkenes.** Cracking Reactions. Thermodynamics. Mechanism. Kinetics. The Industrial Process. Influence of Feedstock on Steam Cracker Operation and Products. Simplified flow scheme of a steam cracker for naphtha cracking. Cracking Furnace. Coke formation.	
15	[2]. Chap.6	**Methanol** Background Information. Reactions, Thermodynamics and Catalysts. Synthesis Gas for Methanol Production. Methanol Synthesis. Synthetic Fuels and Fuel Additives. Fischer–Tropsch Process. **Seminar 7.** Production of Light Alkenes.	
16			Final

Recommended Sources

TEXTBOOK

1. Uttam Ray Chaudri *Fundamentals of petroleum and petrochemical engineering*., 2011
2. Jacob A. Moulijn,Michiel Makkee, Annelies E. Van Diepen *Chemical process technology,* Second Edition, 2013

REFERENCES

George T.Austin Shreves *Chemical Process Industries*, Fifth edition

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**
Presentation	1	10	10
Self-study	14	4	56
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			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

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

Course Unit Title	Chemical Technologies-3
Course Unit Code	CHEM 5011
Type of Course Unit	Elective
Level of CourseUnit	-
National Credits	0
Number of ECTS Credits Allocated	5

Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	0
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, Seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Programme Components	-

Course description:

Plastics are very broad category of materials. They include most elastomers (such as rubber), adhesives (such as epoxies and acrylics), fibers (such as Nylon and Polyesters), and traditional engineering plastics. Plastics is more common name for Polymers. Polymers have been under development since the eighteenth century. In the last few decades, polymers have been replacing other materials in an increasing number of products. It is therefore important for modern materials engineers to understand the fundamental concepts of engineering polymers and be able to select, modify, and develop the proper polymer for a certain performance.

Objectives of the Course:

the main goal

- familiarize students with the technological processes carried out at factories in Azerbaijan.
- present polymers as an engineering material and emphasize the basic concepts of their nature, production and properties. Polymers are introduced at three levels; namely, the molecular level, micro level and macro level. Thanks to the knowledge of all three levels, the student can understand and predict the properties of various polymers and their effectiveness in various products. The course also aims to familiarize students with the principles of polymer processing technology and design considerations using engineering polymers in Azerbaijan.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Polymers from the Molecular viewpoint including basic concepts in organic chemistry, polymerization processes, thermoplastics and thermosets, and copolymers.	1,3
2	Know the structure of polymeric substances	1,2,3
3	List the types of polymerization reactions	1,2,3

4	Know the structure and physical properties of polymers	1,3
5	Be able to synthesize polymers	1,3
Assessment Methods: 1. Final Exam, 2. Presentation, 3.Midterm,		
Course's Contribution to Program		
		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	4
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	3
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	3

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)			
Course Contents			
Week	Chapter	Topics	Exam
1	[1], p.357	Production of Polymers: Introduction	
2	[1], p.357-360	Polymerization Reactions, Step growth Polymerization. Chain growth Polymerization, Radical and Coordination Pathways. Coordination Pathways **Sem:** Production of Polymers. Polymerization Reactions, Step growth Polymerization	
3	[1], p.363-366	Polyethenes – background information. Catalyst development. Classification and properties. Applications	
4	[1], p.366-375	Monomer Production and Purification. Polymerization – Exothermicity .Production of Polyethenes **Sem:** Polyethenes – background information. Production of Polyethenes.	
5	[2], p.1-11	Industrial production of polypropylen. Manufacturing process of polypropylen Molecular structure – tacticity . Crystal structure of polypropylene. Isotactic polypropylene (ipp). Syndiotactic polypropylene (spp). Atactic polypropylene (app). Degradation optical properties	
6	[2], p.1-11	Industrial production of polypropylen. Manufacturing process of polypropylen Production. Catalysts. Industrial processes. Manufacturing from polypropylene.biaxially oriented polypropylene (bopp). Applications **Sem:** Industrial production of polypropylen. Manufacturing process of polypropylene.	
7			Midterm
8	[3], Chapter 4 p. 70-85	Plastic industries. Raw materials in plastic industry **Sem:** Plastic industries. Raw materials in plastic industry	

9	[3], Chapter 4 p.85-94	Plastic industries, manufacture processes. Condensation polymerization products	
10	[3], Chapter 4 p.94-98	Plastic industries. Manufacture processes. Addition polymerization **Sem:** Plastic industries, manufacture processes	
11	[3], Chapter 4 p.98-101	Alloying and blending, Natural products cellulosa derivatives. Laminates and foams.	
12	[3], Chapter 5 p.103-105	Rubber industries natural rubber **Sem:** Alloying and blending, Natural products cellulosa derivatives.	
13	[3], Chapter 4 p.105-120	Rubber industries. Synthetic rubber	
14	[3], Chapter 5 p.105-122	Rubber industries. Synthetic rubber. Rubber compounding **Sem:** Rubber industries. Synthetic rubber	
15	[3], Chapter 5 p.122-126	Rubber industries . Rubber derivatives. Rubber fabrication	
16			Final

Recommended Sources

TEXTBOOK(S)

1. Jacob A. Moulijn , Michiel Makkee , Annelies E. van Diepen. Chemical Process Technology 2nd Edition, Kindle Edition, 2003

2. Hideki Sato, Hiroyuki Ogawa, Review on Development of Polypropylene Manufacturing Process Sumitomo Chemical Co., Ltd.. Process & Production Technology Center,.2005

3. George T. Austin. Shreve's Chemical Process Industries, Production Technology Center, 2010

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 İndustry University

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)	TotalWorkload(hour)
Course duration in class	**14**	**3**	**42**
Preparation for Presentation	1	10	10
Self-study	14	4	56
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	18	18
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

Chemical engineering (CHEN) program, Department of "Petrochemical technology and industrial ecology".

Course Unit Title	Process operations in chemical and biochemical engineering
Course Unit Code	ENG 3201
Type of Course Unit	Compulsory
Level of Course Unit	3rd year CHEN program
National Credits	0
Number of ECTS Credits Allocated	4
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	-

Year of Study	3
Semester when the course unit is delivered	6
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	CHEM 3101 Chemical Engineering Thermodynamics-2
Recommended Optional Program Components	-

Course description:
Information about the basic principles of process operations in chemical and biochemical engineering, unit operations-fluid flow processes, heat transfer processes, adsorption, crystallization, evaporation, distillation and etc., introduction to biochemical and microbiological applications to chemical, commercial and engineering processes.

Objectives of the Course:
In chemical engineering and related fields, a process operation is a basic step in a process. Unit operations involve a physical change or chemical transformation such as fluid flow processes, heat transfer processes, adsorption, separation, crystallization, evaporation, distillation, filtration, extraction and other reactions. The objective of the course, as implied by the course content above is to introduce fundamental biochemical and chemical engineering concepts primarily to chemical engineers. The course does not assume any biological background or any prior courses in biology or microbiology, although it certainly helps to have some. To accommodate those who do not have the biological background, the course will first survey the basic ideas from microbiology, biochemistry..

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	fully understand key concepts of process operations in chemical and biochemical engineering	1,2
2	apply theory to practical experimental problems.	1,2,3
3	explain the basic principles of various process operations in chemical and biochemical engineering	1,2
4	identify, formulate, and solve complex chemical and biochemical engineering problems	1,2,3
5	compare and evaluate different processes in chemical and biochemical engineering	1,2
6	explain the most common unit operations and give examples of industrial processes in which each of the operations occur	1,2,3
7	develop some skills about biochemical and chemical processes	1,2,3

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	4
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	3
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4

4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issuesin chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	2
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	4
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	4

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

Course Contents

Week	Chapter	Topics	Exam
1	[1] Chap. 1	**Introduction.** Biochemical Engineering. Bioprocess.	
2	[1] Chap. 2	**Enzyme kinetics** Introduction. Nomenclature of enzymes. Commercial Applications of Enzymes. Simple enzyme kinetics. Other influences on enzyme activity. **Seminar 1**. Bioprocess. Enzyme kinetics	
3	[1] Chap. 2 [2] Chap.4	**Enzyme kinetics. Bioprocess/fermentation technology.** Fermentation. Bioreactors.	
4	[1] Chap.4	**Industrial application of enzymes** Introduction. Organic chemistry of carbohydrates. **Seminar 2.** Industrial application of enzymes	
5	[1] Chap.10	**Downstream Processing** Introduction. Major process steps in downstream processing.	
6	[3] Chap.8 [4] Chap.5	**Fluid flow processes.Transportation of fluids.** **Piping and instrumentation.** Introduction.Valve selection. Pumps. Pumps selection. Selection of fans, compressors and jet ejectors. **Seminar 3**. Downstream Processing.	
7	[3] Chap.15	**Heat exchange equipments.** Design and selection of heat exchangers. Condensers. Reboilers.	
8			Midterm
9	[4] Chap.10	**Equipment selection, specification and design.** **Solid-solid separations**. Liquid-solid cyclones. Flotation separators. Magnetic separators. **Liquid-solid (solid-liquid) separators**. Filtration. Filters. Centrifuges. Sedimentation centrifuges and filtration centrifuges. **Seminar 4.** Solid-solid separations. Liquid-solid (solid-liquid) separators.	

10	[4] Chap.10 [3] Chap.16	**Equipment selection, specification and design.** **Separation of dissolved solids**. Evaporation. Evaporators. Crystallisation. Crystallisers. **Liquid-liquid separations.** Decanters (Settlers).	
11	[4] Chap.10	**Equipment selection, specification and design.** **Separation of dissolved liquids.** Solvent extraction and leaching. Solvent extraction (liquid-liquid extraction). Leaching. **Gas-solids separations (gas cleaning) Gas-cleaning equipment** **Gas-liquid separators.** Vertical separators and horizontal separators. **Seminar 5.** Evaporation. Evaporators. Liquid-liquid separations. Decanters (Settlers).	
12	[4] Chap.10	**Equipment selection, specification and design.** **Mixing equipment.** Gas mixing. Liquid mixing. Inline mixing. Stirred tanks. **Reactors.** Principal types of reactor.	
13	[3] Chap.18	**Distillation.** Flash distillation. Continuous distillation with reflux (rectification). Batch distillation. **Seminar 6.** Mixing equipment.	
14	[4] Chap.11	**Separation columns** Continuous distillation: Process description. Reflux considerations. Continuous distillation: Basic principles .Other distillation systems.	
15	[3] Chap.25	**Adsorption.** Adsorption. Adsorbent and adsorption processes. Adsorption equipment. **Seminar 7.** Adsorption. Adsorbent and adsorption processes. Adsorption equipment.	
16			Final

Recommended Sources
TEXTBOOK

1. R.Dutta Fundamentals of biochemical engineering, Springer Verlag,2008

2. John E. Smith Biotechnology book,Fifth Edition, Cambridge University Press ,2009

3. Warren L.McCabe, Julian C.Smith, Peter Harriott Unit operations of chemical engineering, Fifth Edition, McGraw-Hill Education, 1993

4. Coulson & Richardson's Chemical engineering, Volume 6, Fourth edution, Chemical Engineering Design . SINNOTT, 2005

REFERENCES

- Ernest E. Ludwig, Applied Process Design for Chemical and Petrochemical Plants, Vol.-I Gulf Publishing Company, Houston, 1999
- Philip C. Wankat *Separation Process Engineering*, Third Edition, prentice Hall,2011
- Seader, J.D.; Henley, E.J. *Separation Process Principles*. Second Edition, John Wiley & Sons, New Jersey, 2006.

Assessment

Attendance	0%	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	-	
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	7	7
Self study	14	3,5	49
Tutorials	14	0.5	7
Midterm Examination	1	3	3
Preparation for midterm exam	1	7	7
Final Examination	1	3	3
Preparation for final exam	1	7	7
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	**Chemical process flowsheeting**
Course Unit Code	CHEM 5002
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	-
Year of Study	-

Semester when the course unit is delivered	-
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:

The flowsheet is the key document in process design. It shows the arrangement of the equipment selected to carry out the process; the stream connections; stream flow-rates and compositions; and the operating conditions. It is a diagrammatic model of the process. Process flowsheeting concerns the use of computers to stimulate and design chemical plant of all types, such as petroleum refineries, petrochemical complexes or even food factories. This course introduction to the flowsheeting in process plant design and look at the various technic question which computer-aided systems may be based. For each one of these approaches the advantages and disadvantages are clearly stated and important methods are described in detail.

Objectives of the Course:

In chemical engineering, design usually refers to design of equipment or design of all or the major part of a chemical processing plant considering safety and economic aspects. The major objective is to understand how to invent chemical and refining process flowsheets, how to generate and develop process alternatives, and how to evaluate and screen them quickly. To simulate the steady state behaviour of process flowsheets using a suitable simulation software.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	understand and apply knowledge of this course.	1,2
3	understand the input/output structure of a flowsheet for a given manufacturing unit.	1,2
4	identify, formulate, and solve complex engineering problems	1,2,3
5	simulate the steady state behavior of process flowsheets at each level of process development.	1,2,3
6	synthesize and design flowsheet sub-systems, to develop the recycle structure	1,2,3

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	4
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	3
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	4

4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issuesin chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	2
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	4
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	4

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

Course Contents

Week	Chapter	Topics	Exam
1	[1] Chap.	**Introduction.** The importance of chemical engineering plant design. Process design development. Cost estimation. Optimum design. Practical considerations in design.	
2	[2] Chap.1 [3] Chap. 4	**Process Planning, Scheduling and Flowsheet Design** Introduction to Flow-sheeting**.** Organizational Structure. Process Design Scope. Role of the process design engineer. Flow-sheet presentations. **Seminar 1.** Organizational Structure. Process Design Scope. Role of the process design engineer. Flowsheets-Types.	
3	[2] Chap. I	**Process Planning, Scheduling and Flowsheet Design** Flowsheets-Types. Chemical/Process engineering drawings. Block flow diagram (BFD), Piping and Instrumentation diagrams (P&ID), Process flow diagrams (PFD)	
4	[2] Chap. I	**Process Planning, Scheduling and Flowsheet Design** Flowsheets-Types.Chemical/Process engineering drawings. Block flow diagram (BFD), Piping and Instrumentation diagrams (P&ID), Process flow diagrams (PFD). **Seminar 2.** Flowsheets-Types. Chemical/Process engineering drawings. Block flow diagram (BFD), Piping and Instrumentation diagrams (P&ID), Process flow diagrams (PFD)	
5	[2] Chap. I	**Process Planning, Scheduling and Flowsheet Design** Flowsheets-Types.Chemical/Process engineering drawings. Block flow diagram (BFD), Piping and Instrumentation diagrams (P&ID), Process flow diagrams (PFD).	
6	[2] Chap. I [3] Chap. 4	**Process Planning, Scheduling and Flowsheet Design** Flowsheet Presentation. Flowsheet Presentation with simple examples. General arrangements guide. Computer-Aided Flowsheet Design/Drafting.	

		Seminar 3. Flowsheets-Types. Chemical/Process engineering drawings. Block flow diagram (BFD), Piping and Instrumentation diagrams (P&ID), Process flow diagrams (PFD).	
7	[2] Chap. I	**Process Planning, Scheduling and Flowsheet Design** Flowsheet symbols. (Process vessels, Pumps and solids, Storage equipment, Flow and instruments, Filters, evaporators and driers, Special types of descriptive flowsheet symbols, Commonly used instruments for process instrumentation flowsheets, Flow diagram symbols: valves, fittings and miscellaneous piping).	
8			midterm
9	[2] Chap. I	**Process Planning, Scheduling and Flowsheet Design** Flowsheet symbols. (Process vessels, Pumps and solids, Storage equipment, Flow and instruments, Filters, evaporators and driers, Special types of descriptive flowsheet symbols, Commonly used instruments for process instrumentation flowsheets, Flow diagram symbols: valves, fittings and miscellaneous piping). **Seminar 4.** Flowsheet symbols.	
10	[2] Chap. I	**Process Planning, Scheduling and Flowsheet Design** Flowsheet symbols. (Process vessels, Pumps and solids, Storage equipment, Flow and instruments, Filters, evaporators and driers, Special types of descriptive flowsheet symbols, Commonly used instruments for process instrumentation flowsheets, Flow diagram symbols: valves, fittings and miscellaneous piping).	
11	[2] Chap. I	**Process Planning, Scheduling and Flowsheet Design** Line Symbols and Designations. (Line Symbols). Materials of Construction for Lines. Test Pressure for Lines. **Seminar 5.** Flowsheet symbols	
12	[2] Chap. I	**Process Planning, Scheduling and Flowsheet Design** Working Schedules. Information Checklists. Standarts and codes. System Design Pressures. Time Planning and Scheduling. Activity Analysis.	
13	[3]	**Piping and instrumentation.** Characteristics of valves and simulation methods Control valves (globe, butterfly, needle valves), isolation valves (gate, plug, ball valves), NRV (non-return valves) or check valves **Seminar 6.**	
14	[3]	**Piping and instrumentation.** Characteristics of valves and simulation methods Control valves (globe, butterfly, needle valves), isolation valves (gate, plug, ball valves), NRV (non-return valves) or check valves	
15	[3]	**Piping and instrumentation.** Characteristics of valves and simulation methods Control valves (globe, butterfly, needle valves), isolation valves (gate, plug, ball valves), NRV (non-return valves) or check valves **Seminar 7.**	
16			Final

Recommended Sources
TEXTBOOK

1. Max. S. Peters and K.D.Timmerhaus, Plant Design and Economics for Chemical Engineers, McGraw Hill, Inc., New York, 1991.
2.Ernest E. Ludwig, Applied Process Design for Chemical and Petrochemical Plants, Vol.-I Gulf Publishing Company, Houston, 1999
3.Coulson & Richardson's Chemical engineering, Volume 6, Fourth edution, Chemical Engineering Design R. K. SINNOTT, 2005

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- Anil Kumar,Chemical Process Synthesis and Engineering Design, Tata McGraw Hillpublishing Company Limited, New Delhi -1981.
- A.N. Westerberg, et al., Process Flowsheeting, Cambridge University Press, 1979.
- Paul Benedek, Steady state flow sheeting of Chemical Plants, Elsevier Scientific Publishing company.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 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	10	10
Self-study	14	4	56
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			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

Chemical engineering (CHEN) program, "Petrochemical technology and industrial ecology" department

Course Unit Title	**Principles of enviromental monitoring**
Course Unit Code	CHEM 5007
Type of Course Unit	Elective
Level of Course Unit	___year CHEN program
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	-
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	Hamzayeva Nushaba
Name of Lecturer (s)	Hamzayeva Nushaba
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Components	-

Course description:

Environmental changes occur naturally and are a part of or the result of multiple cycles and interactions. Numerous natural cycles of the earth's environment have been studied within the framework of three major scientific disciplines: chemistry, physics, and biology. Environmental scientists study the dynamics of cycles, such as the nitrogen and water cycles, and their relationships to soil- geologic materials, surface waters, the atmosphere, and living organisms. The untrained observer may see the atmosphere as being separated from the earth's surface. However, to the trained observer the environment is composed of integrated and interconnected cycles and domains. Environment is a continuum of physical, chemical, and biological processes that cannot be easily separated from one another.

Objectives of the Course:

- The goals of this subject are to master the basic principles environmental monitoring from all aspects, including sampling methods, environmental characterization, and associated applications. In a first part, cover basic information central to environmental monitoring, including objectives and definitions, statistics and geo- statistics, field surveys and mapping, and automated data acquisition.. In a second part, techniques of sample collection with emphasis on field methodology used in soil, vadose zone, water, and air sampling, including remote sensing

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	1,3
2	Ability to execute, coordinate, implement and substantiate laboratory processes while carrying out the experiments,	1,3
3	Ability to obtain and extract chemical compounds using standard methods and syntheses.	1,2,3

4	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling and design of chemical engineering systems.	1,3
5	Ability to analyze and interpret data using statistical methods.	1,3
6	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering.	1,3
7	Abilityto carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	1,3
8	Ability to choose and use existing technologies, materials in chemical engineering while undertaking project tasks and solving these issues.	1,2,3
9	must be able to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	3
10	must be able to design systems, components, nodes, and processes that meet the requirements, taking into account natural limitations such as economics, ecology, and social aspects.	1,2,3
11	must be able to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1,2,3
12	must be able to analyze the problem, to identify and identify the basic requirements, justify the idea and critically evaluate the results and compare them.	2,3
13	must be able to use computer technology to gain knowledge from digital information sources.•	2,3
14	must be able to understand professional, ethical, legal and security issues, as well as the responsibilities in engineering.	2,3
15	must be able to work productively in multidisciplinary groups, especially in projects requiring engineering habits.	1,2,3

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

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	4
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	3
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods..	4
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate	4

	malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	4
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	3
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	3

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

Course Contents

Week	Chapter	Topics	Exam
1	[1] CHAP.II	Natural and anthropogenic pollution sources Seminar I: - Natural and anthropogenic pollution sources	
2	[2] Chap.III	ATMOSPHERE AS SUBJECT OF THE ANALYSIS.	
3	[3] Chap.III	Air sampling technique Seminar II : - Air sampling technique	
4	[3] CHAP.VI	Sampling of air using a liquid absorbers	
5	[2] CHAP.V	Sampling of air using a liquid absorbers Seminar III : - Sampling of air using a liquid absorbers	
6	[1] Chap.VII	Individually active and individually passive dosimetry.	
7	[3] Chap.IV	Desorption, concoction and identification of air tests from adsorbents. Seminar IV : - Desorption, concoction and identification of air tests from adsorbents.	
8			Midterm
9	[2] Chap.VII	Water pollution sources. Quality indicators of water.	
10	[2] Chap. VI	Alkalinity and acidity of water Seminar V - Alkalinity and acidity of water	
11	[1] Chap.VIII	Definition of the oxygen dissolved in water and unstable organic matter	

12	[1] Chap.IV	Biological and chemical oxygen demand (BOD and ChOD) in sewage Seminar VI - Biological and chemical oxygen demand (BOD and ChOD) in sewage	
13	[1] Chap.VI	.Structure and soil composition	
14	[3] Chap.V	Purpose and main objectives of monitoring Seminar VII - Purpose and main objectives of monitoring	
15	[2] Chap.IX	Assessment of anthropogenic impacts on the biosphere and forecasting of future ecological state	
16			Final

Recommended Sources
TEXTBOOK(S)

1. Janick Artiola, Ian L. Pepper, Mark L. Brusseau, Environmental Monitoring and Characterization, press, 2004
2.N.M. Avouris, B. Page. Environmental Informatics – Methodology and Applications of Environmental Information Processing, Kluwer Academic, Dordrecht, 1995.
3. D.A. Bruns and G.B. Wiersma,Conceptual Basis of Environmental Monitoring Systems: A Geospatial, Perspective, 2000

Assessment

Attendance	-	At least 75% class attendance is compulsory
Presentation	20%	
Quiz	10%	
Seminars	-	
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	7	7
Self-study	14	4	56
Tutorials	14	1	14
Midterm Examination	1	3	3
Preparation for midterm exam	1	9	9
Final Examination	1	3	3
Preparation for final exam	1	20	20
Total Workload			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**

Chemical engineering (CHEN) program, "Machine-building and materials science" department

Course Unit Title	**Principles of engineering materials**
Course Unit Code	ENG 5003
Type of Course Unit	Elective
Level of Course Unit	-
National Credits	0
Number of ECTS Credits Allocated	5
Theoretical (hour/week)	2
Practice (hour/week)	1
Laboratory (hour/week)	0
Year of Study	-
Semester when the course unit is delivered	-
Course Coordinator	PhD Sayami Huseynov
Name of Lecturer (s)	PhD Sayami Huseynov
Name of Assistant (s)	-
Mode of Delivery	Face to Face, Seminar.
Language of Instruction	English
Prerequisites	-
Recommended Optional Program Component-s	

Course description:

The course content is focused on the aspects of materials and materials properties. The course takes both a general approach and a detailed approach where the first includes: Materials and their roles and importance in modern society, materials and innovations, resources and availability, principles for systematic materials selection and principles for engineering design with respect to material properties. Detailed topics are: physical and mechanical properties including density, elastic properties, yielding and plastic properties, hardness and ductility. Relations between atomic structure, molecular structure, microstructure and material properties. Phase diagrams, heat treatment and strengthening mechanisms for important metals and alloys. Corrosion and degradation mechanisms. Important engineering materials will be emphasized: Carbon steels, steel alloys, light weight alloys, engineering polymers and fiber composites.

Objectives of the Course:

- be engaged in advanced education, research, and development in materials science and engineering, including materials discovery and/or processing, and in any professional disciplines.
- employ elements of the materials research process in their careers including the use of:
- demonstrate ethical responsibility and an appreciation for the societal and global impact of their endeavors and maintaining their intellectual curiosity through lifelong learning.

Learning Outcomes

At the end of the course the student will be able to		Assessment
1	Determine structure and properties of metals, ceramics, polymers and composites.	1,3
2	Explain relationships between structures and properties.	1,2,3
3	Understand manufacturing, processing and fabrication of materials.	1,3
4	Determine properties and performance of materials in different environments.	1,3,2
5	Understand principles for rational and knowledge based selection of materials.	1,2,3
6	Solve basic engineering problems related to materials selection and components.	1,2,3
7	Recognize the needs for specific material competence in different engineering projects.	1,2
Assessment Methods: 1. Final Exam, 2. Presentation, 3. Midterm Exam		

Course's Contribution to Program

		CL
1	Ability to solve complex issues and tasks by using the principles of mathematics, physics, chemistry and chemical engineering.	4
2	Ability to execute, coordinate, implement, substantiate laboratory processes while carrying out the experiments and to obtain and extract chemical compounds using standard methods and syntheses.	1
3	Ability to use the basics of mathematics, algorithmic principles and methods of computer engineering in the modeling, to design of chemical engineering systems, analyze and interpret data using statistical methods.	3
4	Ability to use the techniques, materials, skills and modern engineering tools which are used in engineering and to carry out industrial and chemical processes, control them and to apply chemical engineering principles at designing of these processes.	5
5	Ability to choose and use existing technologies, materials while undertaking project tasks and solving these issues in chemical engineering and ability to eliminate malfunctions that may occur in industrial and chemical processes or in laboratory equipment.	4
6	Ability to design systems, components, units and processes that meet the requirements, taking into account natural limitations such as economics, ecology, security and social aspects.	2
7	Ability to use the language skills to exchange and obtain some knowledge gained from the foreign sources.	1
8	Ability to analyze the problem, to identify the basic requirements, to justify the idea and critically evaluate the results and to compare them.	2
9	Ability to understand professional, ethical, legal and security issues and the responsibilities characteristic for engineering.	3
10	Ability to work productively in multidisciplinary groups, especially in projects requiring engineering skills and to carry out all work in accordance with relevant laws, regulations, standards, methods and guidelines.	2

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

Course Contents

Week	Chapters	Topics	Exam

	(books')		
1	[1] Chapter 17	**CORROSION AND DEGRADATION OF MATERIALS** Corrosion of Metals; Electrochemical Considerations; Corrosion Rates; Prediction of Corrosion Rates	
2	[1] Chapter 17	**FORMS OF CORROSION** Passivity; Environmental Effects; Corrosion Environments; Corrosion Prevention; Oxidation	
3	[1] Chapter 9	**PHASE DIAGRAMS** Definitions and Basic Concepts; Solubility Limit; Phases; Microstructure; Development of Microstructure in Eutectic Alloys; Eutectoid and Peritectic Reactions	
4	[1] Chapter 9	**IRON–CARBON SYSTEM** The Iron–Iron Carbide (Fe–Fe_3C) Phase Diagram; Development of Microstructure in Iron–Carbon Alloys; The Influence of Other Alloying Elements	
5	[1] Chapter 11	**APPLICATIONS AND PROCESSING OF METAL ALLOYS** Nonferrous Alloys; Aluminum and its Alloys; Casting	
6	[1] Chapter 14	**POLYMER STRUCTURES** Chemistry of Polymer Molecules; Molecular Weight; Molecular Shape; Molecular Configurations; Thermoplastic and Thermosetting Polymers	
7	[1] Chapter 15	**CHARACTERISTICS AND APPLICATIONS OF POLYMERS** Mechanical Behavior of Polymers; Mechanisms of Deformation and for Strengthening of Polymers; Crystallization, Melting, and Glass Transition Phenomena in Polymers; Factors That Influence Melting and Glass Transition Temperatures	
8			Midterm
9	[1] Chapter 15	**POLYMER SYNTHESIS AND PROCESSING** Polymerization; Polymer Additives; Forming Techniques for Plastics; Fabrication of Elastomers; Fabrication of Fibers and Films	
10	[1] Chapter 12	**STRUCTURES AND PROPERTIES OF CERAMICS** Silicate Ceramics; Carbon Nanotubes; Brittle Fracture of Ceramics; Mechanisms of Plastic Deformation	
11	[1] Chapter 13	**APPLICATIONS AND PROCESSING OF CERAMICS** Glasses; Glass-Ceramics; Clay Products; Refractories; Abrasives; Cements; Advanced Ceramics; Fabrication and Processing of Glasses and Glass-Ceramics	
12	[1] Chapter 16	**PARTICLE-REINFORCED COMPOSITES** Large-Particle Composites; Dispersion-Strengthened Composites	

13	[1] Chapter 16	**FIBER-REINFORCED COMPOSITES** Influence of Fiber Length; Influence of Fiber Orientation and Concentration; Metal-Matrix Composites; Ceramic-Matrix Composites; Hybrid Composites; Processing of Fiber-Reinforced Composites Structural Composites; Laminar Composites	
14	[1] Chapter 10	**PHASE TRANSFORMATIONS** The Kinetics of Phase Transformations; Metastable Versus Equilibrium States; Isothermal Transformation Diagrams; Continuous-Cooling Transformation Diagrams	
15	[1] Chapter 10	**SHAPE-MEMORY ALLOYS** Tempered Martensite; Crystallization; Melting; Melting and Glass Transition Temperatures	
16			Final exam

Recommended Sources

TEXTBOOK(S)

1. William D. Callister, David G. Rethwisch, Materials science and engineering: an introduction. John Wiley & Sons, Inc.; Eighth edition, 2009,992 pages.

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 Azerbaijan State Oil and Industrial University for Undergraduate Studies

Course Policies

- 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**	**3**	**42**

Presentation	1	10	10
Tutorials	14	1	14
Self-study	14	4	56
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			**150**
Total Workload/30(h)			**150/30**
ECTS Credit of the Course			**5**