2016

YEDİTEPE UNIVERSITY

FACULTY OF ENGINEERING

BOLOGNA

UNDERGRADUATE

CHEMICAL ENGINEERING PROGRAMME INFORMATION PACKET

YEDITEPE UNIVERSITY

FACULTY OF ENGINEERING

CHEMICAL ENGINEERING PROGRAMME INFORMATION PACKET (2016)

GOALS & OBJECTIVES

The educational objectives of our program are for our graduates to be qualified for executive, production, design and R&D positions in chemical and all -related industries and for conducting scientific research studies in the graduate programs of high-quality national and foreign educational institutions . Our graduates must have well-developed self confidence and sense of research and responsibiliy and be capable of solving problems through systems approach.

The mission of the Chemical Engineering Department of Yeditepe University is to educate students to become chemical engineers with a strong fundamental engineering background who are capable of conducting innovative and independent research and are aware of the societal impacts of their professional practice.

PROGRAM LEARNING OUTCOMES	
PLO1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.
PLO2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.
PLO3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.
PLO4	ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.
PLO5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.
PLO6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.
PLO7	ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.
PLO8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.
PLO9	Awareness of professional and ethical responsibility.
PLO10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.
PLO11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.

Teaching & Learnig Methods

Teaching-learning methods and strategies are selected in the way to enhance the abilities of the students in working individually, recognition of the need for lifelong learning, observing, teaching others, presentation, critical thinking, working in a team, employing information technologies effectively.
Moreover, it is respected that the teaching methods support the students with different types of talents. The teaching methods used in the program are listed below*:

(*) One or more of these methods may be employed depending on the nature of the course.

Teaching Methods*	**Essential Learning Facilities**	**Tools used**
Lecture	Listening and understanding	Standard class technologies, multimedia tools, projector, computer, overhead projector
Lecture with discussion	Listening and understanding, observation/circumstances processing, critical thinking, problem formulation	Standard class technologies, multimedia tools, projector, computer, overhead projector
Problem Solving	Special skills planned in advance	
Case study	Special skills planned in advance	
Brain Storming	Listening and understanding, observation/circumstances processing, critical thinking, problem formulation, group study	Standard class technologies, multimedia tools, projector, computer, overhead projector
Discussion in a small group	Listening and understanding, observation/circumstances processing, critical thinking, problem formulation	Standard class technologies, multimedia tools, projector, computer, overhead projector
Seminar	Research – Life-long learning, writing, listening, informatics, listening and understanding, administrative skills	Standard class technologies, multimedia tools, projector, computer, overhead projector, special facilities
Group Study	Research – Life-long learning, writing, listening, informatics, listening and understanding, administrative skills, group study	Internet databases, library databases, e-mail, online discussion, web-based discussion forums
Laboratory	observation/circumstances processing, informatics administrative skills, group study	Special facilities
Homework	Research – Life-long learning, writing, listening, informatics	Internet databases, library databases, e-mail
Investigation / Sample Survey Study	Research – Life-long learning, writing, reading	
Panel	Listening and understanding, observation/circumstances processing	Standard class technologies, multimedia tools, projector, computer, overhead projector, special facilities
Guest Speaker	Listening and understanding, observation/circumstances processing	Standard class technologies, multimedia tools, projector, computer, overhead projector, special facilities
Student Ensembles Facilities / Projects	observation/circumstances processing critical thinking, problem formulation, group study, research-long-life learning, reading, writing, administrative skills, special skills plnned beforehand.	

YEDITEPE UNIVERSITY

CURRICULUM

FACULTY OF ENGINEERING

Effective 2016 Fall

DEPARTMENT OF CHEMICAL ENGINEERING

		FIRST SEMESTER	T	U	L	Y	E
CHEM	111	General Chemistry I	2	2	0	3	6
AFE	131	Academic English I	2	2	0	3	4
ES	115	Fundamentals of Scientific Programming	2	0	2	3	6
MATH	131	Calculus I	3	2	0	4	6
PHYS	101	Physics I	3	0	2	4	6
						17	28

		SECOND SEMESTER	T	U	L	Y	E
CHBE	102	Introduction to CHBE.	1	0	2	2	5
CHEM	112	General Chemistry II	2	2	0	3	6
CHEM	113	General Chemistry Lab	1	0	2	2	5
AFE	132	Academic English II	2	2	0	3	4
MATH	132	Calculus II	3	2	0	4	6
PHYS	102	Physics II	3	0	2	4	6
						18	32

		THIRD SEMESTER	T	U	L	Y	E
CHBE	203	Organic Chemistry	2	0	2	3	5
CHBE	211	Physical Chemistry I	2	2	0	3	5
CHBE	215	Material and Energy Balances	2	2	0	3	5
MATH	221	Linear Algebra	2	2	0	3	6
MATH	241	Differential Equations	3	2	0	4	6
HUM	103	Humanities	2	0	0	2	3
						18	30

		FOURTH SEMESTER	T	U	L	Y	E
CHBE	204	Bioorganic Chemistry	2	0	2	3	5
CHBE	213	Physical Chemistry Lab	1	0	2	2	4
CHBE	214	Chemical Engineering Thermodynamics	2	2	0	3	6
CHBE	232	CHBE I: Fluid Mechanics	2	2	0	3	6
ECON	294	Economics for Engineers	3	0	0	3	4
FE	XX1	Free Elective I	3	0	0	3	5
						17	30

		FIFTH SEMESTER	T	U	L	Y	E
CHBE	301	Experimental CHBE I	1	0	2	2	4
CHBE	331	CHBE II : Heat Transfer	2	2	0	3	6
CHBE	361	Materials in Chem. & Bio.App.	3	0	0	3	5
CHBE	311	Computer Applications in CHBE	2	2	0	3	5
ES	301	Engineering Management	3	0	0	3	4
FE	XX2	Free Elective II	3	0	0	3	5
TKL	201	Turkish I	2	0	0	2	2
						19	31

		SIXTH SEMESTER	T	U	L	Y	E
CHBE	302	Experimental CHBE II	1	0	2	2	4
CHBE	333	CHBE III: Mass Transfer	2	2	0	3	6
CHBE	362	Reactor Design	2	2	0	3	6
CHBE	386	Mathematical Modeling in CHBE	2	2	0	3	6
CHBE	XX1	Restricted Elective I	3	0	0	3	5
TKL	202	Turkish II	2	0	0	2	2
						16	29

		SEVENTH SEMESTER	T	U	L	Y	E
CHBE	401	Experimental CHBE III	1	0	2	2	4
CHBE	441	Process Dynamics & Control	2	2	0	3	6
CHBE	463	Chemical & Biochemical Process Design I	3	2	0	4	6
CHBE	354	Separation Processes	3	0	0	3	5
CHBE	XX2	Restricted Elective II	3	0	0	3	5
HTR	301	History of Turkish Revolution I	2	0	0	2	2
CHBE	400	Summer Practice	0	2	0	0	1
						17	29

		EIGHTH SEMESTER	T	U	L	Y	E
CHBE	464	Chemical & Biochemical Process Design II	2	2	0	3	6
CHBE	492	Engineering Project	1	0	4	3	8
CHBE	XX3	Restricted Elective III	3	0	0	3	5
CHBE	XX4	Restricted Elective IV	3	0	0	3	5
CHBE	XX5	Restricted Elective V	3	0	0	3	5
HTR	302	History of Turkish Revolution II	2	0	0	2	2
						17	31

* X denotes the level 1, 2 or 3 of the course, depending on the student's ability

T: Theory **L: Laboratory** **E: ECTS**
U: Practice **Y: Yeditepe Credits**

Minimum Degree Requirements	
Credits	**140**
ECTS	**240**
Number of Courses	**47**
Number of Summer Practices	**1**

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
GENERAL CHEMISTRY I	**CHEM111**	**1**	**2+2**	**3**	**6**

Prerequisites	none

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	To be assigned by the department
Instructors	To be assigned by the department
Assistants	To be assigned by the department
Goals	The aim of this course is to demostrate the properties and behaviour of the macroscopic world in terms of the structure and arrangement of the consistent molecules, and to build a foundation in chemical knowledge for solving problems in science and engineering.
Content	Quantum theory and electronic structure of atoms; Periodic relationship among elements; Chemical Bonding; Compounds; Mass relationships in chemical reactions; Gases; Thermochemistry and laws of thermodynamics

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Adequate knowledge in chemistry; ability to use theoretical and applied information in chemistry to model and solve engineering problems. • Understand the atomic and molecular nature of matter and of chemical reactions that describe their transformations; • Describe the subatomic structure of atoms and apply this information to the bonding, structure, shape and polarity of molecules and to periodic trends; • Understand the periodic table as an organizing concept of chemical properties • Solve chemical problems using concepts of balanced chemical reactions and stoichiometry, gas laws and thermochemistry	1,6,7	1,2	A,C

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**

1	Chemistry: The study of change (Chemistry, the scientific method, classifications, states and properties of matter, handling numbers ans dimensional analysis)	Textbook
2	Atoms, Molecules and Ions / Quantum Theory (The atomic theory, the structure of an atom, quantum theory)	Textbook
3	Atoms, Molecules and Ions / Electronic Structure of Atoms (Electron configuration, the periodic table, molecules and ions, chemical formulas and naming compounds)	Textbook
4	Periodic Relationships Among the Elements (Periodic variation in physical properties, ionization energy, electron affinity, chemicial properties of representative elements)	Textbook
5	Chemical Bonding I (Lewis dot symbols, ionic and covalent bonds, electronegativity)	Textbook
6	Chemical Bonding I / Chemical Bonding II (Writing Lewis structures, calculating formal charges, molecular geometry)	Textbook
7	Chemical Bonding II (Valence bond theory and hybridization of atomic orbitals)	Textbook
8	Chemical Bonding II (Molecular orbital theory) MIDTERM I	Textbook
9	Mass relationships in Chemical Reactions (Avogadro's number, percent composition of compounds, chemical reactions and equations)	Textbook
10	Mass relationships in Chemical Reactions (Chemical reactions and equations and stoichiometry)	Textbook
11	Gases (The gas laws and gas stoichiometry)	Textbook
12	Gases / Thermochemistry (The kinetic molecular theory of gases, introduction to thermodynamics)	Textbook
13	Thermochemistry (Enthalpy of chemical reactions, calorimetry) MIDTERM II	Textbook
14	Thermochemistry (Standard enthalpy of formation and reaction)	Textbook

RECOMMENDED SOURCES	
Textbook	"Chemistry", Raymond Chang, Kenneth A. Goldsby, McGraw Hill, 11th Edition, 2012.
Additional Resources	"General Chemistry. Principles and Modern Applications." Ralph H.Petrucci, 10th edition, Prentice Hall, 2010.

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Quiz	10	17

Mid-terms	2	83
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.					
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.					**X**
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.					**X**
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					
9	Awareness of professional and ethical responsibility.					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 12x Total course hours)	12	4	48
Hours for off-the-classroom study (Pre-study, practice)	14	5	60
Midterm examination	2	1.5	3
Assignment	7	5	35

Final examination	1	3	3
Total Work Load			149
Total Work Load / 25 (h)			6.0
ECTS Credit of the Course			6

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
GENERAL CHEMISTRY II	**CHEM112**	**2**	**2+2**	**3**	**6**

Prerequisites	CHEM111 – GENERAL CHEMISTRY I

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	---
Instructors	To be assigned by the department
Assistants	To be assigned by the department
Goals	The aim of this course is to build a foundation in chemical knowledge that allows the students to make qualitative and quantitative inquires into topics in chemistry, science and engineering; to develop critical thinking and problem solving skills; to familiarize students with chemical problems and to develop skills to identify and formulate complex problems; to inform the students about contemporary issues relevant to course topic.
Content	Reactions in aqueous solutions; Intermolecular forces and liquids and solids; Physical properties of solutions; Chemical kinetics; Chemical equilibrium; Acids and bases; Acid-base equilibria and solubility equilibria; Chemistry in atmosphere

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Understanding of basic chemical principles and concepts; ability to use theoretical and applied information in chemistry to model and solve engineering problems; ability to identify, formulate, and solve chemistry problems with an engineering approach applying the proper analysis and numerical methods • Describe the types of reactions occuring in aqueous solutions; • Interpret phase diagrams, identify intermolecular forces, crystal structures, and colligative properties of solutions; • Describe the use of rate laws pertaining to reactions of different order, understand how various factors affect the rate of a reaction and the significance of reaction mechanism; • Describe the condition of chemical equilibrium and perform calculations involving equilibrium systems; • Describe, predict and calculate the outcomes resulting from interactions of acids, bases, buffers and salts, with water and each other; • Define chemical terms and solve mathematical problems related to chemical calculations; • Describe the natural phenomena occuring in the atmosphere and understand their environmental consequences.	1,2,4,6,7,11	1,2	A,C

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT

Week	Topics	Study Materials
1	Reactions in Aqueous Solutions. General Properties of Aqueous Solutions.	Textbook
2	Concentration of Solutions. Quantitative Methods of Analysis (Gravimetric Analysis, Titrations).	Textbook
3	Intermolecular Forces and Liquids and Solids. Properties of Liquids.	Textbook
4	Crystal Structure. Phase Changes. Phase Diagrams.	Textbook
5	Physical Properties of Solutions. Concentration Units. The Effect of Temperature and Pressure on Solubility. MIDTERM EXAM I.	Textbook
6	Colligative properties of Nonelectrolyte and Electrolyte Solutions.	Textbook
7	Chemical Kinetics. The Rate of Reaction. The Rate Law.	Textbook
8	The Relation between Reactant Concentration and Time.Order of Reaction. Reaction Half-Life.Activation Energy and Temperature.	Textbook
9	Reaction Mechanisms. Catalysis.	Textbook
10	Chemical Equilibrium and Equilibrium Constant MIDTERM II.	Textbook
11	The Relationship Between Chemical Kinetics and Chemical Equilibrium. Factors That Effect Chemical Equilibrium.	Textbook
12	Acids and Bases. pH-A Measure of Acidity. Acid-Base Properties of Salts.	Textbook
13	Acid-Base Equilibria. Buffer Solutions. Acid-Base Titrations.	Textbook
14	Solubility Equilibria. Chemistry in Atmosphere.	Textbook

RECOMMENDED SOURCES

Textbook	"Chemistry", Raymond Chang, Kenneth A. Goldsby, McGraw Hill, 11th Edition, 2012.
Additional Resources	"General Chemistry. Principles and Modern Applications." Ralph H.Petrucci, Prentice Hall, 2010.

MATERIAL SHARING

Documents	
Assignments	
Exams	

ASSESSMENT

IN-TERM STUDIES	NUMBER	PERCENTAGE

Quiz	5	25
Mid-terms	2	75
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.				**X**	
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.				**X**	
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.					**X**
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.				**X**	
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					
9	Awareness of professional and ethical responsibility.					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 12x Total course hours)	12	4	48
Hours for off-the-classroom study (Pre-study, practice)	14	4	56
Midterm examination	2	1.5	3

Homework Assignment	6	6	36
Quiz	6	0.5	3
Final examination	1	2	2
Total Work Load			148
Total Work Load / 25 (h)			5.9
ECTS Credit of the Course			6.0

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
GENERAL CHEMISTRY LABORATORY	**CHEM113**	**2**	**1+0+2**	**2**	**5**

Prerequisites	none
Corequisite	CHEM112 – GENERAL CHEMISTRY II

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	---
Instructors	Assist.Prof. Nihan Çelebi Ölçüm
Assistants	To be assigned by the department
Goals	The aim of this course is to place the abstract concepts encountered in lecture into an experimental context, to reinforce the theoretical background of the textbook and lecture, to introduce students to rigorous experimental methods, record keeping and report writing, to develop students' skills in various laboratory techniques, and to teach students to conduct experiments and analyze and interpret data.
Content	Grand review of chemical fundamentals; Safety rules; Chemical glassware and equipment; Preparing solutions; Factors affecting the solubility; Solubility rules and precipitation; Reactions in aqueous solutions; Chemical kinetics; Chemical equilibrium; Acidity of solutions; Volumetric analysis.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Adequate knowledge in chemistry; ability to use theoretical and applied information in chemistry to model and solve engineering problems. • Proficiency in chemical fundamentals,such as naming compounds and writing chemical equations; • Describe the properties of solutions and types of reactions occuring in aqueous solutions; • Interpret solubility curves, identify intermolecular forces, and colligative properties of solutions; • Describe how various factors affect the rate of a reaction; • Describe fundamental aspects of acids and bases and their reactions; • Proficiency in performing calculations related to stoichiometry, gas laws, solutions, solubility, chemical rates and acid-base equilbria.	1,6,7	1,2	A,C
2) Ability to conduct experiments, observe chemical principles in action, describe observations, keep records, do calculations according to experimental data, discuss results, identify errors and draw conclusions. • Formulate and test hypotheses and understand the importance of accuracy, precision and repeatability in such experimentation; • Produce and analyze data using concrete and/or abstract	5,6,7,9	1,2,3	A,B,C

reasoning for interpretation; • Efficiently communicate the results of analysis; • Develop useful laboratory skills and use these skills in accordance with laboratory safety procedures.			
3) Ability to employ information technologies effectively for accessing information and report writing	4,6,7,8,9	1,2,3	C
4) Ability to select, and use modern techniques and tools needed for experimental investigations of chemical phenomena. • Demonstrate the appropriate use of common laboratory equipment; • Proficiency in assembling laboratory glassware, and performing fundamental laboratory techniques.	4,6,7	1,2,3	B

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT

Week	Topics	Study Materials
1	Grand Review of Chemical Fundamentals	Textbook
2	Introduction; Safety Rules; Chemical glassware and equipment	Textbook
3	Yield of a Chemical Reaction (Exp#7) Finding the Gas Law Constant (Exp#13)	Textbook
4	Preparing a Solution, Dilution and Mixing (Exp#1-2-3)	Textbook
5	Solubility Rules and Precipitation Reactions (Exp#6)	Textbook
6	Factors Affecting Solubility (Exp#4-5)	Textbook
7	MIDTERM EXAM I	Textbook
8	Freezing Point Depression (Exp#14)	Textbook
9	Factors Affecting Reaction Rate (Exp#11)	Textbook
10	Acidity (pH) of Solutions (Exp#8)	Textbook
11	Strong Acid-Strong Base and Weak Acid-Strong Base Titration (Exp#9)	Textbook
12	MIDTERM EXAM II	Textbook
13	Potentiometric Titration (Exp#10)	Textbook
14	Review	Textbook

RECOMMENDED SOURCES

Textbook	"General Chemistry Laboratory Manual - Techniques and Experiments" D. Rende, S. Bucak, Z. Tuiebakhova, N. Baysal. Yeditepe University
Additional Resources	"Chemistry", Raymond Chang, Kenneth A. Goldsby, McGraw Hill, 11th edition, 2012.

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	46
Lab Reports	10	31
Quiz	10	23
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		35
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		65
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.					
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					**X**
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					**X**
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.					**X**
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.					**X**
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					**X**
9	Awareness of professional and ethical responsibility.			**X**		
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable					

	development.					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 12x Total course hours)	12	3	36
Hours for off-the-classroom study (Pre-study, practice)	14	2	28
Midterm examination	2	1.5	3
Lab Reports	10	5.5	55
Final examination	1	3	3
Total Work Load			125
Total Work Load / 25 (h)			5.0
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
INTRODUCTION TO CHEMICAL AND BIOPROCESS ENGINEERING	**CHBE102**	**2**	**1 + 2**	**2**	**5**

Prerequisites	None

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Compulsory
Course Coordinator	Assist. Prof. Dr. Levent Organ
Instructors	Assist. Prof. Dr. Levent Organ
Assistants	To be assigned by the department
Goals	The course aims to introduce the profession of chemical engineering and to provide students with knowledge and abilities to carry out fundamental engineering calculations, to express and calculate process variables related to chemical processes and to perform basic material balances.
Content	Profession of chemical engineering. Chemical industry. Units and dimensions. Numerical calculation and estimation. Dimensional homogeneity. Definition of a process. Process data representation and analysis. Process variables (density and specific gravity, temperature, pressure, flow rates, chemical composition) and their measurement. Process classification. Material balance equation and its basic applications.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Ability to carry out fundamental engineering calculations such as unit conversions, calculation of mean and standard deviation of data, interpolation, extrapolation, fitting linear and nonlinear data.	1, 7	1, 2	A, C
2) Ability to calculate process variables such as flow rates and chemical composition.	1, 7	1, 2	A, C
3) Ability to identify the type of a process.	1, 7	1, 2	A, C
4) Ability to carry out basic material balance calculations.	1, 7	1, 2	A, C

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT

Week	Topics	Study Materials
1	INTRODUCTION, CHEMICAL ENGINEERING, CHEMICAL INDUSTRY, UNITS AND DIMENSIONS	Textbook
2	SYSTEMS OF UNITS, SIGNIFICANT UNITS	Textbook
3	VALIDATING RESULTS, MEAN, VARIANCE, STANDARD DEVIATION	Textbook
4	DIMENSIONAL HOMOGENEITY AND UNIT CONSISTENCY	Textbook
5	LINEAR INTERPOLATION, FITTING LINEAR AND NONLINEAR DATA	Textbook
6	DEFINITION OF A PROCESS, DENSITY, SPECIFIC GRAVITY	Textbook
7	MIDTERM EXAM 1, FLOW RATES, FLOW RATE MEASUREMENT	Textbook
8	CHEMICAL COMPOSITION (MASS AND MOLE FRACTIONS)	Textbook
9	AVERAGE MOLECULAR WEIGHT, CONCENTRATION	Textbook
10	FLUID PRESSURE AND HYDROSTATIC HEAD	Textbook
11	MIDTERM EXAM 2, ABSOLUTE AND GAUGE PRESSURES	Textbook
12	TEMPERATURE AND TEMPERATURE MEASUREMENT	Textbook
13	PROCESS CLASSIFICATION (CONTINUOUS, BATCH, SEMIBATCH, STEADY, TRANSIENT)	Textbook
14	MATERIAL BALANCE EQUEATION AND APPLICATIONS	Textbook

RECOMMENDED SOURCES	
Textbook	Elementary Principles of Chemical Processes by Felder and Rousseau, 3rd Edition, Publisher: Wiley, 2000.
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	81,25
Assignment	10	18,75
Lab Work		
Term Project		

Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		36
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		64
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.					
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.					
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.					**X**
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					
9	Awareness of professional and ethical responsibility.					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 12x Total course hours)	12	3	36
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Midterm examination	2	2	4
Homework	12	3	36

Project			
Final examination	1	3	3
Total Work Load			149
Total Work Load / 25 (h)			6
ECTS Credit of the Course			6

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
ORGANIC CHEMISTRY	**CHBE 203**	**3**	**2+0+2**	**3**	**5**

Prerequisites	CHEM 111

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	Assist.Prof. Semin Funda Oğuz
Instructors	Assist.Prof. Semin Funda Oğuz
Assistants	To be assigned by the department
Goals	The aim of this course is to provide students with knowledge of organic chemistry, understanding of the structure, properties and reactions of organic compounds, abilities to perform organic syntheses experiments and test the properties of organic compounds experimentally.
Content	Introduction to organic chemistry for chemical engineers. Definition of isomerism, resonance, functional groups and chemical properties. Reactions of alkanes, alkenes, alkynes, alcohols, aromatic compounds, carbonyl compounds. Stereochemistry. Laboratory work: basic separation techniques, identification and purification of organic compounds and application of these techniques to simple organic reactions. Synthesis of various organic compounds.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Adequate knowledge in the properties of different classes of organic compounds, their formations and reactions	1	1,2,3	A,B,C
2) Adequate knowledge in stereochemical view of organic compounds and their reactions	1	1,2	A, C
3) Ability to design stepwise reactions to obtain different type of compounds from specific compounds	1	1,2	A,C
4) Ability to use laboratory techniques to perform organic syntheses and purify the reaction products	5, 6	3	A,B
5) Ability to follow Safety Rules and use MSDS data Sheets	9, 11	3	C
6) Ability to analyze experimental data and write the report of the experiment	6, 7, 8	3	B, C

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	CHAPTER 1- Structure Determines Properties	Textbook
2	CHAPTER 2- Alkanes & Cycloalkanes: Introduction to Hydrocarbons	Textbook
3	CHAPTER 3- Alkanes & Cycloalkanes: Conformations and cis-trans Stereoisomers	Textbook
4	CHAPTER 4- Alcohols and Alkyhalides	Textbook
5	CHAPTER 5- Structure and Preparation of Alkenes	Textbook
6	CHAPTER 6- Addition Reactions of Alkenes: Elimination Reactions	Textbook
7	CHAPTER 6- Addition Reactions of Alkenes & CHAPTER 7 Stereochemistry	Textbook
8	CHAPTER 7- Stereochemistry	Textbook
9	CHAPTER 9- Alkynes	Textbook
10	CHAPTER 11- Arenes and Aromaticity	Textbook
11	CHAPTER 12- Reactions of Arenes	Textbook
12	CHAPTER 14- Organometallic Compounds; CHAPTER 15 Alcohols; CHAPTER 17- Aldehydes & Ketones: Nucleophilic Addition to the Carbonyl Group	Textbook
13	CHAPTER 18- Carboxylic Acids	Textbook
14	CHAPTER 19- Carboxylic Acid Derivatives: Nucleophilic Acyl Substitution	Textbook

RECOMMENDED SOURCES	
Textbook	Carey & Giuliano "Organic Chemistry", 8th Ed., Mc-Graw Hill, 2010 Lab manual
Additional Resources	McMurry "Organic Chemistry", 5th Edition, Brooks/Cole

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	57,2
Assignment	4	14,3
Lab Quizes	8	5,7

Lab Reports	8	22
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		30
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		70
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.			**X**		
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.					
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.			**X**		
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.			**X**		
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.				**X**	
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.		**X**			
9	Awareness of professional and ethical responsibility.			**X**		
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.		**X**			

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 14x Total course hours)	14	4	64
Hours for off-the-classroom study (Pre-study, practice)	14	1	14
Midterm examination	2	1,5	3

Laboratory Reports	8	5	22
Final examination	1	2	2
Total Work Load			131
Total Work Load / 25 (h)			5.2
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
BIOORGANIC CHEMISTRY	**CHBE 204**	**4**	**2+0+2**	**3**	**5**

Prerequisites	CHBE 203 – ORGANIC CHEMISTRY

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	Assist.Prof. Erde Can
Instructors	Assist.Prof. Erde Can
Assistants	To be assigned by the department
Goals	The aim of this course is to provide students with a knowledge of the chemicals of life (carbohydrates, lipids, amino acids, proteins, nucleic acids etc.): their structures, characteristics, chemical reactions and functions in the body and an ability for their qualitative and quantitative analysis.
Content	Chemicals of life, carbohydrates, classification, properties and chemical reactions; lipids, general characteristics, fatty acids, fats and oils, waxes, glycerophospholipids, sphingolipids, steroids, cell membranes; aminoacids , electrophoresis, peptides and proteins, protein structure, denaturation; nucleic acids ,nucleosides and nucleotides, DNA and RNA. DNA replication. types of RNA. Term project.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Adequate knowledge of the chemicals of life (carbohydrates, lipids, aminoa acids, proteins, nucleic acids etc.): structures, characteristics and, chemical reactions and ability to use theoretical and applied information in these areas for their functions in the body, and their qualitative and quantitative analysis	1,5	1,2,3	A,B
2) Ability to design and conduct experiments, gather data, analyze and interpret results for chemical reactions, qualitative and quantitative analysis of carbohydrates, lipids and amino acids	5	1,3	A,B
3) Ability to access information and to follow developments in the field of chemicals of life, their interactions in the body, effects on health and applications in drug, cosmetics, food and biofuels.	8	1,4	A,D
4) Ability to work efficiently in intra-disciplinary teams in term projects and in laboratory experiments and ability to communicate effectively both orally and in writing (via laboratory reports and project reports and presentations)	6,7	1,3	B,D

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	STEREOCHEMISTRY	Textbook
2	CARBOHYDRATES I (CHEMICAL STRUCTURES, CLASSIFICATION, FISCHER PROJECTIONS)	Textbook
3	CARBOHYDRATES II (CHARACTERISTICS, CYCLIC STRUCTURES, CHEMICAL REACTIONS)	Textbook
4	LIPIDS I (CLASSIFICATION, OILS AND FATS, WAXES)	Textbook
5	LIPIDS II (CHEMICAL REACTIONS, PHOSPHOLIPIDS, STEREOIDS, CELL MEMBRANE)	Textbook
6	MIDTERM EXAM I	Textbook
7	AMINO ACIDS, PROTEINS, PEPTIDES	Textbook
8	PROTEIN STRUCTURE, PRIMARY, SECONDARY, TERTIARY AND QUARTERNARY LEVELS	Textbook
9	PROTEIN HYDROLYSIS VE DENATURATION	Textbook
10	NUCLEIC ACIDS	Textbook
11	NUCLEOSIDES, NUCLEOTIDES	Textbook
12	MIDTERM EXAM II	Textbook
13	DNA, RNA, TYPES OF RNA	Textbook
14	POSTER PRESENTATION	Textbook

RECOMMENDED SOURCES	
Textbook	Lab material: BIOORGANIC CHEMISTRY LABORATORY HANDBOOK (Yeditepe University)
Additional Resources	CAREY,F.A. , "ORGANIC CHEMISTRY", 9th Ed., McGRAW-HILL (TEXTBOOK), 2013 TIMBERLAKE,K.C., "GENERAL, ORGANIC AND BIOLOGICAL CHEMISTRY", 4th Ed.,PRENTICE HALL, 2012 Mc MURRY, J., "ORGANIC CHEMISTRY", 7th Ed,BROOKS/COLE, 2007

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	57

Lab Work	9	36
Term Project (Poster and Presentations)	1	7
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		30
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		70
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.					
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					**X**
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.					**X**
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.					**X**
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					**X**
9	Awareness of professional and ethical responsibility.					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 12x Total course hours)	12	4	48
Hours for off-the-classroom study (Pre-study, practice)	14	2	28

Laboratory Experiment and Report Preprations	9	4	36
Midterm examination	2	2	4
Homework	4	3	12
Project	1	20	20
Final examination	1	2	2
Total Work Load			150
Total Work Load / 25 (h)			6.0
ECTS Credit of the Course			6

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
PHYSICAL CHEMISTRY	**CHBE 211**	**3**	**2+2**	**3**	**5**

Prerequisites	CHEM 112 – GENERAL CHEMISTRY

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Compulsory
Course Coordinator	Prof. Dr. Seyda Malta
Instructors	Prof. Dr. Seyda Malta
Assistants	To be assigned by the department
Goals	The aim of this course is to teach the students fundamentals of physical chemistry and provide them with the ability to solve problems related to the fundametals of thermodynamics, phase behaviour and chemical equilibrium.
Content	Properties of gases, first, second and third law of thermodynamics, phase behaviour of pure substances and simple mixtures, chemical equilibrium

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Knowledge on perfect and real gases; laws of thermodynamics and phase behaviour or pure substances and mixtures; chemical equilbrium to be applied in their science and engineering disciplines to solve their relevant problems.	1, 2	1,2	A,C
2) Ability to solve problems on thermodynamic principles such as internal energy, enthalpy, entropy, Gibbs Free Energy, chemical potential and chemical equilbrium and develop skills to identify and formulate complex problems into their basic components to be able to analyze them.	2	1,2	A,C
3) Ability to command in English both oral and written through following the text book, listening to lectures in English and giving exams in English.	7	1,2	A,C, E
4) Using the homeworks as an opportunity to study together, developing a habit in students to study together and work as a group, and use this to better their individual problem solving skills, implemeted to quizzes and exams.	6	1,2	A,C, E

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project, E: Class Participation

COURSE CONTENT

Week	Topics	Study Materials
1	INTRODUCTION, PROPERTIES OF GASES	Textbook
2	PROPERTIES OF GASES, cont.; HOMEWORK&QUIZ-1	Textbook
3	FIRST LAW OF THERMODYNAMICS	Textbook
4	FIRST LAW OF THERMODYNAMICS, cont.; HOMEWORK&QUIZ-2	Textbook
5	SECOND LAW OF THERMODYNAMICS	Textbook
6	SECOND LAW OF THERMODYNAMICS, cont.; HOMEWORK&QUIZ-3	Textbook
7	REVISION and MIDTERM 1	Textbook
8	PHYSICAL TRANSFORMATIONS OF PURE SUBSTANCES; HOMEWORK&QUIZ-4	Textbook
9	SIMPLE MIXTURES	Textbook
10	HOMEWORK&QUIZ-5; PHASE DIAGRAMS	Textbook
11	PHASE DIAGRAMS, continued; HOMEWORK&QUIZ-6	Textbook
12	REVISION and MIDTERM 2	Textbook
13	CHEMICAL EQUILIBRIUM	Textbook
14	CHEMICAL EQUILIBRIUM, continued; HOMEWORK&QUIZ-7	Textbook

RECOMMENDED SOURCES	
Textbook	Physical Chemistry, Atkins & de Paula, W H Freman, 9th edition, 2010.
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	30
Homework & Quiz	7	35
Final	1	35
Total		**100**

CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		35
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		65
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.				**X**	
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.				**X**	
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.					**X**
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					
9	Awareness of professional and ethical responsibility.					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the two midterms: 13x Total course hours)	13	4	52
Hours for off-the-classroom study (Pre-study, practice)	14	3	42
Midterm examination	2	2	4
Homework	7	3	21
Final examination	1	3	3

Total Work Load			122
Total Work Load / 25 (h)			4.9
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
PHYSICAL CHEMISTRY LABORATORY	**CHBE 213**	**4**	**1+0+2**	**2**	**4**

Prerequisites	CHEM 113 – GENERAL CHEMISTRY LAB.
Corequisites	CHBE 211 – PHYSICAL CHEMISTRY

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Compulsory
Course Coordinator	Prof. Dr. Seyda Malta
Instructors	Prof. Dr. Seyda Malta
Assistants	To be assigned by the department
Goals	The aim of this course is to apply the fundamentals of physical chemistry to experiments to gain further understanding of physical chemistry. In the theoretical part of the course, chemical kinetics and reaction mechanisms are covered.
Content	Rates of chemical reactions, kinetics of chemica reactions, molecular reaction dynamics, Absorption of Light; Boiling Point Elevation; Conductivity of Strong and Weak Electrolytes; Determination of Enthalpy of Combustion with a Calorimetric Bomb; Determining the Molecular Weight of a Polymer from Intrinsic Viscosity Measurements; Determination of Melting Enthalpy of a Pure Substance; Distribution Equilibrium; Kinetics of Sucrose Inversion; Saponification Rate of Tert-butyl Chloride; Phase Diagram of Partially Miscible Liquids

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Adequate knowledge in chemical kinetics and dynamics to model and solve engineering problems.	1	1	A
2) Ability to identify, formulate, and solve complex engineering problems related to chemical kinetics and dynamics; ability to select and apply proper analysis methods for this purpose.	2	1,2	A
3) Ability to devise, select, and use modern techniques and tools needed for physical chemistry laboratory practices such as viscometer, calorimeter, spectrophoteter, etc.; ability to employ Excel and Word Software programs effectively to plot data, make calculations and write reports.	4	3	A, B
4) Ability to design and conduct experiments, gather data, analyze and interpret results for physical chemistry laboratory practices. .	5	3	B
5) Ability to work efficiently in intra-disciplinary teams by working as a pair doing experiments; ability to work individually while writing reports on experiments and exams. .	7	3	B

6) Ability to communicate effectively both orally and in writingby following the lab manual and doing exams in English.	8	1,3	A, B

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT

Week	Topics	Study Materials
1	INTRODUCTIONS, EXCEL TO PLOT DATA	Excel Manual
2	RATES OF CHEMICAL REACTIONS	Textbook
3	KINETICS OF CHEMICAL REACTIONS	Textbook
4	EXPERIMENT 1: ABSORPTION OF LIGHT; KINETICS OF CHEMICAL REACTIONS	Textbook & Lab Manual
5	EXPERIMENT 2: BOILING POINT ELEVATION; KINETICS OF CHEMICAL REACTIONS	Textbook & Lab Manual
6	EXPERIMENT 3: CONDUCTIVITY OF STRONG AND WEAK ELECTROLYTES; MOLECULAR REACTION DYNAMICS	Textbook & Lab Manual
7	EXPERIMENT 4: DETERMINATION OF ENTHALPY OF COMBUSTION WITH A CALORIMETRIC BOMB; MOLECULAR REACTION DYNAMICS	Textbook & Lab Manual
8	EXPERIMENT 5: DETERMINING THE MOLECULAR WEIGHT OF A POLYMER FROM INTRINSIC VISCOSITY MEASUREMENTS; ; MOLECULAR REACTION DYNAMICS	Textbook & Lab Manual
9	EXPERIMENT 6: DETERMINATION OF MELTING ENTHALPY OF A PURE SUBSTANCE	Lab Manual
10	EXPERIMENT 7: DISTRIBUTION EQUILIBRIUM	Lab Manual
11	EXPERIMENT 8: KINETICS OF SUCROSE INVERSION	Lab Manual
12	EXPERIMENT 9: SAPONIFICATION RATE OF TERT-BUTYL CHLORIDE	Lab Manual
13	EXPERIMENT 10: PHASE DIAGRAM OF PARTIALLY MISCIBLE LIQUIDS	Lab Manual
14	MAKE-UP	Lab Manual

RECOMMENDED SOURCES

Textbook	Physical Chemistry, Atkins & de Paula, W H Freman, 9th edition, 2010. Physical Chemistry Laboratory Manual
Additional Resources	

MATERIAL SHARING

Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	35
Lab Reports	10	30
Final	1	35
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		35
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		65
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.			**X**		
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.			**X**		
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					**X**
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.				**X**	
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.					**X**
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.			**X**		
9	Awareness of professional and ethical responsibility.					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding one midterm: 13x Total course hours)	13	3	39
Hours for off-the-classroom study (Pre-study, practice)	14	2	28
Midterm examination	1	2	2
Reports	10	3	30
Final examination	1	3	3
Total Work Load			102
Total Work Load / 25 (h)			4.08
ECTS Credit of the Course			4

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
CHEMICAL ENGINEERING THERMODYNAMICS	**ChBE 214**	**4**	**2+2**	**3**	**6**

Prerequisites	CHEM 111: GENERAL CHEMISTRY

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Compulsory
Course Coordinator	Assist. Prof. Dr. Cem L. Altan
Instructors	Assist. Prof. Dr. Cem L. Altan
Assistants	To be assigned by the department
Goals	The aim of this course is to improve the ability of chemical engineering students for the application of thermodynamics to various chemical engineering systems which are both theoretical and applied in natüre, and stimulate and enhance the understanding of fundamental concepts in thermodynamics.
Content	Introductory definitions and concepts for thermodynamics use, First law of thermodynamics and related basics, volumetric properties of püre fluids, heat effects, second law of thermodynamics, thermodynamic properties of fluids, introduction to vapor/liquid equilibrium, solution (mixture) thermodynamics, chemical reaction equilibria, thermodynamics of flow processes, introduction to production of power from heat, introduction to refrigeration, selected topics in phase equilibria.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Adequate knowledge in mathematics, science and engineering subjects pertaining to thermodynamics; ability to use theoretical and applied information in these areas to solve engineering problems related to thermodynamics.	1,2,6	1,2	A,B,C
2) Ability to identify, formulate, and solve complicated engineering problems related to thermodynamics; to select and apply proper analysis methods for this purpose.	1,2,6	1,2	A,B,C
3) Ability to work efficiently in intra-disciplinary teams; ability to work individually.	1,2,6	1,2	A,B,C
4) Ability to communicate effectively in writing; knowledge of a minimum of one foreign language.	1,2,7	1,2	A,B,C

Teaching Methods:	1: Lecture, 2: Problem session
Assessment Methods:	A; Homework, B: Quiz, C: Exam

COURSE CONTENT

Week	Topics	Study Materials
1	INTRODUCTORY DEFINITIONS AND CONCEPTS	Textbook
2	THE FIRST LAW OF THERMODYNAMICS AND RELATED BASICS	Textbook
3	VOLUMETRIC PROPERTIES OF PURE FLUIDS	Textbook
4	HEAT EFFECTS	Textbook
5	THE SECOND LAW OF THERMODYNAMICS	Textbook
6	THERMODYNAMIC PROPERTIES OF FLUIDS	Textbook
7	INTRODUCTION TO VAPOR/LIQUID EQUILIBRIUM	Textbook
8	SOLUTION (MIXTURE) THERMODYNAMICS	Textbook
9	SOLUTION (MIXTURE) THERMODYNAMICS (contd)	Textbook
10	CHEMICAL REACTION EQUILIBRIA	Textbook
11	THERMODYNAMICS OF FLOW PROCESSES	Textbook
12	INTRODUCTION TO PRODUCTION OF POWER FROM HEAT	Textbook
13	INTRODUCTION TO REFRIGERATION	Textbook
14	SELECTED TOPICS IN PHASE EQUILIBRIA	Textbook

RECOMMENDED SOURCES	
Textbook	***Textbook***: Smith, J.M., Van Ness, H.C., Abbott, M.M., Introduction to Chemical Engineering Thermodynamics, Mc Graw-Hill, 2005, 7.ed.
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	61.5
Quiz	3	23.1
Assignment	5	15.4
Attendance		**100**
Total		35

CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.				**X**	
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.				**X**	
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.				**X**	
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.				**X**	
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					
9	Awareness of professional and ethical responsibility.					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam and quiz hours (total of 5 hours))	14	2,3 or 4	49
Hours for off-the-classroom study (Pre-study, practice)	14	4.5	63
,Midterm examination	2	2	4
Quiz	3	1	3
Homework	5	5	25

Final examination	1	3	3
Total Work Load			147
Total Work Load / 25 (h)			5.9
ECTS Credit of the Course			6

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
MATERIAL AND ENERGY BALANCES	**CHBE215**	**3**	**2+2**	**3**	**5**

Prerequisites	CHBE 102

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Compulsory
Course Coordinator	Assist. Prof. Dr. Levent Organ
Instructors	Assist. Prof. Dr. Levent Organ
Assistants	To be assigned by the department
Goals	The course aims to provide students with knowledge and abilities to formulate and solve material and energy balances on chemical processes and to apply the engineering approach to solving process-related problems: breaking a problem down into its components, establishing the relations between known and unknown process variables, assembling the information needed to solve for the unknowns and putting the pieces together to obtain the desired solution.
Content	Material balances on single unit and multi-unit systems. Chemical reaction stoichiometry. Material balances on reactive processes. Forms of energy. Energy balance equation for an open system at steady state. Energy balances on nonreactive processes. Heats of reaction. Energy balances on reactive processes. Applications involving material and energy balances.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Ability to formulate and solve material balances to determine unknown process variables in reactive and nonreactive chemical processes.	1, 7	1, 2	A, C
2) Ability to formulate and solve energy balances to determine unknown process variables and heating or cooling requirements in reactive and nonreactive chemical processes.	1, 7	1, 2	A, C
3) Ability to identify unknown variables in a given process, and ability to identify the sequence of sub-systems of the process to be analyzed to determine the unknowns.	1, 7	1, 2	A, C
4) Ability to find out or estimate necessary material and thermodynamic properties to be used in the application of the material and energy balances.	1, 7	1, 2	A, C

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment	A: Testing, B: Experiment, C: Homework, D: Project

Methods:	

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	INTRODUCTION, MATERIAL BALANCE EQUATION, DEGREES OF FREEDOM ANALYSIS, BASIS SELECTION	Textbook
2	BALANCES ON MULTIPLE UNIT PROCESSES, RECYCLE AND BYPASS	Textbook
3	CHEMICAL REACTION STOICHIOMETRY, ATOMIC SPECIES BALANCES	Textbook
4	MATERIAL BALANCES FOR PROCESSES INVOLVING REACTION, RECYCLE AND PURGE	Textbook
5	PROBLEM SOLVING, MIDTERM EXAM 1	Textbook
6	SINGLE PHASE SYSTEMS: LIQUID AND SOLID DENSITIES, IDEAL GASES AND IDEAL GAS MIXTURES	Textbook
7	MULTIPHASE SYSTEMS: SINGLE COMPONENT PHASE EQUILIBRIUM, GAS-LIQUID SYSTEMS WITH ONE CONDENSABLE COMPONENT, SATURATION AND HUMIDITY	Textbook
8	FORMS OF ENERGY, SHAFT AND FLOW WORK, ENTHALPY, ENERGY BALANCE ON OPEN SYSTEMS AT STEADY STATE	Textbook
9	STATE PROPERTIES AND REFERENCE STATES, TABLES OF THERMODYNAMIC DATA, SIMPLE ENERGY BALANCE APPLICATIONS	Textbook
10	MIDTERM EXAM 2, HYPOTHETICAL PROCESS PATHS, HEAT CAPACITY FORMULAS	Textbook
11	LATENT HEATS, ENERGY BALANCE APPLICATIONS INVOLVING PHASE CHANGE	Textbook
12	PSYCHROMETRIC CHART	Textbook
13	HEATS OF REACTION, HESS'LAW, STANDARD HEATS OF REACTION AND COMBUSTION	Textbook
14	ENERGY BALANCES ON REACTIVE PROCESSES	Textbook

RECOMMENDED SOURCES	
Textbook	Elementary Principles of Chemical Processes by Felder and Rousseau, 3rd Edition, Publisher: Wiley,2000
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	81,25

Assignment	10	18,75
Lab Work		
Term Project		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		36
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		64
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.					
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.					
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.					**X**
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					
9	Awareness of professional and ethical responsibility.					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 12x Total course hours)	12	4	48

Hours for off-the-classroom study (Pre-study, practice)	14	4.5	63
Midterm examination	2	2	4
Homework	10	3	30
Project			
Final examination	1	3	3
Total Work Load			148
Total Work Load / 25 (h)			6
ECTS Credit of the Course			6

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
CHEMICAL AND BIOPROCESS ENGINEERING I: FLUID MECHANICS	**CHBE 232**	**4**	**2+2**	**3**	**6**

Prerequisites	MATH 241 – DIFFERENTIAL EQUATIONS

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	Assist. Prof. Betül Ünlüsü
Instructors	Assist. Prof. Betül Ünlüsü
Assistants	To be assigned by the department
Goals	The aim of this course is for students to learn the properties of fluids encountered in the analysis of fluid flow; and to gain the abilities to model fluid behavior using the fundamental conservation laws of physics and solve model equations with analytical and numerical techniques; and also, design fluid flow systems.
Content	Properties of fluids, fluid statics and its applications, integral and differential mass, energy and momentum balance equations, laminar and turbulent flow in pipes, flow measurements, design equations.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Adequate knowledge of basic concepts in fluid mechanics and properties of fluids; ability to use the fundamental physics laws to model fluid flow	1,6	1,2	A,C
2) Ability to solve model equations governing fluid behavior using appropriate analytical and numerical techniques	1,5,6	1,2,4	A,C
3) Ability to design fluid flow systems relevant for chemical processes	3,6,11	1,2,4	A,C,D
4) Ability to use the techniques of computational fluid dynamics to analyze fluid flow	4,6	1,2,4	D
5) Ability to communicate effectively in English	7	1,2	A,C,D

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	INTRODUCTION TO FLUID MECHANICS	Textbook

2	PROPERTIES OF FLUIDS	Textbook
3	FLUID STATICS	Textbook
4	MASS CONSERVATION AND BERNOULLI EQUATIONS	Textbook
5	GENERAL MECHANICAL ENERGY BALANCE	Textbook
6	MIDTERM EXAM I	Textbook
7	FLOW IN PIPES (LAMINAR AND TURBULENT FLOW)	Textbook
8	FLOW IN PIPES (MAJOR AND MINOR FRICTIONAL LOSSES)	Textbook
9	FLOW IN PIPES (PIPING NETWORKS AND PUMPS)	Textbook
10	FLOW IN PIPES (VELOCITY AND FLOW RATE MEASUREMENT)	Textbook
11	MIDTERM EXAM II	Textbook
12	DIFFERENTIAL ANALYSIS OF FLUID FLOW (EQUATION OF CONTINUITY)	Textbook
13	DIFFERENTIAL ANALYSIS OF FLUID FLOW (NAVIER-STOKES EQUATION)	Textbook
14	INTRODUCTION TO COMPUTATIONAL FLUID DYNAMICS	Textbook

RECOMMENDED SOURCES	
Textbook	ÇENGEL, Y. A., CIMBALA, J. H., "FLUID MECHANICS FUNDAMENTALS AND APPLICATIONS", 2nd Ed., MC-GRAW-HİLL, 2010
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	57
Assignment	5	14
Quizzes	4	14
Term Project	1	15
Total		**100**

CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		30
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		70
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.					
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					**X**
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					**X**
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.			**X**		
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.				**X**	
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.			**X**		
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					
9	Awareness of professional and ethical responsibility.					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.			**X**		

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 12x Total course hours)	12	4	48
Hours for off-the-classroom study (Pre-study, practice)	14	3	42
Midterm examination	2	2	4
Homework	5	4	20
Project	1	30	30

Final examination	1	3	3
Total Work Load			147
Total Work Load / 25 (h)			5.9
ECTS Credit of the Course			6

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
EXPERIMENTAL CHEMICAL AND BIOPROCESS ENGINEERING I	**CHBE 301**	**5**	**1+0+2**	**2**	**4**

Prerequisites	CHBE 232 - CHBE I: Fluid Dynamics

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Compulsory
Course Coordinator	Prof.Dr. Süheyla Uzman
Instructors	Prof.Dr. Süheyla Uzman
Assistants	To be assigned by the department
Goals	The aim of this course is to use the fundamental principles of Chemical Engineering in laboratory scale experiments
Content	Principles of safety regulations, introduction to unit operations & unit processes, tools used in experimental analysis, series of laboratory & computational experiments on Fluid Mechanics, Reactor Types and physical/chemical processes

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Ability to use chemical Engineering principles in laboratory experiments on Fluid Mechanics, Reactor Types and extraction.	1,4	1,2,3	A,B
2) Ability to design and present a laboratory experiment on one of the topics of the course.	1,5,6,7	1,2,3	D
3) Ability to work in teams	4,6	1,2,3	B,D

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Laboratory Work , 4: Case-study
Assessment Methods:	A: Examination , B: Experiment Report , C: Homework, D: Project Report

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Laboratory Safety Rules, CHEMCAD (Lecture)	Lab Manual
2	Fluid Mechanics (Lecture)	Lab Manual
3	Mass Transfer/Separation Processes (Lecture)	Lab Manual
4	Heat Transfer (Lecture)	Lab Manual

5	Reactor Design (Lecture)	Lab Manual
6	Midterm Examination	Lab Manual
7	Laboratory Experiments	Lab Manual
8	Laboratory Experiments	Lab Manual
9	Laboratory Experiments	Lab Manual
10	Laboratory Experiments	Lab Manual
11	Laboratory Experiments	Lab Manual
12	Laboratory Experiments	Lab Manual
13	Laboratory Experiments	Lab Manual
14	Laboratory Experiments	Lab Manual

RECOMMENDED SOURCES	
Textbook	Laboratory Manual: 'Unit Operations Laboratory Manual', Dept . of Chem. Eng. ,Yeditepe University
Additional Resources	Perry's Chemical Engineering Handbook, Perry ,R.H. and D.W.Green, 7 th Ed., McGraw Hill, 1997

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	20
Assignment	5	10
Lab Work	7	40
Term Project	1	10
Total		**80**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		20
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		80
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**	
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.						
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.						
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					**X**	
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					**X**	
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.					**X**	
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.					**x**	
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.						
9	Awareness of professional and ethical responsibility.						
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.						
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.						

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 12x Total course hours)	13	3	39
Hours for off-the-classroom study (Pre-study, practice)	14	3	42
Midterm examination	1	2	2
Homework	5	2	10
Project	1	30	30
Final examination	1	3	3
Total Work Load			126
Total Work Load / 25 (h)			5.0
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
PRINCIPLES OF PROGRAMMING LANGUAGES	**ChBE 302**	**6**	**1+0 + 2**	**2**	**4**

Prerequisites	COo-requisite: CHBE 301

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	Prof.Dr.Süheyla Uzman
Instructors	Prof.Dr.Süheyla Uzman
Assistants	To be announced by the department
Goals	The aim of this course is the lab scale application of Chemical Engineering Principles
Content	Following ChBE 301, more experiments on heat transfer, mass transfer,reactor types, reaction kinetics,a project proposal and presentation.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Ability to carry out experiments on heat transfer,mass transfer, distillation,absorption etc.	1,4	1,2,3	A,C
2) Ability to design, propose and present a project on one of the topics of the course	1,5,6,7	1,2,3	D
3) Ability to work in a team	4,6	1,2,3	B,D

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Experiments	Lab. Manual
2	Experiments	Lab. Manual
3	Experiments	Lab. Manual
4	Experiments	Lab. Manual
5	Experiments	Lab. Manual

6	Experiments	Lab. Manual
7	Experiments	Lab. Manual
8	Midterm Examination	Lab. Manual
9	Experiments	Lab. Manual
10	Experiments	Lab. Manual
11	Experiments	Lab. Manual
12	Experiments	Lab. Manual
13	Experiments	Lab. Manual
14	Experiments	Lab. Manual

RECOMMENDED SOURCES	
Textbook	Laboratory Manual: 'Unit Operations Laboratory Manual', Dept . of Chem. Eng. ,Yeditepe University
Additional Resources	Perry's Chemical Engineering Handbook, Perry ,R.H. and D.W.Green, 7 th Ed., McGraw Hill, 1997

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	20
Lab Work	11	50
Term Project	1	10
Total		**80**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		20
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		80
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.					
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					**X**
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					**X**
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					**X**
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.					**X**
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.					**X**
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					
9	Awareness of professional and ethical responsibility.					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 12x Total course hours)	13	3	39
Hours for off-the-classroom study (Pre-study, practice)	14	3	42
Midterm examination	1	2	2
Homework	6	2	12
Project	1	40	40
Final examination	1	3	3
Total Work Load			126
Total Work Load / 25 (h)			5.0
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
Computer Applications in CHBE	**CHBE 311**	**5**	**2 + 2**	**3**	**5**

Prerequisites	None

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	M. Oluş Özbek
Instructors	M. Oluş Özbek
Assistants	(to be announced)
Goals	This course aims to help the students to gain the ability to solve the mathematical problems faced in chemical and bioprocess engineering as well as statistical analysis of the collected data.
Content	Root finding in linear and nonlinear equation sets, error analysis, statistical data analysis and curve fitting, numerical differentiation and integration, solution of initial value and boundary value problems using iterative methods.

Learning Outcomes	**Program Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Ability to apply a suitable computational method for the solution of a specific problem, with the estimation of the accuracy and the error	1	1,2	A,B
2) Ability to derive iterative procedure for the common chemical engineering problems and apply them in a computer algorithm to obtain the solution.	2	1,2	A,B
3) Ability to analyze discrete plant data statistically and approximate it as continuous functions where necessary.	4,8	1,2	B,C

Teaching Methods:	1: Lecture, 2: Homework, 3: Laboratory
Assessment Methods:	A: Midterm and final exams, B: Homework, C: In-class practice

COURSE CONTENT

Week	Topics	Study Materials
1	Introduction to continuous and discrete functions	textbook
2	Error analysis	textbook
3	Root finding in single nonlinear equations, bracketing methods	textbook
4	Root finding in single nonlinear equations, open methods	textbook
5	Root finding in system of nonlinear equations, open methods	textbook
6	Solution methods for system of linear equations	textbook
7	Midterm Exam I	textbook
8	Approximation of discrete functions	textbook
9	Forward and backward differentiation methods	textbook
10	Central differentiation and integration methods	textbook
11	Regression and statistical analysis of collected data	textbook
12	Midterm Exam II	textbook
13	Iterative solution of initial value problems (ODE)	textbook
14	Iterative solution of boundary value problems (ODE)	textbook

RECOMMENDED SOURCES	
Textbook	Applied Numerical Methods With Matlab For Engineers And Scientists, 3rd Ed., S. Chapra, McGraw Hill 2012.
Additional Resources	Numerical Methods for Engineers, 6th Ed. by S. Chapra and R. Canale, McGraw Hill 2006. Numerical Methods and Modeling for Chemical Engineers, M. E. Davis, Wiley 1984. Problem Solving in Chemical Enineering With Numerical Methods, M. B. Cutlib, M. Shacham, Prentice Hall 1999.

MATERIAL SHARING	
Documents	Lecture notes, related links
Assignments	Homeworks
Exams	Exams and solutions (exluding the final)

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	60
Assignment	6	40
	Total	**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		30
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		70
	Total	**100**

COURSE CATEGORY	Background

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		NA	1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.				**X**		
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.						**X**
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.	**X**					
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					**X**	
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.	**X**					
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams. Ability to work individually.	**X**					
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.	**X**					
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.			**X**			
9	Awareness of professional and ethical responsibility.	**X**					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable	**X**					

	development.		
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.	**X**	

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Including the exam week: 16x Total course hours)	16	4	64
Hours for off-the-classroom study (Pre-study, practice)	16	1	16
Mid-terms	2	7	14
Homework	6	3	18
Final examination	1	8	8
Total Work Load			120
Total Work Load / 25 (h)			4.8
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
CHEMICAL AND BIOPROCESS ENGINEERING II: HEAT TRANSFER	**ChBE 331**	**5**	**2+2**	**3**	**6**

Prerequisites	ChBE 232 CHEMICAL AND BIOPROCESS ENGINEERING I:FLUID MECHANICS

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Compulsory
Course Coordinator	Assoc. Prof. Dr. Tuğba Davran Candan
Instructors	Assoc. Prof. Dr. Tuğba Davran Candan
Assistants	To be announced by the department
Goals	The aim of this course is to stimulate and enhance the understanding of fundamental concepts in heat transfer by chemical engineering students, and provide students with knowledge and abilities for the application of heat transfer to various engineering systems which are both theoretical and applied in nature.
Content	Introduction to heat transfer and its mechanisms: conduction, convection and radiation; steady state conduction heat transfer; heat transfer through plane, cylindrical and spherical surfaces; critical radius and insulation; finned surfaces; heat conduction using shape factors ; unsteady state conduction heat transfer: lumped system analysis; forced convection: flow through pipes and channels, nondimensional numbers; heat exchangers, LMTD and NTU analysis methods; natural convection; radiation heat transfer and applications; differential equations and methods of solution in conduction.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Adequate knowledge in mathematics, science and engineering subjects pertaining to heat transfer; ability to use theoretical and applied information in these areas to solve engineering problems relevant to heat transfer.	1,2,6	1,2	A,B,C
2) Ability to identify, formulate, and solve complicated engineering problems related to heat transfer; ability to select and apply proper analysis methods for this purpose.	1,2,6	1,2	A,B,C
3) Ability to work efficiently in intra-disciplinary teams; ability to work individually.	1,2,6	1,2	A,B,C
4) Ability to communicate effectively in writing; knowledge of a minimum of one foreign language.	1,2,7	1,2	A,B,C

Teaching Methods:	1: Lecture, 2: Problem session
Assessment Methods:	A: Homework, B: Quiz, C: Exam

COURSE CONTENT

Week	Topics	Study Materials
1	INTRODUCTION TO HEAT TRANSFER AND ITS MECHANISMS: CONDUCTION, CONVECTION AND RADIATıON	Textbook
2	STEADY STATE CONDUCTION HEAT TRANSFER; ***QUIZ 1***	Textbook
3	HEAT TRANSFER THROUGH PLANE, CYLINDRICAL AND SPHERICAL SURFACES	Textbook
4	CRITICAL RADIUS AND INSULATION; ***QUIZ 2***	Textbook
5	FINNED SURFACES; ***QUIZ 3***	Textbook
6	HEAT CONDUCTION USİNG SHAPE FACTORS	Textbook
7	UNSTEADY STATE CONDUCTION HEAT TRANSFER: LUMPED SYSTEM ANALYSİS	Textbook
8	FORCED CONVECTION: FLOW THROUGH PıPES AND CHANNELS, NONDIMENSIONAL NUMBERS; ***MID TERM EXAM 1***	Textbook
9	FORCED CONVECTION: FLOW THROUGH PIPES AND CHANNELS, NONDIMENSIONAL NUMBERS; HEAT EXCHANGERS, LMTD AND NTU METHODS	Textbook
10	HEAT EXCHANGERS, LMTD AND NTU METHODS	Textbook
11	NATURAL CONVECTION; ***QUIZ 4***	Textbook
12	RADIATION HEAT TRANSFER AND APPLICATıONS	Textbook
13	RADIATION HEAT TRANSFER AND APPLıCATIONS; ***MIDTERM EXAM 2***	Textbook
14	DIFFERENTIAL EQUATIONS AND METHODS OF SOLUTION IN CONDUCTıON	Textbook

RECOMMENDED SOURCES	
Textbook	***Textbook:*** Cengel, Yunus, Ghajar, Afshin, 'Heat and Mass Transfer: Fundamentals & Applications', 4.ed., McGraw-Hill, 2011. ***Course Notes:*** Powerpoint notes (4 slides per page) given at the beginning of the course to be photocopied by the students.
Additional Resources	Incropera, F.P., DeWitt, D.P.,Bergman, T.L., Lavine, A.S., 'Fundamentals of Heat and Mass Transfer', 6.ed., Wiley,2007.

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-term	2	50
Assignment	13	8.3
Quiz (1 Quiz is take-home)	5	25

Attendance		16,7
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.				**X**	
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.				**X**	
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.				**X**	
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.				**X**	
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					
9	Awareness of professional and ethical responsibility.					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration ((Excluding the exam and quiz hours (total of 6 hours))	14	2,3 or 4	50
Hours for off-the-classroom study (Pre-study, practice)	14	4	56
Midterm examination	2	2	4

Quiz	4	1	4
Take-home quiz (group work by 2 students)	1	6	6
Homework	13	2	26
Final examination	1	3	3
Total Work Load			149
Total Work Load / 25 (h)			5.96
ECTS Credit of the Course			6

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
CHEMICAL AND BIOPROCESS ENGINEERING III: MASS TRANSFER	**CHBE333**	**6**	**2+2**	**3**	**6**

Prerequisites	CHBE 215
Corequisites	CHBE 214

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Compulsory
Course Coordinator	Assist. Prof. Dr. Levent Organ
Instructors	Assist. Prof. Dr. Levent Organ
Assistants	To be announced by the department
Goals	The course aims to provide students with a fundamental understanding of mass transfer and separation processes and to provide knowledge and abilities to describe mass transfer using diffusion coefficients and using mass transfer coefficients, to calculate mass transfer flux, and to carry out basic design of mass transfer equipment commonly used in absorption and distillation.
Content	Molecular diffusion in gases, liquids and solids. Diffusion coefficients. Convective mass transfer and its coefficients. Mass transfer between phases (film and overall coefficients). Types of separation processes. Design of packed towers for absorption with dilute solutions. Binary distillation with reflux in plate towers with Mc-Cabe and Thiele method. Multicomponent distillation in plate towers with shortcut methods.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Ability to calculate mass transfer flux using a diffusion coefficient.	1, 7	1, 2	A, C
2) Ability to choose a mass transfer correlation for a given system and use it for the calculation of mass transfer coefficient.	1, 7	1, 2	A, C
3) Ability to calculate mass transfer flux using a mass transfer coefficient.	1, 7	1, 2	A, C
4) Ability to carry out basic design of mass transfer equipment commonly used in absorption and distillation.	1, 7	1, 2	A, C
5) Knowledge about the application of separation processes for a cleaner environment.	11	1, 2	C

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	INTRODUCTION, MOLECULAR DIFFUSION IN GASES, GENERAL FLUX EQUATION FOR DIFFUSION PLUS CONVECTION	Textbook
2	DIFFUSION COEFFICIENTS FOR GASES, MOLECULAR DIFFUSION IN LIQUIDS	Textbook
3	DIFFUSION COEFFICIENTS FOR LIQUIDS, MOLECULAR DIFFUSION IN SOLIDS	Textbook
4	CONVECTIVE MASS TRANSFER AND ITS COEFFICIENTS, DIMENSIONLESS NUMBERS, CORRELATIONS	Textbook
5	PROBLEM SOLVING, MIDTERM EXAM 1	Textbook
6	ANALOGIES, TYPES OF SEPARATION PROCESSES, EQUILIBRIUM RELATIONS BETWEEN PHASES	Textbook
7	MASS TRANSFER BETWEEN PHASES (FILM AND OVERALL COEFFICIENTS)	Textbook
8	PACKED TOWERS FOR ABSORPTION, DESIGN OF PACKED TOWERS FOR ABSORPTION (DILUTE SYSTEM)	Textbook
9	PRESSURE DROP AND FLOODING IN PACKED TOWERS	Textbook
10	PROBLEM SOLVING, MIDTERM EXAM 2	Textbook
11	VAPOR-LIQUID EQUILUBRIUM RELATIONS, INTRODUCTION TO DISTILLATION WITH REFLUX, MCCABE-THIELE METHOD	Textbook
12	RELATIVE VOLATILITY, TOTAL REFLUX AND THE FENSKE EQUATION	Textbook
13	MINIMUM AND OPTIMUM REFLUX RATIO, TRAY EFFICIENCIES, INTRODUCTION TO MULTICOMPONENT DISTILLATION	Textbook
14	SHORTCUT METHOD FOR MULTICOMPONENT DISTILLATION, FLOODING VELOCITY AND DIAMETER OF TOWERS	Textbook

RECOMMENDED SOURCES	
Textbook	Transport Processes and Separation Process Principles (Includes Unit Operations) by Christie J. Geankoplis, 4th Edition, Publisher: Prentice Hall,2003
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	81,25
Assignment	10	18,75

Lab Work		
Term Project		
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		36
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		64
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.					
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.					
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.					**X**
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					
9	Awareness of professional and ethical responsibility.					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.			**X**		

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 12x Total course hours)	12	4	48
Hours for off-the-classroom study (Pre-study, practice)	14	4.5	63

Midterm examination	2	2	4
Homework	10	3	30
Project			
Final examination	1	3	3
Total Work Load			148
Total Work Load / 25 (h)			6
ECTS Credit of the Course			6

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
SEPARATION PROCESSES	**ChBE 354**	**7**	**3+0**	**3**	**5**

Prerequisites	none
Corequisite	ChBE 333 Chemical and Bioprocess Engineering III: Mass Transfer

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Compulsory
Course Coordinator	Prof.Dr.Salih Dinçer
Instructor	Prof.Dr.Salih Dinçer
Assistants	To be announced by the department
Goals	The aim of this course is to introduce the students with the separation process methods not covered in the mass transfer course together with the underlying theoretical and applied principles of separation processes as applied in the chemical engineering practice.
Content	Classification of the methods of separation processes with specific examples; introduction of the factors affecting the selection of feasible separation processes and technological aspects of various separation processes; study of theoretical, computational/graphical and design aspects of liquid-liquid (extraction), solid-liquid (leaching), gas- or liquid-solid (adsorption; ion exchange) and liquid-solid (crystallization) separation processes with emphasis on multi-stage separation with more than 2 component; introduction to membrane separation processes: dialysis, reverse osmosis and pervaporation; study of a mechanical-physical solid-liquid separation process: filtration.

Course Learning Outcome	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1. Adequate knowledge in mathematics, science and chemical engineering subjects pertaining to separation processes; ability to use theoretical and applied information in these areas to solve various separation problems.	1,2,6	1,2	A,C
2.Ability to identify, formulate, and solve complex separation process problems; ability to select and apply proper analysis and modeling methods for this purpose.	1,2,6	1,2	A,C
3.Ability to work efficiently in intra-disciplinary teams; ability to work individually towards separation processes.	1,2,6	1,2	A,C
4. Ability to communicate effectively in writing; knowledge of a minimum of one foreign language pertaining to separation processes.	1,2,6,7	1,2	A,C

Teaching Methods:	1: Lecture, 2: Problem session
Assessment Methods:	A; Homework, B: Quiz, C: Exam

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	***INTRODUCTION TO SEPARATION PROCESS PRINCIPLES***; MECHANISMS OF SEPARATION PROCESSES; METHODS OF SEPARATION PROCESSES; SELECTION OF SEPARATION PROCESSES ***LIQUID to LIQUID SEPARATION: EXTRACTION***; EQUILIBRIUM RELATIONS; SINGLE STAGE SEPARATION; TYPES OF EXTRACTION EQUIPMENT	Textbook
2	***LIQUID to LIQUID SEPARATION: EXTRACTION***; DESIGN PRINCIPLES OF EXTRACTION TOWERS; INTERFACIAL TENSION; PERFORATED-PLATE (SIEVE-TRAY) EXTRACTION TOWERS; MECHANICALLY AGİTATED EXTRACTİON TOWERS	Textbook
3	***LIQUID to LIQUID SEPARATION: EXTRACTION***; CONTINUOUS MULTISTAGE COUNTERCURRENT EXTRACTION; COUNTERCURRENT-STAGE EXTRACTION WİTH IMMISCIBLE LIQUIDS	Textbook
4	***LIQUID to LIQUID SEPARATION: EXTRACTION***; DESIGN OF TOWERS FOR EXTRACTION; DESIGN OF PACKED TOWERS FOR EXTRACTION USING MASS-TRANSFER COEFFICIENTS	Textbook
5	***SOLID to LIQUID SEPARATION: LEACHING***; LEACHING PROCESSES IN GENERAL; PREPARATION OF SOLIDS FOR LEACHING; RATES OF LEACHING; RATE OF LEACHING WHEN DIFFUSION IN SOLID CONTROLS; TYPES OF EQUIPMENT FOR LEACHING; EQIILIBRIUM RELATIONS AND DIAGRAMS IN LEACHING	Textbook
6	***SOLID to LIQUID SEPARATION: LEACHING***; SINGLE-STAGE LEACHING and the OPERATING LINE; COUNTERCURRENT MULTISTAGE LEACHING and the OPERATING LINE; VARIABLE UNDERFLOW IN COUNTERCURRENT MULTISTAGE LEACHING; CONSTANT UNDERFLOW IN COUNTERCURRENT MULTISTAGE LEACHING	Textbook
7	***GAS OR LIQUID to SOLID SEPARATION: ADSORPTION***; EQUILIBRIUM RELATIONS FOR ADSORBENTS; BATCH ADSORPTION; DESIGN OF FIXED BED ADSORPTION COLUMNS; CONCENTRATION PROFILES; BREAKTHROUGH CONCENTRATION CURVE	Textbook
8	***MIDTERM EXAM 1***	Textbook
9	***GAS OR LIQUID to SOLID SEPARATION: ADSORPTION***; MASS TRANSFER ZONE; CAPACITY OF COLUMN AND SCALE-UP DESIGN METHOD; ADSORPTION CYCLES. **A SPECIAL CASE OF ADSORPTION: ION EXCHANGE**	Textbook
10	***LIQUID to SOLID SEPARATION: CRYSTALLIZATION;*** CRYSTALLIZATION PROCESS DESCRIPTION; EQUILIBRIUM SOLUBILITY; YIELDS AND MATERIAL BALANCES IN CRYSTALLIZATION; HEAT EFFECTS AND HEAT BALANCES IN CRYSTALLIZATION; EQUIPMENT CLASSIFICATION FOR CRYSTALLIZATION	Textbook
11	***INTRODUCTION to MEMBRANE SEPARATION PROCESSES;*** INDUSTRIAL APPLICATIONS OF DIFFERENT TYPES OF MEMBRANE PROCESSES; MEMBRANE PROPERTIES AND SHAPES;TRANSPORT IN MEMBRANES; CONCENTRATION	Textbook

	PROFILES; LIQUID PERMEATION MEMBRANE PROCESSES AND SERIES RESISTANCE CONCEPT	
12	***INTRODUCTION to MEMBRANE SEPARATION PROCESSES;*** LIQUID PERMEATION SEPARATION EXAMPLE: DIALYSIS AND REVERSE OSMOSIS; GAS PERMEATION MEMBRANE PROCESSEs; SERIES RESISTANCE CONCEPT; LIQUID TO VAPOR (OR GAS) TRANSİTİON MEMBRANE SEPARATION PROCESS: PERVAPORATION	Textbook
13	MIDTERM EXAM 2	Textbook and Course Notes
14	***STUDY OF FILTRATION: A MECHANICAL-PHYSICAL SOLID-LIQUID SEPARATION PROCESS;*** THE FILTRATION PROCESS, FILTER PROPERTIES AND BASIC FILTRATION THEORY	Textbook

RECOMMENDED SOURCES	
Textbook	***Textbook***: Christie John Geankoplis, "Transport Processes and Separation Process Principles (Includes Unit Operations)", 4/e, Pearson Education (Prentice-Hall), 2003.
Additional Resources	***Course Notes:*** Paper copy of the powerpoint course presentations.

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	83.3
Assignment	10	8.3
Attendance		8.3
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	***Expertise/Field Compulsory Course***

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.				**X**		
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.			**x**			

3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.						
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.						
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.						
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.				**X**		
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.				**X**		
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.						
9	Awareness of professional and ethical responsibility.						
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.						
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.						

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam hours (total of 4 hours))	14	3	42-4=38
Hours for off-the-classroom study (Pre-study, practice)	14	3	42
Midterm examination	2	2	4
Homework	10	4	40
Final examination	1	3	3
Total Work Load			127
Total Work Load / 25 (h)			5.1
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
MATERIALS IN CHEMICAL AND BIOLOGICAL APPLICATIONS	**CHBE 361**	**5**	**3 + 0**	**3**	**5**

Prerequisites	none

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	Assist.Prof. Erde Can
Instructors	Assist.Prof. Erde Can
Assistants	To be announced by the department
Goals	The aim of this course is to provide students with a knowledge of the structure and characteristics of different types of materials and abilities for materials selection and design with special emphasis in chemical and biological applications and economic, environmental, and societal issues in materials science and engineering.
Content	Classification of materials and properties. Atomic structure and interatomic bonding, the structure of crystalline solids, ceramics, bioceramics, bioglass and glass ceramics, polymers. Hydrojels, advanced materials used for biological applications, composites. Materials selection and design considerations. Economic, environmental and societal issues in materials science and engineering. Term project.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Adequate knowledge in structure and characteristics of different types of materials and ability to use theoretical and applied information in this area for materials design.	1,3	1,2	A,D
2) A knowledge of the prossesing methods of diffenet types of materials and the various application areas of these materials and ability to use this information in materials design and engineering.	1,3	1,2	A,D
3) Knowledge on various factors that effect materials selection during the design process. Knowledge and ability to use certain criteria for materials selection during the design process.	1,3,11	1,2	A,D
4) Knowledge of the economic, environmental and societal issues in materials science and engineering	11	1,2	A,D
5) Knowledge of advanced materilas (biocompatible, biodegradable polymers, ceramics composite materials , alloys..) used in biological applications	3,8,11	1,2	D

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	INTRODUCTION (MATERILAS SCIENCE AND APPLICATIONS)	Textbook
2	ATOMIC STRUCTURE AND INTERATOMIC BONDING	Textbook
3	THE STRUCTURE OF CRYSTALLINE SOLIDS I (METALIC CRYSTAL STRUCTURES, DENSITY CALCULATIONS, POLYMORPHISM, ALLOTROPY)	Textbook
4	THE STRUCTURE OF CRYSTALLINE SOLIDS II (POINT COORDINATES, CRYSTALLOGRAPHIC DIRECTIONS AND PLANES , DIRECTIONAL AND PLANOR DENSITIES, SINGLE CRYSTALLINE AND POLYCRYSTALLINE MATERIALS, ANISOTROPY, XRD, AMORPHOUS MATERIALS)	Textbook
5	CERAMIC MATERIALS I: STRUCTURE	Textbook
6	CERAMIC MATERIALS II: PROPERTIES	Textbook
7	CERAMIC MATERIALS III: PROCESSING AND APLLICATIONS	Textbook
8	MIDTERM I	Textbook
9	POLYMERS I: STRUCTURE	Textbook
10	POLYMERS II: PROPERTIES	Textbook
11	POLYMERS III: PROCESSING AND APLLICATIONS	Textbook
12	COMPOSITE MATERIALS	Textbook
13	ECONOMIC, ENVIRONMENTAL, AND SOCIETAL ISSUES IN MATERIALS SCIENCE AND ENGINEERING	Textbook
14	TERM PROJECTS	Textbook

RECOMMENDED SOURCES	
Textbook	CALLISTER W.D. ,"MATERIALS SCIENCE AND ENGINEERING , AN INTRODUCTİON", 8th Ed., WILEY, USA, 2011
Additional Resources	SMITH W.F.,HASHEMI J., "FOUNDATIONS OF MATERIALS SCIENCE AND ENGINEERING ", 5th Ed., Mc GRAW HILL, USA, 2011

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-term	1	64

Term Project	1	36
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		45
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		55
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.					
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.				**X**	
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.					**X**
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.					**X**
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					**X**
9	Awareness of professional and ethical responsibility.					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.					**X**

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 12x Total course hours)	13	3	39
Hours for off-the-classroom study (Pre-study, practice)	14	2	28
Midterm examination	1	2	2

Homework	7	2	14
Project	1	30	30
Final examination	1	2	2
Total Work Load			115
Total Work Load / 25 (h)			4.6
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
REACTOR DESIGN	**CHBE362**	**6**	**2+2**	**3**	**6**

Prerequisites	CHBE213– PHYSICAL CHEMISTRY LABORATORY

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	Assoc. Prof. Dr. Tuğba Davran Candan
Instructors	Assoc. Prof. Dr. Tuğba Davran Candan
Assistants	To be announced by the department
Goals	**The aim of this course is to develop a fundamental understanding of reaction engineering and to enable students to identify, formulate, and solve complex chemical reaction engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.**
Content	Kinetics of homogeneous reactions, analysis of simple and complex rate equations; correlation of rate data, global rates, isothermal and non-isothermal operation of homogeneous reactors: ideal batch, plug-flow and stirred-tank reactors; multiple reactor systems, deviations from ideal performance, design of ideal reactors for multiple reactions.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Understanding of chemical reaction engineering principles and concepts;	1,6	1,2,3,4	A
2) Adequate knowledge in mathematics, science and engineering subjects pertaining to reaction engineering; ability to use theoretical and applied information in these areas to model and solve reaction engineering engineering problems	1,6	1,2,3,4	A
3) Ability to identify, formulate, and solve complex chemical reaction engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.	3,6	1,2,3,4	A
4) Ability to devise, select, and use modern techniques and tools needed for the design of reactors	4,6	1,2,3,4	A

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Case-study, 4: Problem solving
Assessment Methods:	A: Exams consisting of theoretical and numerical questions.

COURSE CONTENT

Week	Topics	Study Materials
1	The general mole balance equation and ideal reactors	Textbook
2	Conversion and reactor sizing (isothermal) I	Textbook
3	Conversion and reactor sizing (isothermal) II	Textbook
4	REVIEW - MIDTERM EXAM 1	Textbook
5	Rate laws and stoichiometry I	Textbook
6	Rate laws and stoichiometry II	Textbook
7	Isothermal reactor design	Textbook
8	REVIEW - MIDTERM EXAM 2	Textbook
9	Collection and analysis of rate data	Textbook
10	Multiple reactions	Textbook
11	REVIEW - MIDTERM EXAM 3	Textbook
12	Steady-state nonisothermal reactor design	Textbook
13	Nonideal Reactors	Textbook
14	REVIEW - MIDTERM EXAM 4	Textbook

RECOMMENDED SOURCES	
Textbook-Lecture Notes	Textbook: ELEMENTS OF CHEMICAL REACTION ENGINEERING, H.Scott Fogler (4th Edition), Pearson Education. Lecture Notes: by Sevil Ünal
Additional Resources	CHEMICAL REACTION ENGINEERING, Octave Levenspiel, John Wiley& Sons

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Midterms	4	100
Assignment	9	0
Lab Work	0	0
Term Project	0	0

Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.					**X**
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					**X**
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.				**X**	
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.				**X**	
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.					
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					
9	Awareness of professional and ethical responsibility.					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam days: 12x Total course hours)	12	4	48
Hours for off-the-classroom study (Pre-study, practice)	14	4	56
Midterm examination	4	2	8
Homework	9	3	27

Final examination	1	2	4
Total Work Load			143
Total Work Load / 25 (h)			5.72
ECTS Credit of the Course			6

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
Mathematical Modeling in CHBE	**ChBE 386**	**6**	**2 + 2**	**3**	**6**

Prerequisites	CHBE 311
Corequisite	CHBE 362, CHBE 331

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	Assist. Prof. Dr. M. Oluş Özbek
Instructors	Assist. Prof. Dr. M. Oluş Özbek
Assistants	To be announced by the department
Goals	The aim of this course is to provide students with knowledge and abilities to model the chemical engineering problems, to develop related differential equations for deriving the design equations
Content	Mathematical models for chemical engineering processes will be developed by using the fundamental laws: conservation of mass, energy and momentum. The steady/unsteady-state lumped models will be constructed and solved. The numerical techniques in solving linear/nonlinear univariate/multivariate algebraic/differential equations, such as Gaussian Elimination, Newton-Raphson, bisection and Euler methods will be discussed. An introduction to the computer package MATLAB will be made, and MATLAB will be used extensively in the numerical analysis of the resulting equations.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Adequate knowledge in mathematics, science and engineering to model and solve the engineering problems.	1,2,3	1,2	A,C,D
2) Ability to implements the abstract concepts to imagine and visualize the engineering problems for deriving related mathematical equations	2,3,4	1,2,4	C,D
3) Ability to learn the numerical metods and program languages for the solution of complex problems	1,2,5	1,2,3	A,C
4) Ability to interrelate the basic previous knowledge with complex industrial problems.	3,8	1,2,4	C,D

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT

Week	Topics	Study Materials
1	INTRODUCTION, The BASIC CONCEPTS IN CHEMICAL ENGINEERING	Textbook
2	MODELLING	Textbook
3	ENERGY BALANCE	Textbook
4	MASS BALANCE	Textbook
5	MOMENTUM BALANCE	Textbook
6	CHEMICAL REACTOR DESIGN	Textbook
7	MIDTERM EXAM I	Textbook
8	INTRODUCTION TO MATLAB	Textbook
9	THE NUMERICAL TECHNIQUES IN SOLVING LINEAR/ NONLINEAR UNIVARIATE / MULTIVARIATE ALGEBRAIC DIFFERENTIAL	Textbook
10	GAUSSIAN ELIMINATION, NEWTON RAPHSON, BISCETION and EULER METHODS	Textbook
11	MIDTERM EXAM II	Textbook

RECOMMENDED SOURCES	
Textbook	Alkis Constantinides - Navid Mostoufi, " Numerical Methods for Chemical Engineers with MATLAB Applications " , Prentice – Hall Inc., 1999 Richard G. Rice, Duong D. Do, " Applied Mathematics and Modeling for Chemical Engineers " , J. Wiley and Sons, 2th edition, 2012
Additional Resources	Mustafa Özilgen, " Handbook of Food Process Modeling and Statistical Quality Control " , 2nd ed., CRC Press,2011

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	40
Assignment	10	20
Quizzes		20
Term Project	1	20
Total		**100**

CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		30
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		70
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.					
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					**X**
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					**X**
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.					**X**
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.					
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					**X**
9	Awareness of professional and ethical responsibility.					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 14x Total course hours)	14	4	56
Hours for off-the-classroom study (Pre-study, practice)			
Midterm examination	2	3	6
Homework	14	4	56
Project	1	30	40
Final examination	1	4	4

Total Work Load			152
Total Work Load / 25 (h)			6.08
ECTS Credit of the Course			6

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
Summer Practice	**ChBE 400**	**7**	**0 + 2 + 0**	**0**	**1**

Prerequisites	AFE 132

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	Prof.Dr.Süheyla Uzman
Instructors	Prof.Dr.Süheyla Uzman
Assistants	To be assigned by the department
Goals	The aim of this course is the presentation of the summer practice by the students
Content	.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Ability to use acquired knowledge during summer practice	1,4	4	D
2) Ability to work as a part of a team	4,6	1,2,3,4	D

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT

Week	**Topics**	**Study Materials**
1	Presentation	Summer Practice Report
2	Presentation	Summer Practice Report
3	Presentation	Summer Practice Report
4	Presentation	Summer Practice Report
5	Presentation	Summer Practice Report
6	Presentation	Summer Practice

		Report
7	Presentation	Summer Practice Report
8	Presentation	Summer Practice Report
9	Presentation	Summer Practice Report
10	Presentation	Summer Practice Report
11	Presentation	Summer Practice Report
12	Presentation	Summer Practice Report
13	Presentation	Summer Practice Report
14	Presentation	Summer Practice Report

RECOMMENDED SOURCES	
Textbook	
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Term Project	1	100
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		100
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**	
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods 85roject85 purpose.						
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods 85roject85 purpose.					**X**	
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information 85roject85onal effectively.					**X**	
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.						
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.					**X**	
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.					**X**	
8	Recognition of the need for lifelong learning; ability to 85rojec information, to follow developments in science and technology, and to continue to educate him/herself.						
9	Awareness of 85roject85onal and ethical responsibility.					**X**	
10	Information about business life practices such as 85roject management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.					**X**	
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.					**X**	

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 12x Total course hours)	13	1	13
Hours for off-the-classroom study (Pre-study, practice)			
Midterm examination			
Homework			
Project	1	12	12
Final examination			
Total Work Load			25
Total Work Load / 25 (h)			1.0
ECTS Credit of the Course			1

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
EXPERIMENTAL CHEMICAL AND BIOPROCESS ENGINEERING III	**ChBE 401**	**7**	**1+0+2**	**2**	**4**

Prerequisites	CHBE 333
Corequisite	CHBE 302, CHBE 362

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	Prof.Dr. Süheyla Uzman
Instructors	Prof.Dr. Süheyla Uzman
Assistants	To be announced by the department
Goals	The aim of this course is the lab scale application of Chemical Engineering Principles
Content	Following ChBE 302, more experiments on heat transfer, mass transfer,reactor types, Extraction,Adsorption,Biotechnology,a project proposal ,application and presentation.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Ability to carry out experiments on heat transfer,mass transfer, extraction,Gas Absorption,Biotechnoloy etc.	3,4,5,6	1,2,3	A,B,D
2) Ability to design, propose and present a project on one of the topics of the course	1,3,5,6	1,2,3	D
3) Ability to work in a team	4,6	1,2,3	B,D

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Experiments	Lab Manual
2	Experiments	Lab Manual
3	Experiments	Lab Manual
4	Experiments	Lab Manual

5	Experiments	Lab Manual
6	Experiments	Lab Manual
7	Experiments	Lab Manual
8	Experiments	Lab Manual
9	Experiments	Lab Manual
10	Experiments	Lab Manual
11	Project Demontration	Lab Manual
12	Experiments	Lab Manual
13	Experiments	Lab Manual
14	Project Presentation	Lab Manual

RECOMMENDED SOURCES	
Textbook	Laboratory Manual: 'Unit Operations Laboratory Manual', Dept . of Chem. Eng. ,Yeditepe University
Additional Resources	Perry's Chemical Engineering Handbook, Perry ,R.H. and D.W.Green, 7 th Ed., McGraw Hill, 1997

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Lab Work	7	50
Term Project	1	30
Total		**80**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		20
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		80
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					X	
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.						
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					X	
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					X	
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					X	
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.					X	
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.					X	
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.						
9	Awareness of professional and ethical responsibility.						
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.						
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.						

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 12x Total course hours)	12	3	36
Hours for off-the-classroom study (Pre-study, practice)	14	3	42
Project	1	45	45
Final examination	1	3	3
Total Work Load			126
Total Work Load / 25 (h)			5.0
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
PROCESS DYNAMICS AND CONTROL	**CHBE441**	**7**	**2+2**	**3**	**6**

Prerequisites	CHBE 386 MATHEMATICAL MODELING IN CHBE

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	Assist. Prof. Dr. M. Oluş Özbek
Instructors	Assist. Prof. Dr. M. Oluş Özbek
Assistants	To be announced by the department
Goals	The aim of this course is to provide students with knowledge and abilities to design process control block diagrams and analysis of the closed loop block diagrams.
Content	Introduction to the basic principles of process analysis, modeling and control techniques in chemical engineering, classification of transport phenomena models, subsystem analysis, numerical examples on tank systems, reaction kinetics, fluid flow and stagewise operations. Linearization of nonlinear models. Laplace transforms of linear dynamic model equations. PID control.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Adequate knowledge in process control concepts; ability to use theoretical and applied information in the area of process control and solve engineering problems.	1,6	1,2	A,B,C
2) Ability to draw closed loop control block diagrams and stability analysis	1,4	1,2	A,B,C

Teaching Methods:	1: Lecture, 2: Question-Answer
Assessment Methods:	A: Testing, B: Homework, C: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	INTRODUCTION	Textbook
2	FUNDAMENTAL MODELS	Textbook
3	LAPLACE TRANSFORMS	Textbook
4	TRANSFER FUNCTIONS	Textbook

5	DYNAMIC PROCESS MODELS	Textbook
6	DYNAMIC BEHAVIOUR OF FIRST ORDER PROCESSES	Textbook
7	MIDTERM EXAM I	Textbook
8	DYNAMIC BEHAVIOUR OF SECOND ORDER PROCESSES	Textbook
9	DYNAMIC RESPONSE OF SECOND ORDER PROCESSES	Textbook
10	FEEDBACK CONTROL	Textbook
11	CLOSED LOOP CONTROL TRANSFER FUNCTIONS	Textbook
12	MIDTERM EXAM 2	Textbook
13	STABILITY OF CLOSED LOOP CONTROL SYSTEMS	Textbook
14	ROUTH STABILITY CRITERION	Textbook

RECOMMENDED SOURCES	
Textbook	PROCESS DYNAMICS AND CONTROL, D. E. SEBORG, D.A. MELLICHAMP, T. F. EDGAR, F. J. DOYLE 3RD EDITION, (2011) JOHN WILEY AND SONS
Additional Resources	PROCESS DYNAMICS: MODELING, ANALYSIS AND SIMULATION B. WAYNE BEQUETTE PRENTICE-HALL, (1998)

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	(40*100/65) 62
Assignment	10	(12*100/65) 18
Term Project	1	(13*100/65) 20
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		35
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		65
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**	
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.						
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.						
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					**X**	
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.						
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.						
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.						
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.						
9	Awareness of professional and ethical responsibility.						
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.						
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.						

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 12x Total course hours)	12	4	48
Hours for off-the-classroom study (Pre-study, practice)	14	2	28
Midterm examination	2	2	4
Homework	10	2	20
Project	1	30	22
Final examination	1	3	3
Total Work Load			125
Total Work Load / 25 (h)			5.0
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
CHEMICAL & BIOCHEMICAL PROCESS DESIGN I	**ChBE 463**	**7**	**3 + 2**	**4**	**6**

Prerequisites	i. A minimum of 80 credits (of 139 graduation credits) should be satisfied, and ii. In addition to (i), student should pass (with minimum DD grade) minimum two of the following courses: a) CHBE-232 Fluid Dynamics b) CHBE-331 Heat Transfer c) CHBE-333 Mass Transfer d) CHBE-362 Reactor Design

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Compulsory
Course Coordinator	Assist. Prof. Dr. Betül Ünlüsü
Instructors	Assist. Prof. Dr. Betül Ünlüsü
Assistants	To be announced by the department
Goals	The aim of this course is to introduce students the industrial applications of chemical engineering principles, basically in process design and execution of process plant projects.
Content	Introduction to process plant projects and design; review of general characteristics of chemical processes; cost estimating for equipment & capital investment; process design heuristics; plot plan and layouts; introduction to project management and multidisciplinary nature of design; other responsibilities of engineering such as HSE, ethics and legal matters; use of computer applications for process simulation, iterative calculations, reporting & presentation; a term project on design of a process unit and homework on pipe & pump sizing of a plant section performed by teams of students.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Application of chemical engineering principles to process design problems; capability of using theoretical and practical (heuristics) information in equipment and process design.	1,2,3,6	1,2	A,C,D
2) Use of computer applications (i.e., Chemcad simulations & MS Excel calculations) in iterative decision making.	4	1,2	A,C,D
3) Cost estimating for major process equipment & capital investment for process plants.	1,2,3	1,2	A
4) Introduction to project management, multidiscipline engineering and other project functions involved in process plant projects.	6,9,10	1,2	A
5) Basic knowledge on other requirements of professional engineering in process plant projects such as HSE (Health, Safety & Environment), ethics, legal aspects, standards, codes and regulations.	9,11	1,2	A

6) Getting prepared for professional working life by work sharing within a team, writing formal technical reports as well as presenting the same in the class with visual aids such as MS PowerPoint.	6,7	1,2	A,C,D

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT

Week	Topics	Study Materials
1	INTRODUCTION TO PROCESS PLANT PROJECTS, PROJECT MANAGEMENT & MULTICISCIPLINARY ENGINEERING	Notes in class
2	PROCESS FLOW DIAGRAMS	Textbook
3	GENERAL FEATURES OF PROCESS DESIGN	Recommended Sources
4	GENERAL FEATURES OF PROCESS DESIGN + CHEMCAD TRAINING	Recommended Sources
5	GROUP PRESENTATIONS ON LITERATURE SURVEY FOR THE TERM PROJECT + INSTRUCTIONS FOR THE NEXT STEP OF THE PROJECT	Literature
6	STRUCTURE OF PROCESS DESIGN + MATERIAL BALANCES	Recommended Sources
7	ENERGY BALANCES + PROCESS DESIGN FOR PIPING SYSTEMS	Recommended Sources
8	HEURISTICS & TUTORIAL ON PIPE & PUMP SIZING HOMEWORK	Textbook
9	HEURISTICS + MIDTERM	Textbook
10	FCI COST ESTIMATING FOR PROCESS EQUIPMENT & PLANTS	Textbook
11	COST ESTIMATING + INSTRUCTIONS ON ENERGY BALANCES OF THE PROJECT	Textbook
12	TUTORIAL ON ENERGY BALANCES OF THE PROJECT	Recommended Sources
13	PLOT PLAN & LAYOUTS	Notes in class+Textbook
14	MULTIDISCIPLINE FUNCTIONS IN PROJECTS, HSE, ETHICS & OTHER RECOMMENDED PRACTICES	Notes in class+Textbook

RECOMMENDED SOURCES

Textbook	**Turton, R., Bailie, R. C., Whiting, W. B., Shaeiwitz, J. A., "Analysis, Synthesis, and Design of Chemical Processes", 3rd Ed., Prentice Hall, 2009.**
Additional Resources	Sinnott R.K., Coulson J.M, Richardson J.F. Chemical Engineering Design" vol.6, 4th Ed., Pergamon Press, Oxford, 2005 Peters, M. S., Timmerhaus, K., West, R. E., "Plant Design and Economics for Chemical Engineers", 5th Ed., McGraw Hill, 2003.

MATERIAL SHARING

Documents	

Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-term	1	27
Main project (in 3 consecutive reporting & presentaion steps)	1	42
Quizzes	2	12
Homework	1	6
Attendence & participation to discussions in class		13
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		25
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		75
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.				**x**	
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.				**x**	
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					**x**
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.			**x**		
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.				**x**	
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.				**x**	
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.		**x**			
9	Awareness of professional and ethical responsibility.			**x**		
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.				**x**	

11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.			**x**			

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 13 x Total course hours)	13	5	65
Hours for off-the-classroom study (Pre-study, practice)	14	2.5	35
Midterm examination	1	2	2
Homework	1	10	10
Project	1	60	60
Final examination	1	3	3
Total Work Load			175
Total Work Load / 25 (h)			7.0
ECTS Credit of the Course			7

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
CHEMICAL AND BIOCHEMICAL PROCESS DESIGN II	**CHBE 464**	**8**	**2 + 2**	**3**	**6**

Prerequisites	CHBE 463 – CHEMICAL AND BIOCHEMICAL PROCESS DESIGN I

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Compulsory
Course Coordinator	Assist. Prof. Dr. Betül Ünlüsü
Instructors	Assist. Prof. Dr. Betül Ünlüsü
Assistants	To be announced by the department
Goals	The aim of this course is to introduce students the industrial applications of chemical engineering principles, basically in process design
Content	Study of fundamental concepts in chemical plant design, organization of chemicals manufacturing plants and the economic considerations associated with the investment, feasibility and operation of such plants, mathematical model formulation of chemical and physical processes and design of such plants with considerations of space and technology as well as social and ethical factors.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
Application of chemical engineering principles to process design problems; capability of using theoretical and practical (heuristics) information in equipment and process design.	1,2,3,6	1,2	A,D
Use of computer applications (i.e., Chemcad simulations & MS Excel calculations) in iterative decision making.	4	1,2	A,D
Cost estimating for major process equipment & capital investment economic analys's involving rate of return on investemnt for process plants.	1,2,3	1,2 4	A
Getting prepared for professional working life by work sharing within a team, writing formal technical reports as well as presenting the same in the class with visual aids such as MS PowerPoint.	6,7	1,2	A,,D
Introduction to project management, multidiscipline engineering and other project functions involved in process plant projects.	6,9,10,11	1,2	A

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT

Week	Topics	Study Materials
1	MATERIAL BALANCE ON SELECTED PROCESS(DME) + CHEMCAD	Textbook
2	ENERGY BALANCE ON DME PROCESS + CHEMCAD	Textbook
3	GROUP PRESENTATIONS	Textbook
4	DESIGN OF MAJOR EQUIPMENT IN THE PROCESS: Preheater and Cooler + HEAT INTEGRATION	Textbook+ Notes in class
5	DESIGN OF MAJOR EQUIPMENT IN THE PROCESS: Reactor	Textbook
6	GROUP PRESENTATIONS	Textbook
7	DESIGN OF SEPARATION EQUIPMENT: Condenser and Reboiler	Textbook+ Notes in class
8	DESIGN OF SEPARATION EQUIPMENT: Condenser and Reboiler + CHEMCAD	Textbook
9	DESIGN OF SEPARATION EQUIPMENT: Condenser and Reboiler	Textbook
10	MIDTERM	Textbook
11	COST ANALYSIS: Fixed capital investment, Working capital, Production costs, Raw material costs, Profitabilty analysis, Rate of return on investment	Textbook+ Notes in class
12	COST ANALYSIS: Fixed capital investment, Working capital, Production costs, Raw material costs, Profitabilty analysis, Rate of return on investment	Textbook+ Notes in class
13	FINAL REPORT AND CHEMCAD RESULTS ON MAIN FLOWSHEET WITH ALL THE STREAM INFORMATION	Textbook
14	GRUOP PRENSENTATIONS	Textbook

RECOMMENDED SOURCES	
Textbook	Turton, R., Bailie, R. C., Whiting, W. B., Shaeiwitz, J. A., "Analysis, Synthesis, and Design of Chemical Processes", 2nd Ed., Prentice Hall, 2003 Sinnott, R.K., Coulson J.M, Richardson J.F. "Chemical Engineering v.6 Design Pergamon Press", Oxford, 2004
Additional Resources	Peters, M. S., Timmerhaus, K., West, R. E., "Plant Design and Economics for Chemical Engineers", McGraw Hill, 2003

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-term	1	28.5
Assignments and Presentations	4	57
Attendance and participation to discussions in class		14.5

Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		30
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		70
Total		**100**

COURSE CATEGORY	Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**x**
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.					**x**
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					**x**
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.			**x**		
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.					
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.				**x**	
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.		**x**			
9	Awareness of professional and ethical responsibility.			**x**		
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.			**x**		
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.		**x**			

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 13x Total course hours)	13	4	52
Hours for off-the-classroom study (Pre-study, practice)	14	2.5	35
Midterm examination	1	1.5	1.5
Homework			

Project	4	15	60
Final examination	1	1.5	1.5
Total Work Load			150
Total Work Load / 25 (h)			6.0
ECTS Credit of the Course			6

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
ENGINEERING PROJECT	**CHBE 492**	**8**	**1+0+4**	**3**	**8**

Prerequisites	Graduation Standing

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Compulsory
Course Coordinator	Assist. Prof. Dr. M. Oluş Özbek
Instructors	To be assigned by the department
Assistants	To be assigned by the department
Goals	The aim of this course is for students to learn how to conduct research on a topic of significance to engineering and/or scientific communities and present the findings of research in an oral and written format
Content	Investigation and report writing on a special topic under the supervision of a faculty member

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Ability to investigate a topic in the field of chemical engineering and related disciplines	1,4,6,8,11	1,2,4	D
2) Knowledge of a contemporary subject in science and engineering	1,6,8,11	1,2,4	D
3) Communicate results of research in English both orally and in writing	7	1,2,4	D

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	RESEARCH UNDER THE SUPERVISION OF A FACULTY MEMBER	BOOKS, RESEARCH ARTICLES
2	RESEARCH UNDER THE SUPERVISION OF A FACULTY MEMBER	BOOKS, RESEARCH ARTICLES
3	RESEARCH UNDER THE SUPERVISION OF A FACULTY MEMBER	BOOKS, RESEARCH ARTICLES
4	RESEARCH UNDER THE SUPERVISION OF A FACULTY MEMBER	BOOKS, RESEARCH ARTICLES

5	RESEARCH UNDER THE SUPERVISION OF A FACULTY MEMBER	BOOKS, RESEARCH ARTICLES
6	RESEARCH UNDER THE SUPERVISION OF A FACULTY MEMBER	BOOKS, RESEARCH ARTICLES
7	RESEARCH UNDER THE SUPERVISION OF A FACULTY MEMBER	BOOKS, RESEARCH ARTICLES
8	RESEARCH UNDER THE SUPERVISION OF A FACULTY MEMBER	BOOKS, RESEARCH ARTICLES
9	RESEARCH UNDER THE SUPERVISION OF A FACULTY MEMBER	BOOKS, RESEARCH ARTICLES
10	RESEARCH UNDER THE SUPERVISION OF A FACULTY MEMBER	BOOKS, RESEARCH ARTICLES
11	RESEARCH UNDER THE SUPERVISION OF A FACULTY MEMBER	BOOKS, RESEARCH ARTICLES
12	RESEARCH UNDER THE SUPERVISION OF A FACULTY MEMBER	BOOKS, RESEARCH ARTICLES
13	RESEARCH UNDER THE SUPERVISION OF A FACULTY MEMBER	BOOKS, RESEARCH ARTICLES
14	RESEARCH UNDER THE SUPERVISION OF A FACULTY MEMBER	BOOKS, RESEARCH ARTICLES

RECOMMENDED SOURCES	
Textbook	
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Project	1	100
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		100

Total		**100**

COURSE CATEGORY	**Expertise/Field Courses**

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.					
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					**X**
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.			**X**		
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.					**X**
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					**X**
9	Awareness of professional and ethical responsibility.					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.				**X**	

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Hours for off-the-classroom study	14	12	168
Meeting with supervisor	14	2	28
Oral Presentation	1	0.5	0.5
Total Work Load			196.5
Total Work Load / 25 (h)			7.9
ECTS Credit of the Course			8

ELECTIVE COURSES

COURSE INFORMATON					
Course Title	Code	Semester	L+P Hour	Credits	ECTS
Inorganic Technologies	CHBE 351	6,7,8	3 + 0	3	5

Prerequisites	None

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Technical Elective
Course Coordinator	M. Mete Göknel
Instructors	M. Mete Göknel
Assistants	(to be announced)
Goals	A general knowledge of unit operations and unit processes concerning the technologies applied to inorganic industries.
Content	Industrial water treatment. Sulphuric acid manufacture. Chlor-Alkali Industry, chlorine, caustic soda and soda ash manufacture. Industrial gases. Fertilizers. Cement and silicate industries. Salt and miscellaneous sodium compounds. Pulp and Paper Industries. Outlook of Turkey inorganic technologies

Course Learning Outcomes	Program Learning Outcomes	Teaching Methods	Assessment Methods
1) General information on unit operations and unit processes, historical background	4, 7, 8	1,2	A,B
2) Processes applied in manufacturing of inorganic industrial chemicals, products and goods.	4, 6, 7, 9, 10, 11	1,2	A,B
3) Outlook of Turkey inorganic industrial manufacturing	6, 7, 8, 9, 11	1,2	A,B

Teaching Methods:	1: Lecture, 2: Homework, 3: Laboratory
Assessment Methods:	A: Midterm and Final exams, B: Homework, C: In-class practice

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Introduction, general info on inorganic technology concepts, syllabus	Textbook, lecture notes
2	Basic info about unit operations and unit processes	Textbook, lecture notes

3	Water conditioning and Industrial water treatment	Textbook, lecture notes
4	Sulphuric acid manufacture	Textbook, lecture notes
5	Chlor-Alkali industry, chlorine, caustic soda and soda ash manufacturing	Textbook, lecture notes
6	Chlor-Alkali industry, chlorine, caustic soda and soda ash manufacturing	Textbook, lecture notes
7	Industrial gases	Textbook, lecture notes
8	Fertilizers	Textbook, lecture notes
9	Cement and silicate industries	Textbook, lecture notes
10	Cement and silicate industries	Textbook, lecture notes
11	Salt and miscellaneous sodium compounds	Textbook, lecture notes
12	Pulp and paper industries	Textbook, lecture notes
13	Outlook of Turkey inorganic manufacturing technologies	Textbook, lecture notes
14	Final review of energy topics, questions and answers	Textbook, lecture notes

RECOMMENDED SOURCES	
Textbook	Shreve's Chemical Process Industries, George T. AUSTIN, Fifth Edition, McGraw-Hill and lecture notes

MATERIAL SHARING	
Documents	Textbook and lecture notes,
Assignments	Homeworks
Exams	Exams and solutions (excluding the Final Exam)

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Attendance & Contribution to topics during lecture		4
Mid-term	1	40
Homework + Term Project/Presentation	4	16
Total		**60**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise / Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.						
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.						
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.						
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.				X		
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.						
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.			X			
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.				**X**		
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.			X			
9	Awareness of professional and ethical responsibility.				X		
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.			X			
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.		X				

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (13 weeks excluding the exams)	13	3	39
Hours for off-the-classroom study (Pre-study, practice)	14	3	42
Midterm examination	1	3	3
Homework	3	6	18
Presentation/Project	1	10	10
Final examination	1	3	3
Total Work Load			115
Total Work Load / 25 (h)			4.6
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
Organic Technologies	CHBE 352	6,7,8	3 + 0	3	5

Prerequisites	None

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Technical Elective
Course Coordinator	M. Mete Göknel
Instructors	M. Mete Göknel
Assistants	(to be announced)
Goals	A general knowledge of unit operations and unit processes concerning the technologies applied to organic industries.
Content	Carbonization of coal and coal chemicals. Petroleum Refining and products. Petrochemicals. Soap and detergents. Sugar industries. Oils, Fats and Waxes. Outlook of Turkey organic technologies.

Course Learning Outcomes	Program Learning Outcomes	Teaching Methods	Assessment Methods
1) General information on unit operations and unit processes, historical background	4, 7, 8	1,2	A,B
2) Processes applied in manufacturing of organic industrial chemicals, products and goods.	4, 6, 7, 9, 10, 11	1,2	A,B
3) Outlook of Turkey organic industrial manufacturing	6, 7, 8, 9, 11	1,2	A,B

Teaching Methods:	1: Lecture, 2: Homework, 3: Laboratory
Assessment Methods:	A: Midterm and Final exams, B: Homework, C: In-class practice

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Introduction, general info on organic technology concepts, syllabus	Textbook, lecture notes
2	Basic info about unit operations and unit processes	Textbook, lecture notes

3	Carbonization of coal and coal chemicals	Textbook, lecture notes
4	Carbonization of coal and coal chemicals	Textbook, lecture notes
5	Petroleum Refining and products	Textbook, lecture notes
6	Petroleum Refining and products	Textbook, lecture notes
7	Petrochemicals	Textbook, lecture notes
8	Petrochemicals	Textbook, lecture notes
9	Soap and detergents	Textbook, lecture notes
10	Sugar industries	Textbook, lecture notes
11	Oils, Fats and Waxes.	Textbook, lecture notes
12	Oils, Fats and Waxes.	Textbook, lecture notes
13	Outlook of Turkey organic manufacturing technologies	Textbook, lecture notes
14	Final review of energy topics, questions and answers	Textbook, lecture notes

RECOMMENDED SOURCES	
Textbook	Shreve's Chemical Process Industries, George T. AUSTIN, Fifth Edition, McGraw-Hill and lecture notes

MATERIAL SHARING	
Documents	Textbook and lecture notes
Assignments	Homeworks
Exams	Exams and solutions (excluding the Final Exam)

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Attendance & Contribution to topics during lecture		4
Mid-term	1	40
Homework + Term Project/Presentation	4	16
Total		**60**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise / Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.						
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.						
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.						
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.				X		
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.						
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.			X			
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.				**X**		
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.			X			
9	Awareness of professional and ethical responsibility.				X		
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.			X			
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.		X				

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (13 weeks excluding the exams)	13	3	39
Hours for off-the-classroom study (Pre-study, practice)	14	3	42
Midterm examination	1	3	3
Homework	3	6	18
Presentation/Project	1	10	10
Final examination	1	3	3
Total Work Load			115
Total Work Load / 25 (h)			4.6
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	Code	Semester	L+P Hour	Credits	ECTS
Process Safety And Risk Analysis	CHBE 357	6,7,8	3 + 0	3	5

Prerequisites	none

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Technical Elective
Course Coordinator	Betül Ünlüsü
Instructors	Betül Ünlüsü
Assistants	(to be announced)
Goals	The aim of this course is to provide students with an understanding of the fundamentals of chemical process safety and the related technologies used in the industry.
Content	Understanding, mitigating, or eliminating the risks associated with handling chemicals. Various methods to determine exposure, radiation, and environment risk assessments. methods to control processes with flammable materials or potential runaway reactions.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Knowledge of fundamental concepts in chemical process safety	1,6,7,8,9,10,11	1,2	A,C
2) Knowledge of inherent safety principles and traditional safety measures. Ability to apply inherent safety to chemical process design.	3,6,7,8,9,10,11	1,2,4	A,C,D
3) Knowledge of case histories of major accidents in chemical process industry.	1,6,7,8,9,10,11	1,2,4	A,C

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	INTRODUCTION TO CHEMICAL PROCESS SAFETY	Textbook
2	LAWS & REGULATIONS ON OCCUPATIONAL HEALTH ANS SAFETY	Textbook
3	FIRES AND EXPLOSIONS	Textbook

4	PROCESS HAZARDS	Textbook
5	PROCESS HAZARDS	Textbook
6	RELIEF SYSTEMS FOR PROCESS FLUIDS	Textbook
7	RISK ASSESSMENT	Textbook
8	RISK ASSESSMENT	Textbook
9	MIDTERM EXAM	Textbook
10	INHERENT SAFETY	Textbook
11	DESIGNS FOR PROCESS SAFETY	Textbook
12	DESIGNS FOR PROCESS SAFETY	Textbook
13	DESIGNS FOR PROCESS SAFETY	Textbook
14	CASE HISTORIES	Textbook

RECOMMENDED SOURCES	
Textbook	Louvar, J.F, & Crowl D.A, 2011. Chemical Process Safety, 3rd edition, Prentice Hall.
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-term Exam	1	30
Assignment	5	12
Quiz	2	6
Term Project	1	12
Total		**60**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise / Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.			X			
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.						
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.			X			
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.						
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.						
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.				X		
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.			X			
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.			X			
9	Awareness of professional and ethical responsibility.			X			
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.			X			
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.				X		

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 13 weeks)	13	3	39
Hours for off-the-classroom study (Pre-study, practice)	14	3	42
Midterm examination	1	2	2
Homework	5	2	10
Project	1	30	30
Final examination	1	2	2
Total Work Load			125
Total Work Load / 25 (h)			5.0
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
Introduction to Biochemical Engineering	CHBE 373	6,7,8	3 + 0	3	5

Prerequisites	None

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Technical Elective
Course Coordinator	Süheyla Uzman
Instructors	Süheyla Uzman
Assistants	(to be announced)
Goals	This course aims to help the students to gain an insight to fundamentals of biochemical engineering and biotechnology
Content	Introduction to biochemical engineering, enzymes ,microbial growth and chemical kinetics, application of chemical engineering principles to the design and operation of industrial microbial processes. Design and operation of fermentation processes, immobilized enzymes and cell reactors, biological waste water treatment

Learning Outcomes	**Program Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Gain of knowledge to understand the problems due to microbiological causes confronted in chemical engineering practice	1	1,2	A,B
2) Ability to use fermentation methods to obtain specific products	1	1,2	A,B
3) Ability to design suitable fermenters for desired specific products	3	1,2	A,B

Teaching Methods:	1: Lecture, 2: Homework, 3: Laboratory
Assessment Methods:	A: Midterm and final exams, B: Homework, C: In-class practice

COURSE CONTENT

Week	Topics	Study Materials
1	Introduction	textbook
2	Microbiology	textbook
3	Microbiology	textbook
4	Microbial growth kinetics	textbook
5	Enzymes	textbook
6	Enzyme kinetics and immobilized enzymes	textbook
7	Midterm Exam I	textbook
8	Industrial applications of enzymes	textbook
9	Fermentation	textbook
10	Cell kinetics and fermentor design	textbook
11	Mixed populations	textbook
12	Seperation and purification processes	textbook
13	Midterm Exam II	textbook
14	Biological wastewater treatment	textbook

RECOMMENDED SOURCES	
Textbook	Bailey and Ollis, "Biochemical Engineering Fundamentals", 2 nd Ed. McGraw Hill,1986
Additional Resources	

MATERIAL SHARING	
Documents	Lecture notes, related links
Assignments	Homeworks
Exams	Exams and solutions (exluding the final)

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	50
Assignment	1	20
Total		**70**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		30

CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		70
Total		**100**

COURSE CATEGORY	Expertise / Field Courses

	COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution						
		NA	1	2	3	4	5	
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.				**X**			
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.				x			
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.				x			
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.	x						
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					x		
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams. Ability to work individually.					x		
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.	**X**						
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.			**X**				
9	Awareness of professional and ethical responsibility.						x	
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.	**X**						
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.						x	

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 12 weeks)	12	3	36
Hours for off-the-classroom study (Pre-study, practice)	14	3	42
Mid-terms	2	3	6
Homework	7	4	28
Final examination	1	3	3
Total Work Load			115
Total Work Load / 16 (h)			4.6
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
ELEMENTS OF SUSTAINABLE CHEMICAL ENGINEERING	**CHBE 378**	**6,7,8**	**3 + 0**	**3**	**5**

Prerequisites	none

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Restricted Elective
Course Coordinator	Assist. Prof. Betül Ünlüsü
Instructors	Assist. Prof. Betül Ünlüsü
Assistants	To be assigned by the department
Goals	The aim of this course is to help students develop an understanding of the fundamental concepts of sustainability and gain the ability to design and operate chemical processes which meet the triple bottom line of environment, economics, and society.
Content	Sustainabiliy concepts. Green chemistry and process metrics. Role of chemical reaction engineering in sustainable development. Waste reduction in chemical reactors and separation processes. Life cycle analysis.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Knowledge of green chemistry and sustainable engineering principles	1,6,10	1,2	A,C
2) Ability to make meaningful comparisons between different chemistry and process options using green chemistry and engineering metrics	2,4,6,11	1,2,4	A,C
3) Knowledge of alternative solvents; ability to apply solvent selection strategies	2,4,6,11	1,2,4	A,C,D
4) Ability to select reactor and separation systems based on the principles of sustainable engineering	3,5,6	1,2,4	D
5) Ability to apply life cycle assesment methodology to chemical processes.	2,4,6,11	1,2,4	A,C
6) Ability to communicate effectively in English	7	1,2	A,C,D

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**

1	INTRODUCTION TO SUSTAINABILITY CONCEPTS	Textbook
2	GREEN CHEMISTRY PRINCIPLES	Textbook
3	GREEN AND SUSTAINABLE ENGINEERING PRINCIPLES	Textbook
4	GREEN CHEMISTRY METRICS	Textbook
5	GREEN ENGINEERING METRICS	Textbook
6	ALTERNATIVE SOLVENTS (NEAR-CRITICAL WATER, FLUOROUS SOLVENTS)	Textbook
7	ALTERNATIVE SOLVENTS (SUPERCRITICAL CARBON DIOXODE, IONIC LIQUIDS, GAS-EXPANDED LIQUIDS)	Textbook
8	REACTION CONDITIONS AND GREEN CHEMISTRY	Textbook
9	MIDTERM EXAM	Textbook
10	REACTORS AND SEPARATION PROCESSES	Textbook
11	REACTORS AND SEPARATION PROCESSES	Textbook
12	PROCESS INTENSIFICATION	Textbook
13	LIFE CYCLE ANALYSIS	Textbook
14	LIFE CYCLE ANALYSIS	Textbook

RECOMMENDED SOURCES	
Textbook	HIMENEZ-GONZALES, C., CONSTABLE, D. J. C., "GREEN CHEMISTRY AND ENGINEERING –A PRACTICAL DESIGN APPROACH", WILEY 2011.
Additional Resources	

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-term Exam	1	50
Assignment	5	17
Quiz	5	16
Term Project	1	17
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL		40

GRADE		
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise / Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.					**X**
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					**X**
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					**X**
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.		**X**			
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.				**X**	
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.			**X**		
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					
9	Awareness of professional and ethical responsibility.					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.		**X**			
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.				**X**	

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 12x Total course hours)	13	3	39
Hours for off-the-classroom study (Pre-study, practice)	14	3	42
Midterm examination	1	2	2
Homework	5	2	10
Project	1	30	30
Final examination	1	3	3

Total Work Load			126
Total Work Load / 25 (h)			5.0
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
CHEMISTRY AND ENGINEERING OF POLYMERS	**CHBE 381**	**6,7,8**	**3 + 0**	**3**	**5**

Prerequisites	-

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Restricted Elective
Course Coordinator	
Instructors	Assist.Prof. Erde Can
Assistants	
Goals	The aim of this course is to provide students with a general knowledge of polymer chemistry, polymer processing, and uses of a variety of industrial polymers, their engineering properties and engineering applications
Content	Introduction to basic principles of polymer chemistry and engineering, the chemical structure and use of a variety of industrial polymers, polymerization mechanisms and kinetics, techniques for molecular and morphological characterization, polymer processing. A variety of engineering properties, engineering applications. Term project.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) General knowledge of the chemical structures of various industrial polymers, polymerization reactions, polymer processing, engineering properties and engineering applications and ability to use theoretical and applied information in these areas to solve polymer engineering problems and to design polymeric materials	1	1,2	A,D
2)) General knowledge of advanced polymeric materials used in current applications (polymer nano-composites, fire-resistant polymers, liquid crystalline polymers, conductive polymers, biodegradable polymers,biocompatible polymers for medical applications..) and ability to access information and to follow developments in these areas.	8,11	1,4	D
3) Knowledge about the global and societal effects of polymer engineering practices on health (eg.biomedical applications of polymers) and environment and contemporary issues (eg plastic wastes, recyclable and biodegradable polymers..)	8,11	1,4	D
4) Ability to work efficiently in intra-disciplinary teams in project assignments and ability to communicate effectively both orally and in writing via preparation of project reports and presentations	6,7	1,2,4	A,D

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study

Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	INTRODUCTION (General concepts and polymer classifications)	Textbook
2	CHEMICAL STRUCTURES OF POLYMERS, MOLECULAR WEIGHT AND MOLECULAR WEIGHT DETERMINATIONS	Textbook
3	POLYMERIZATION REACTIONS I (Condensation, free radical polymerization reactions, mechanisms and kinetics)	Textbook
4	POLYMERIZATION REACTIONS II (Ionic polymerizations, copolymerization)	Textbook
5	POLYMERIZATION TECHNIQUES (Bulk, solution, suspension, emulsion polymerization and polymerization in supercritical fluids)	Textbook
6	POLYMER CHARACTERIZATION TECHNIQUES (Polymer molecular weight analysis, mechanical tests..)	Textbook
7	MIDTERM EXAM I	Textbook
8	POLYMER STRUCTURE AND PHYSICAL PROPERTIES I (Morphology and Order in Crystalline Polymers, Rheology and the Mechanical Properties of Polymers Viscous flow, rubber elasticity, viscoelasticity, glassy state and the glass transition)	Textbook
9	POLYMER STRUCTURE AND PHYSICAL PROPERTIES II (Mechanical properties of crystalline polymers, and the crystalline melting point)	Textbook
10	INDUSTRIAL POLYMERS I (Thermoplastics and elastomers)	Textbook
11	INDUSTRIAL POLYMERS II (Thermosets and engineering polymers)	Textbook
12	POLYMER PROCESSING I (Extrusion, molding etc.)	Textbook
13	POLYMER PROCESSING II (Calendering, coating etc..)	Textbook
14	PROJECT PRESENTATIONS	Textbook

RECOMMENDED SOURCES	
Textbook	FRIED,J.R., ,"POLYMER SCIENCE AND TECHNOLOGY", 2nd Ed., PRENTICE HALL,2003
Additional Resources	Mc CRUM,N.G., BUCKLEY,C.P., BUCKNALL,C.B., "PRINCIPLES OF POLYMER ENGINEERING ", 2nd Ed., OXFORD UNIVERSITY PRESS,1997.

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-term	1	64
Term Project	1	36
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		45
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		55
Total		**100**

COURSE CATEGORY	Expertise / Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**	
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.						
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.						
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.						
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.						
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.					**X**	
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.					**X**	
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					**X**	
9	Awareness of professional and ethical responsibility.						
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.						
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.					**X**	

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)

Course Duration (Excluding the exam weeks: 12x Total course hours)	13	3	39
Hours for off-the-classroom study (Pre-study, practice)	14	3	42
Midterm examination	1	2	2
Project	1	30	30
Final examination	1	2	2
Total Work Load			115
Total Work Load / 25 (h)			4.6
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
INSTRUMENTAL METHODS OF ANALYSIS	**CHBE 415**	**6,7,8**	**3 + 0**	**3**	**5**

Prerequisites	CHBE 203

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Restricted Elective
Course Coordinator	
Instructors	Assist. Prof. Semin Funda Oğuz
Assistants	Zeynep Ustaoğlu
Goals	The aim of this course is teaching modern instrumentation techniques and meanwhile supplying the theoretical knowledge beyond these techniques, the application boundaries and rules, important points to be taken into account and expertise of the interpretation of the data.
Content	Application and theory of modern instrumentation techniques, principles of instrumental analysis, atomic spectroscopy, molecular spectroscopy, chromatographic separation and various methods, possibilities and limitations in different methods and instrumental techniques, applications, observations, applicability, qualitative and quantitative measurements of chemical properties.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Ability to understand the working principles of modern instrumentations	1	1,2,3	A,B,C
2) Ability to define application areas of instrumentation techniques	4	1,3	A, B, C
3) Ability to observe and apply the instrumentation techniques	5,6	3,4	A,C
4) Ability to interpret the instrumental analyses results	5, 7	1, 3	A,B,C
5) Ability to follow the improvements in instrumentation techniques	7, 8	1,3	D

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**

1	Introduction to Molecular Spectroscopy	Textbook
2	UV/VIS Spectroscopy	Textbook
3	IR Spectroscopy	Textbook
4	IR Spectroscopy and Raman Spectroscopy	Textbook
5	NMR Spectroscopy	Textbook
6	NMR Spectroscopy	Textbook
7	Mass Spectrometry	Textbook
8	Scanning Electron Microscopy	Textbook
9	Atomic Absorption Spectrometry	Textbook
10	Separation Techniques and High Pressure Liquid Chromatography	Textbook
11	High Pressure Liquid Chromatography	Textbook
12	Gas Chromatography	Textbook
13	Differential Thermal Analysis and Differential Scanning Calorimetry	Textbook
14	Presentations	Textbook

RECOMMENDED SOURCES	
Textbook	Skoog, Holler and Niemann, ”Principles of Instrumental Analysis”, 5th Edition, Brooks/Cole, 1997
Additional Resources	Rouessac F. and Rouessac A., “Chemical Analysis, Modern Instrumentation Methods and Techniques”, 2nd Edition, Wiley,2007

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-term	1	50
Assignment	3	25
Lab Report	5	25
Term Project Presentation (substitutes two low-graded assignments)	1	17
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL		40

GRADE		
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise / Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.			**X**		
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.					
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.			**X**		
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.			**X**		
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.				**X**	
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.				**X**	
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.				**X**	
9	Awareness of professional and ethical responsibility.					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	1	14
Midterm examination	1	2	2
Homework	3	6	18
Laboratory Reports	5	6	30
Project	1	15	15

Final examination	1	2	2
Total Work Load			123
Total Work Load / 25 (h)			4.9
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	Code	Semester	L+P Hour	Credits	ECTS
World Energy Resources and Energy Politics	CHBE 431	6,7,8	3 + 0	3	5

Prerequisites	None

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Technical Elective
Course Coordinator	M. Mete Göknel
Instructors	M. Mete Göknel
Assistants	(to be announced)
Goals	The aim of this course is to provide students with a general knowledge of world energy resources, energy politics of principal actors, Turkey's energy politics, and effect of geopolitics environment, energy security, the vital importance of energy in daily life and within the economy and politics of the Country.
Content	World energy resources and their geographical distribution, supply and demand, energy security, energy and environment, role of energy in economy, industry, transportation sectors, world energy transportation routes, Turkey and energy resources of the countries in the same geography, importance of Turkey as transport route, politics to be followed.

Course Learning Outcomes	Program Learning Outcomes	Teaching Methods	Assessment Methods
1) General information on energy, energy resources, distribution of fossil energy resources, reserve and production of countries, supply and demand.	1, 7, 8	1,2	A,B
2) Energy politics, energy security, factors and actors effecting energy price politics, production methods, conventional and unconventional production and products.	1, 6, 7, 11	1,2	A,B
3) Geopolitics position of Turkey, GME or GMENA Project scenarios, energy resources of neighboring countries and their access to international markets, Anatolia as an energy bridge, energy hub concept	6, 7, 8, 9	1,4	A,B
4) Energy Technologies, primary and secondary energy production, energy efficiency, EPC-energy performance contract- applications	5, 7, 8, 9	1,2	A,B
5) Turkish energy resources, politics, laws and regulations, energy market law, EMRA	7, 8, 10,	1,2	A,B

Teaching Methods:	1: Lecture, 2: Homework, 3: Lab,
Assessment Methods:	A: Midterm and Final exams, B: Homework, C: In-class practice

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Introduction, general info on energy, concepts, syllabus	Ppt, lecture notes
2	Basic notes on energy and resources, fossil fuels, primary and secondary energy concepts	Ppt lecture notes
3	World fossil energy resources geographic distribution, reserve/production, production technologies, conventional and unconventional processes, shale gas	Ppt lecture notes
4	World energy supply and demand, transportation routes and security, pipelines and strategies	Ppt lecture notes
5	Energy politics, concept of energy security, risk management in energy security	Ppt lecture notes
6	Global energy outlook, scenarios, predictions	Ppt lecture notes
7	International politics effecting world energy politics, principal actors, GME or GMENA project scenarios,	Ppt lecture notes
8	Caspian region, Middle east, Eastern Mediterranean, Russian Federation energy resources and routes to international markets	Ppt lecture notes
9	Turkey and regional energy politics, Turkey and Anatolia as an energy bridge/energy hub,	Ppt lecture notes
10	Energy resources of Turkey, reserve/production, energy outlook	Ppt lecture notes
11	Technologies applied in electrical energy production using fossil fuels, and others; thermal, hydraulic, renewable, nuclear,	Ppt lecture notes
12	Laws, regulations applied in energy sector, EMRA, energy market	Ppt lecture notes
13	Planning, financing and application of energy investments, project and contract management, EPC applications	Ppt lecture notes
14	Final review of energy topics, questions and answers	Ppt lecture notes

RECOMMENDED SOURCES	
Textbook	The basic material is instructor's power point presentations (pot). These ppt presentations include the most up-to-date information from all relevant reports, outlooks and articles
Additional Resources	• Ensuring Energy Security, Daniel Yergin • PRICE, Daniel Yergin • The Fundamentals of Energy Security, Special Report, CERA • IEA Response System For Oil Supply Emergencies, IEA • Energy road map 2050, European Commission • Iraq Energy Outlook, IEA • Energy Statistics Manual, IEA • BP Statistical Review of World Energy, • Blood and Oil, Michael Klare • Renewable Energy, United Nations • Renewable Energy Policy Considerations for Deploying Renewables, IEA • **Hikmet Uluğbay, İmparatorluktan Cumhuriyete Petropolitik** • **Dr.**Volkan Ediger, Osmanlı'da Neft ve Petrol • Dr. Cenk Pala,20.Yüzyılın Şeytan Üçgeni - ABD - Petrol - Dolar • http://www.eia.doe.gov (Energy Information Administration, US Dept. of Energy) • http://www.iea.org (International Energy Agency) • http://www.opec.org (OPEC website) • http://ec.europa.eu/energy/index_en.html (EU Commission Energy homepage) • http://www.energy.eu (Europe's Energy Portal) • http://www.bp.com (British Petroleum's website – Reserve, production, etc data) • http://www.gazprom.com/eng (Gazprom's website) • http://www.wtrg.com (Oil Prices)

	• http://www.oil.com (Oil Prices) • http://www.enerji.gov.tr (Enerji ve Tabii Kaynaklar Bakanlığı) • http://www.epdk.gov.tr (Enerji Piyasası Düzenleme Kurulu) • http://www.tpao.gov.tr (Türkiye Petrolleri Anonim Ortaklığı) • http://www.botas.gov.tr (BOTAŞ) • http://www.yegm.gov.tr (Yenilenebilir Enerji Genel Müdürlüğü)

MATERIAL SHARING	
Documents	Lecture notes, related links
Assignments	Homeworks
Exams	Exams and solutions (excluding the Final Exam)

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Attendance & Contribution to topics during lecture		4
Mid-term	1	40
Homework + Term Project/Presentation	4	16
Total		**60**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise / Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.				**X**	
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.					
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.			**X**		
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.					**X**
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.				**X**	

8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					**X**
9	Awareness of professional and ethical responsibility.					**X**
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.				**X**	
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.				**X**	

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (13 weeks, excluding the exams)	13	3	39
Hours for off-the-classroom study (Pre-study, practice)	14	2	42
Midterm examination	1	3	3
Homework	3	6	18
Presentation/Project	1	10	10
Final examination	1	3	3
Total Work Load			115
Total Work Load / 25 (h)			4.6
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	Code	Semester	L+P Hour	Credits	ECTS
Chemical And Bioprocesses	CHBE 443	6,7,8	3 + 0	3	5

Prerequisites	none

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Technical Elective
Course Coordinator	Betül Ünlüsü
Instructors	Betül Ünlüsü
Assistants	(to be announced)
Goals	The aim of this course is to equip students with the knowledge of the current status of the chemical industry and future trends, with a detailed study of the chemical and bioprocesses used in different sub-sectors.
Content	A survey of various chemical and bioprocesses as pertinent to the conventional chemical and biochemical industry considering the developments expected in the future.

Course Learning Outcomes	Program Learning Outcomes	Teaching Methods	Assessment Methods
1) Knowledge of different areas in chemical process industry, primary processes used in each area, and their flow diagrams.	1,6,7,8,9,10,11	1,2	A,C
2) Ability to make meaningful comparisons between processes used in different sub-sectors of the chemical industry.	1,6,7,8,9,10,11	1,2,4	A,C,D

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	OVERVIEW OF CHEMICAL PROCESS INDUSTRY	Course Notes
2	PETROLEUM PROCESSING	Course Notes

3	COAL TECHNOLOGIES	Course Notes
4	INORGANIC CHEMICALS	Course Notes
5	AGRICULTURAL CHEMICALS	Course Notes
6	PHARMACEUTICALS	Course Notes
7	INDUSTRIAL ENZYMES	Course Notes
8	PLASTICS	Course Notes
9	MIDTERM EXAM	Course Notes
10	RUBBER	Course Notes
11	PAINT AND COATINGS	Course Notes
12	SOAP AND DETERGENTS	Course Notes
13	BIOMASS PROCESSING	Course Notes
14	GREEN ENGINEERING	Course Notes

RECOMMENDED SOURCES	
Textbook	Instructor’s Lecture Notes
Additional Resources	Austin, G. T. 2012. Shreve's Chemical Process Industries, 5th edition, Mc-Graw Hill.

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-term Exam	1	30
Assignment	5	12
Quiz	2	6
Term Project	1	12
Total		**60**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise / Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		1	2	3	4	5	
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.			X			
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.						
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.						
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.						
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.						
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.				X		
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.			X			
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.				X		
9	Awareness of professional and ethical responsibility.			X			
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.		X				
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.				X		

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 12 weeks)	13	3	39
Hours for off-the-classroom study (Pre-study, practice)	14	3	42
Midterm examination	1	2	2
Homework	5	2	10
Project	1	30	30
Final examination	1	2	2
Total Work Load			126
Total Work Load / 25 (h)			5.01
ECTS Credit of the Course			5

COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
Statistical Quality Control For Chemical And Biological Industries	CHBE 446	6,7,8	3+0	3	5

Prerequisites	None

Language of Instruction	English
Course Level	Undergraduate
Course Type	Elective
Course Coordinator	Prof. Dr. Mustafa Özilgen
Instructors	Prof. Dr. Mustafa Özilgen
Assistants	To be assigned
Goals	Teaching fundamental concepts of statistical quality control with chemical and biological applications. Interdisciplinary group projects (3 or 4 students/group) will be prepared to improve team work, computing, and statistical quality control system design skills.
Content	Fundamental principles of statistical quality control

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
Overview of statistical models	10, 11, 13, 18	1, 2, 4	A, D
Quality control	1, 6, 10, 11, 12,13, 15, 16, 18, 24	1, 2, 4	A, D
Examples related with foods	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 26, 27, 28	1, 2, 4	A, D
Interdisciplinary project	14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26	1, 2, 4	A, D

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1-2	This is a project based statistical quality assurance system design class. The	Text Book

	students will form interdisciplinary groups during the first two weeks of the class, chose a process, and then draw the process flow diagram. Fundamental principles of the statistical quality control will be discussed	
3-6	The Nature of the data and its acquisition methods will be covered by referring to the statistical models	Text Book
7-8	The concept of manufacturing and critical control points will be discussed by referring to the HACCP principles	Text Book
9-10	Statistical quality control charts for measurements and attributes	Text Book
11-12	Standard sampling plans for quality control with attributes	Text Book
13-14	Students will choose appropriate locations in their flow charts and prepare quality control charts for measurements and attributes, and also design sampling plans as parts of their projects. FMEA methodology will be covered and the students will perform the FMEA analysis of their own process	Text Book

RECOMMENDED SOURCES	
Textbook	Özilgen, M. Food Process Modeling and Control, Chemical Engineering Applications, Gordon &Breach Publishers, Amsterdam, 1998
Additional Resources	Özilgen, M. Handbook of Food Process Modeling and Statistical Quality Control, 2nd Ed. Taylor & Francis, USA, 2011 Özilgen, M. Endüstrileşme Sürecinde Bilgi Birikiminin Öyküsü, 2nd ed. Arkadaş Yayınevi, Ankara, 2011

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Midterm Exam	2	57
Term Project	1	43
Total		**100**
Contribution of final examination to overall grade		30
Contribution of in-term studies to overall grade		70
Total		**100**

COURSE CATEGORY	Expertise / Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Theoretical knowledge about physical, chemical and biological properties of foods from animal and plant origins.					X
2	Theoretical knowledge about fundamental nutritional elements of foods from animal and plant origins and their relationship with consumers.					X
3	Theoretical knowledge about food processes and food technologies.					X
4	Theoretical knowledge about thermodynamics, heat and mass transfer and fluid mechanics in food processes.					
5	Theoretical knowledge about obtaining and maintenance of food quality and food safety.					X
6	Theoretical knowledge about national and international food regulations and laws.					X
7	Theoretical knowledge about the role of microorganisms in food processing and preservation and in good hygiene practices.					X
8	Theoretical knowledge about applications of biotechnology in the food industry.					
9	Theoretical knowledge about application of physical, chemical, biological, sensory and statistical analyses in foods and food processes.					X
10	Application of mathematics, science and fundamental engineering knowledge to identify, define and solve food engineering problems.					X
11	Analysis of foods and evaluation of data.					x
12	Application of microbiological analyses on foods and taking necessary precautions for food preservation based on the data.			x		
13	Usage of knowledge on statistical and software in food process management.					x
14	Determination of critical control points on process flow chart, identification and application of necessary corrective actions.					X
15	Transfer of theoretical knowledge about food production processes and food quality and safety to application.					X
16	Design and application of experiments in food processes, evaluation and discussion of data.					X
17	Evaluation of local and global effects of scientific and technological progress and engineering applications on health and environment.					X
18	Usage of information technologies to solve food engineering problems and to design processes.					x
19	Design of a complex system, process, equipment or product within specified requirements and boundaries, application of modern design techniques for the purpose.					x
20	Execution of planning, development and application steps of design together with food safety rules.					X
21	Consideration of consumer types and properties while designing products.					X
22	Efficient contribution to team work and inter disciplinary collaborations.					x
23	Studying individually and taking initiatives when necessary.					x
24	Appreciation of the need for lifelong learning, and for follow up on and application of developments in science and technology.					X
25	Expressing one’s self both orally and in writing in Turkish and English, using these languages effectively in professional communication.					x
26	Awareness of legal aspects of engineering practices.		x			
27	Awareness of professional ethics and responsibilities.		X			
28	Awareness of responsibilities and duties in project development, application and management for food manufacture.					x

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	**Quantity**	**Duration (Hour)**	**Total Work Load (Hour)**
Course hours (Including exams)	14	4	56
Study hours out of class	14	3	42
Project	1	12	12
Midterm – Individual study	2	12	24
Exam	2	2	4
Final – Individual study	1	24	24
Exam	1	2	2
Total Work Load			164
Total Work Load / 30 (h)			5.4
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
Wastewater Treatment	CHBE 451	6,7,8	3 + 0	3	5

Prerequisites	None

Language of Instruction	English
Course Level	Bachelor's Degree (First Cycle Programmes)
Course Type	Elective
Course Coordinator	
Instructors	
Assistants	(to be announced)
Goals	This course aims to help the students to gain an insight to wastewater treatment methods
Content	Characterization of waste-waters, principles and applications of physical, chemical and biological processes for water and waste purification. Design of engineering treatment systems to meet water quality and effluent standards. Topics include aerobic-anaerobic process assessments; defining and ranking pollution prevention options; feasibility analyses including technical and environmental aspects; and life cycle analysis.

Learning Outcomes	**Program Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Gain of knowledge to understand the problems of water pollution	1	1,2	A,B
2) Ability to use treatment methods to overcome and eliminate water pollution	1	1,2	A,B
3) Ability to design suitable methods to remove common and specific substances	3	1,2	A,B

Teaching Methods:	1: Lecture, 2: Homework, 3: Laboratory
Assessment Methods:	A: Midterm and final exams, B: Homework, C: In-class practice

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Introduction	textbook
2	Characterization of wastewaters	textbook
3	Domestic wastewater	textbook
4	Industrial wastewaters	textbook
5	Water Pollution	textbook
6	Effluent standards	textbook
7	Midterm Exam I	textbook
8	Important parameters of water pollution /definitions and analysis methods	textbook
9	BOD, COD, TOC, and others	textbook
10	Physical/Chemical Methods of Treatment	textbook
11	Biological Wastewater Treatment	textbook
12	Primary, secondary, tertiary treatment	textbook
13	Midterm Exam II	textbook
14	Life cycle analysis	textbook

RECOMMENDED SOURCES	
Textbook	"Wastewater Engineering, Treatment and Reuse", 4th Edition ,Metcalf &Eddy,Inc.,Revised by G.Tchobanoglous, F.Burton, H.D.Stensel, McGraw Hill, 2003
Additional Resources	Bailey and Ollis, "Biochemical Engineering Fundamentals", 2 nd Ed. McGraw Hill,1986

MATERIAL SHARING	
Documents	Lecture notes, related links
Assignments	Homeworks
Exams	Exams and solutions (exluding the final)

ASSESSMENT

IN-TERM STUDIES	NUMBER	PERCENTAGE
Mid-terms	2	50
Assignment	1	20
Total		**70**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		30
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		70
Total		**100**

COURSE CATEGORY	Expertise / Field Courses

	COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution						
		NA	1	2	3	4	5	
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.				**X**			
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.				x			
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.				x			
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.	x						
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					x		
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams. Ability to work individually.					x		
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.	**X**						
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.			**X**				
9	Awareness of professional and ethical responsibility.						x	

10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.	**X**	
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.	x	

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Including the exam week: 14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	2	28
Mid-terms	2	3	6
Homework	1	5	5
Final examination	1	3	3
Total Work Load			84
Total Work Load / 16 (h)			5.25
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	Code	Semester	L+P Hour	Credits	ECTS
Pollution Control and Prevention	CHBE 452	6,7,8	3+ 0	3	5

Prerequisites	None

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Technical Elective
Course Coordinator	Süheyla Uzman
Instructors	Süheyla Uzman
Assistants	(to be announced)
Goals	This course aims to help the students to gain an insight to environmental pollution and methods of prevention
Content	Pollution control, pollution prevention and control strategies with focus on hazardous substances that are toxic, persistent, and bioaccumulate, insights into some of the major factors that may influence the control of pollution sources. Traditional, and new, chemical separations processes with environmental applications

Learning Outcomes	**Program Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Gain of knowledge to understand the problems due to air, water and soil pollution	1	1,2	A,B
2) Ability to use prevention methods to overcome and eliminate pollution	1	1,2	A,B
3) Ability to design suitable methods to remove and/or regain specific substances	3	1,2	A,B

Teaching Methods:	1: Lecture, 2: Homework, 3: Laboratory
Assessment Methods:	A: Midterm and final exams, B: Homework, C: In-class practice

COURSE CONTENT

Week	Topics	Study Materials
1	Introduction	textbook
2	Types of pollution	textbook
3	Air Pollution	textbook
4	Soil Pollution	textbook
5	Water Pollution	textbook
6	Industrial Water Pollution	textbook
7	Midterm Exam I	textbook
8	Properties of Hazardous Compounds	textbook
9	Groups of Hazardous Compounds	textbook
10	Methods to control & prevent air Pollution	textbook
11	Methods to control & prevent soil Pollution	textbook
12	Methods to control & prevent water Pollution	textbook
13	Midterm Exam II	textbook
14	Regulations Worldwide & in Turkey on Environmental Pollution Control	textbook

RECOMMENDED SOURCES	
Textbook	"Wastewater Engineering, Treatment and Reuse", 4th Edition ,Metcalf &Eddy,Inc.,Revised by G.Tchobanoglous, F.Burton, H.D.Stensel, McGraw Hill, 2003
Additional Resources	Bailey and Ollis, "Biochemical Engineering Fundamentals", 2 nd Ed. McGraw Hill,1986

MATERIAL SHARING	
Documents	Lecture notes, related links
Assignments	Homeworks
Exams	Exams and solutions (exluding the final)

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	50
Assignment	1	20

Total		**70**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		30
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		70
Total		**100**

COURSE CATEGORY	Expertise / Field Courses

	COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution						
		NA	1	2	3	4	5	
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.				**X**			
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.				x			
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.				x			
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.	x						
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					x		
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams. Ability to work individually.					x		
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.	**X**						
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.			**X**				
9	Awareness of professional and ethical responsibility.						x	
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.	**X**						
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.						x	

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Including the exam week: 12 weeks)	12	3	36
Hours for off-the-classroom study (Pre-study, practice)	14	3	42
Mid-terms	2	3	6
Homework	4	7	28
Final examination	1	3	3
Total Work Load			115
Total Work Load / 25 (h)			4.6
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	Code	Semester	L+P Hour	Credits	ECTS
Heterogeneous Catalysis	CHBE 456	6,7,8	3 + 0	3	5

Corequisites	CHBE 362

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Technical Elective
Course Coordinator	Tuğba Davran-Candan
Instructors	Tuğba Davran-Candan
Assistants	(to be announced)
Goals	The aim of this course is to provide students an understanding of the fundamentals of heterogeneous catalysis.
Content	Introduction to heterogeneous catalysis, Adsorption, Diffusion & Reaction on Porous Catalysts, Catalyst Preparation, Catalyst Characterization

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Knowledge of fundamental concepts in heterogeneous catalysis	1, 2, 6, 7, 8	1,2	A, D
2) Knowledge of obtaining physical properties of catalysts	1, 2, 6, 7, 8	1,2,4	A, D
3) Knowledge of catalyst preparation and characterization	1, 2, 6, 7, 8	1,2,4	A, D
4) Knowledge of accessing and following scientific information in the field and ability to defend orally what has been acquired	1, 2, 6, 7, 8	1,2,4	A, D

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	INTRODUCTION TO HETEROGENEOUS CATALYSIS	Lecture Notes
2	ADSORPTION	Lecture Notes
3	ADSORPTION ISOTHERMS	Lecture Notes

4	PHYSICAL PROPERTIES OF SOLID CATALYSTS	Lecture Notes
5	DETERMINATION OF SURFACE AREA, PORE VOLUME & DISTRIBUTION, PORE MODELS	Lecture Notes
6	DIFFUSION IN POROUS CATALYSTS	Lecture Notes
7	CHEMICAL REACTION IN POROUS CATALYSTS	Lecture Notes
8	CASE STUDIES	Lecture Notes
9	MIDTERM EXAM	Lecture Notes
10	CATALYST PREPARATION STEPS	Lecture Notes
11	CATALYST PREPARATION METHODS	Lecture Notes
12	CATALYST CHARACTERIZATION TECHNIQUES	Lecture Notes
13	CASE STUDIES	Lecture Notes
14	ORAL PRESENTATIONS OF THE TERM PROJECT	Lecture Notes

RECOMMENDED SOURCES	
Textbook	Principles & Practice of Heterogeneous Catalysis, J. M. Thomas & W. J. Thomas
Additional Resources	Lecture Notes

MATERIAL SHARING	
Documents	Lecture Notes
Exams	Exams and solutions

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-term Exam	1	30
Term Project	1	30
Total		**60**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.				**X**	
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.			**X**		
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.					**X**
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.					**X**
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					**X**
9	Awareness of professional and ethical responsibility.					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 13 weeks)	13	3	39
Hours for off-the-classroom study (Pre-study, practice)	13	3	39
Midterm examination	1	2	2
Project	1	35	35
Final examination	1	2	2
Total Work Load			117
Total Work Load / 25 (h)			4.7
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	Code	Semester	L+P Hour	Credits	ECTS
Phase Equilibria	CHBE 457	6,7,8	3 + 0	3	5

Prerequisites	none

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Technical Elective
Course Coordinator	Betül Ünlüsü
Instructors	Betül Ünlüsü
Assistants	(to be announced)
Goals	The aim of this course is to help students gain the ability of modeling the behavior of fluid mixtures at thermodynamic phase equilibrium and develop an understanding of the significance of phase equilibrium in chemical processes
Content	Solution thermodynamics, vapor-liquid and liquid-liquid equilibria, and chemical reaction equilibria in binary and multicomponent systems; estimation of related thermodynamic properties.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Knowledge of fundamental concepts in thermodynamics of phase equilibria	1,5,6,7	1,2	A,C
2) Ability to model phase equilibria in systems with and without reactions using equations of state and activity coefficient models	2,4,6,7	1,2	A,C,D

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	INTRODUCTION TO THERMODYNAMICS OF PHASE EQUILIBRIA	Course Notes
2	EQUATIONS OF STATE	Course Notes
3	THERMODYNAMIC FUNCTIONS AND CONDITIONS OF PHASE EQUILIBRIUM	Course Notes

4	PHASE DIAGRAMS	Course Notes
5	ACTIVITY COEFFICIENTS	Course Notes
6	FUGACITY COEFFICIENTS	Course Notes
7	VAPOR-LIQUID EQUILIBRIUM	Course Notes
8	VAPOR-LIQUID EQUILIBRIUM	Course Notes
9	MIDTERM EXAM	Course Notes
10	LIQUID-LIQUID EQUILIBRIUM	Course Notes
11	VAPOR-LIQUID-LIQUID EQUILIBRIUM	Course Notes
12	SOLID-FLUID EQUILIBRIUM	Course Notes
13	CHEMICAL REACTION EQUILIBRIA	Course Notes
14	EXPERIMENTAL METHODS FOR PHASE EQUILIBRIA	Course Notes

RECOMMENDED SOURCES	
Textbook	INSTRUCTOR'S COURSE NOTES
Additional Resources	• Orbey, H., and Sandler, S. I., 1998. Modeling Vapor-Liquid Equilibria: Cubic Equations of State and their Mixing Rules. Vol. 1. Cambridge University Press. • Kontogeorgis, G. M., Folas, G. K., 2010.Thermodynamic Models for Industrial Applications. Wiley.

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Midterm Exam	1	30
Assignment	5	12
Quiz	2	6
Term Project	1	12
Total		**60**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60

Total		**100**

COURSE CATEGORY	Expertise / Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.					**X**
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					**X**
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.		**X**			
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.				**X**	
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.			**X**		
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					
9	Awareness of professional and ethical responsibility.					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.					
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION

Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 13 weeks)	13	3	39
Hours for off-the-classroom study (Pre-study, practice)	14	3	42
Midterm examination	1	2	2
Homework	5	2	10
Project	1	30	30
Final examination	1	3	3
Total Work Load			126
Total Work Load / 25 (h)			5.01

ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
Process Optimization	CHBE 458	6,7,8	3+0	3	5

Prerequisites	CHBE 386

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Technical Elective
Course Coordinator	M. Oluş Özbek
Instructors	M. Oluş Özbek
Assistants	(to be announced)
Goals	This course aims to give seniors in chemical engineering an ability to formulate optimization problems of chemical processes, to analyze and solve these problems and to compare various optimization algorithms.
Content	Fundamentals of analytical optimization. One dimensional linear-search methods. Multi-dimensional unconstrained and constrained numerical optimization algorithms. Applications of linear programming, nonlinear programming, mixed integer linear/ nonlinear programming, and parameter estimation in chemical engineering. Feasible-path and infeasible-path techniques for chemical process flowsheet optimization.

Learning Outcomes	**Program Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Ability to apply a suitable computational method for the solution of a specific problem, with the estimation of the accuracy and the error	1,2	1,2	A,B
2) Ability to derive iterative procedure for the common chemical engineering problems and apply them in a computer algorithm to obtain the solution.	1,2	1,2	A,B
3) Ability to analyze discrete plant data statistically and approximate it as continuous functions where necessary.	4,8	1,2	B,C

Teaching Methods:	1: Lecture, 2: Homework
Assessment Methods:	A: Midterm and final exams, B: Homework, C: In-class practice

COURSE CONTENT		
Week	**Topics**	**Study Materials**

1	Introduction To Optimization	Textbook, Lecture Notes
1-2	Developing Models For Optimization	Textbook, Lecture Notes
3-4	Analytical Techniques	Textbook, Lecture Notes
5-6	Unconstrained One-Dimensional Optimization	Textbook, Lecture Notes
6	Midterm I	
7-8	Unconstrained Multivariable Optimization	Textbook, Lecture Notes
9-10	Constrained Multivariable Optimization	Textbook, Lecture Notes
11-12	Global Optimization Of Continuous And Discrete Processes	Textbook, Lecture Notes
13-14	Optimization Applications On Chemical Processes	Textbook, Lecture Notes

RECOMMENDED SOURCES	
Textbook	Edgar T.F., Himmelblau D.M., and Lasdon L.S., Optimization of Chemical Processes, 2nd Edition, McGraw-Hill Book Co., 2001
Additional Resources	Venkataraman P., Applied Optimization with MATLAB Programming, Wiley, 2001 Winston W.L., Operations Research - Applications and Algorithms, Brooks Cole, 2004 Humphreys K.K. Jelen's Cost and Optimization Engineering, 3rd Ed., McGraw-Hill Book Co., 1991 Grossmann I.E., Edt., Chemical Engineering Optimization Models with GAMS, CACHE Design Case Studies Series, Case Study No:6, 1991

MATERIAL SHARING	
Documents	Lecture notes, related links
Assignments	Homeworks
Exams	Exams and solutions (exluding the final)

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	30
Assignment	2	30
	Total	**60**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		30
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		10
	Total	**100**

COURSE CATEGORY	Expertise / Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		NA	1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.						**X**
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.						**X**
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.				**X**		
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.						**X**
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.	**X**					
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams. Ability to work individually.				**X**		
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.		**X**				
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.			**X**			
9	Awareness of professional and ethical responsibility.				**X**		
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.				**X**		
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.			**X**			

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam week: 13 weeks)	13	3	39

Hours for off-the-classroom study (Pre-study, practice)	14	3	42
Mid-terms	1	2	2
Homework	10	3	30
Final examination	1	3	3
Total Work Load			116
Total Work Load / 25 (h)			4.64
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
Organic Technologies	CHBE 466	6,7,8	3 + 0	3	5

Prerequisites	None

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Technical Elective
Course Coordinator	Prof. Dr. Volkan GÜNAY
Instructors	Prof. Dr. Volkan GÜNAY
Assistants	(to be announced)
Goals	A general knowledge of production, processings and characterization concerning the technologies applied to ceramic and glass materials and industries.
Content	Introduction to ceramic engineering, Raw materials, processing of ceramic and glasses, Shaping and sintering of ceramics, Melting and casting of glasses, Properties of brittle materials, Outlook of Turkey ceramic and glass technologies and industries.

Course Learning Outcomes	Program Learning Outcomes	Teaching Methods	Assessment Methods
1) General information on ceramics and glasses, structural aspects, applications, historical background,	4, 7, 8	1,2	A,B
2) Processes applied in manufacturing of ceramics and glasses, products and goods.	4, 6, 7, 9, 10, 11	1,2	A,B
3) Outlook of Turkey; ceramic and glass industrial manufacturing and the current state of Turkish ceramic and glass industries	6, 7, 8, 9, 11	1,2	A,B

Teaching Methods:	1: Lecture, 2: Homework, 3: Laboratory
Assessment Methods:	A: Midterm and Final exams, B: Homework, C: In-class practice

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Introduction, general info on Ceramic Engineering, syllabus	Textbook, lecture notes
2	Traditional Ceramics and Industries	Textbook, lecture notes

3	Engineering Ceramics and Composites	Textbook, lecture notes
4	Glasses and glass-ceramics	Textbook, lecture notes
5	Bonding and crystal structure of Ceramics and Glasses	Textbook, lecture notes
6	Raw materials in ceramics and glasses	Textbook, lecture notes
7	Powder processing and shaping	Textbook, lecture notes
8	Sintering and mechanisms	Textbook, lecture notes
9	Manufacturing technologies in ceramics and in glasses	Textbook, lecture notes
10	Mechanical behaviours of ceramics and glasses	Textbook, lecture notes
11	Properties of ceramics and glasses	Textbook, lecture notes
12	Properties of ceramics and glasses	Textbook, lecture notes
13	Design with ceramics and glasses	Textbook, lecture notes
14	Ceramics and glass industries in Turkey	Textbook, lecture notes

RECOMMENDED SOURCES	
Textbook	Lecture notes and suggested books -Introduction to Ceramics, 2nd Edition, W.D. Kingery, D.R. Uhlmann, 1976 -Physical Ceramics: Principles for Ceramic Science and Engineering, Y-T. Chiang, D.P. Birnie, Wiley, 1997.

MATERIAL SHARING	
Documents	Textbook and lecture notes
Assignments	Homeworks
Exams	Exams and solutions (excluding the Final Exam)

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-term 1	1	30
Mid-term	1	30
Total		**60**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise / Field Courses

COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.					
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.					
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.				X	
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.					
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.			X		
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.				**X**	
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.			X		
9	Awareness of professional and ethical responsibility.				X	
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.			X		
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.		X			

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (14 weeks excluding the exams)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	4	56
Midterm examination	2	6	12
Final examination	1	3	3
Total Work Load			113
Total Work Load / 25 (h)			4.52
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
SURFACE CHEMISTRY IN NANOSCIENCE	**CHBE 468**	**6,7,8**	**3 + 0**	**3**	**5**

Prerequisites	CHBE 211 – PHYSICAL CHEMISTRY

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Restricted Elective
Course Coordinator	
Instructors	Prof. Dr. Seyda Malta
Assistants	To be announced
Goals	The aim of this course is to give the fundementals of colloid and surface chemistry and give the students the ability to apply this knowledge to nanotechnology. The course is supplemented with experiments to solidify the theoretical knowledge.
Content	Molecular interactions, self-assembly, Brownian motion, sedimentation; Surface Chemistry. Surface tension, capillary action, contact angle, methods of surface tension measurement; Surfactants, micelles, packing parameter, CMC, etc.; Electrostatics; Colloidal Stability; Phase Diagrams. Vesicles, microemulsions, emulsions, etc.; Polymers in Solution; Nanoparticles and methods of synthesis; Techniques used in Size Determination; Techniques used for Crystal Structure (XRD) and evaluation of data.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Adequate knowledge in science and technology in colloid and surface chemistry; ability to use theoretical and applied information in these areas to solve relevant problems.	1	1	A
2) Ability to devise, select, and use modern techniques such as conductivity meter, spectrophotmeter, tensiometer, zeta-potential, viscosity meter, etc needed for engineering practice; ability to employ Excel to plot data and make calculations and Word to write reports effectively.	4	1, 3	A, B
3) Ability to conduct experiments, gather data for investigating problems on colloid and surface chemistry such as sedimetation, adsorption, self-assembly and analyze and interpret results from these experiments and also data from other techniques such XRD, microscopy and light scattering.	3	1, 3	B
4) Ability to work efficiently in intra-disciplinary teams by performing experiments as a pair in the lab and ability to work individually by writing reports on these experiments and taking exams.	6	3	B

5) Ability to communicate effectively both orally and in writing by following the text book, lab manual and teaching and writing reports and exams in English.	7	1, 2, 3	A, B
6) Recognition of the need for lifelong learning; ability to access information, to follow developments in science and nanotechnology, and to continue to educate him/herself on these topics.	8	1, 2	A, B
7) Knowledge about nanotechnology and the global and societal effects of nanotechnology on health, environment, and safety.	11	1, 2	A, B

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT

Week	Topics	Study Materials
1	INTRODUCTIONS, COLLOID AND SURFACE CHEMISTRY	Textbook
2	MOLECULAR INTERACTIONS, SELF-ASSEMBLY, BROWNIAN MOTION, SEDIMENTATION EXPERIMENT: SEDIMENTATION	Textbook & Lab Manual
3	SURFACE CHEMISTRY. SURFACE TENSION, CAPILLARY ACTION, CONTACT ANGLE, METHODS OF SURFACE TENSION MEASUREMENT	Textbook
4	SURFACTANTS, MICELLES, PACKING PARAMETER, CMC, ETC EXPERIMENT: FACTORS AFFECTING SURFACE TENSION	Textbook & Lab Manual
5	ELECTROSTATICS EXPERIMENT: ADSORPTION OF POLYELECTROLYTES	Textbook & Lab Manual
6	COLLOIDAL STABILITY EXPERIMENT: FLOCCULATION AND COAGUATION	Textbook & Lab Manual
7	PHASE DIAGRAMS. VESICLES, MICROEMULSİONS, EMULSIONS, ETC EXPERIMENT: PREPARATION OF DIFFERENT COLLOIDAL STRUCTURES	Textbook & Lab Manual
8	REVIEW AND MIDTERM 1	Textbook
9	POLYMERS IN SOLUTION EXPERIMENT: DETERMINATION OF POLYMER SHAPE USING VISCOSITY MEASUREMENTS	Textbook & Lab Manual
10	NANOPARTICLES AND METHODS OF SYNTHESIS EXPERIMENT: MAGNETITE SYNTHESIS	Textbook & Lab Manual
11	TECHNIQUES USED IN SIZE DETERMINATION	Textbook

	DLS AND DISCUSSION OF TEM RESULTS	
12	TECHNIQUES USED FOR CRYSTAL STRUCTURE (XRD) AND EVALUATION OF DATA	Textbook
13	POPULAR TOPICS BY STUDENTS	Textbook
14	REVIEW AND MIDTERM 2	Textbook

RECOMMENDED SOURCES	
Textbook	Introduction to Modern Colloid Science, R. Hunter, Oxford Press,1994
Additional Resources	Laboratory Experiments Manual

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	40
Lab Reports + Lab Performance	7	25
Final	1	35
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		35
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		65
Total		**100**

COURSE CATEGORY	Expertise / Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.					**X**
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.				**X**	

3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.						
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.				**X**		
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.				**X**		
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.			**X**			
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.						
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.					**X**	
9	Awareness of professional and ethical responsibility.						
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.						
11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.					**X**	

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding two midterms: 13x Total course hours)	13	4	52
Hours for off-the-classroom study (Pre-study, practice)	13	3.5	45.5
Midterm examination	2	2	4
Reports	7	3	21
Final examination	1	3	3
Total Work Load			125
Total Work Load / 25 (h)			5.02
ECTS Credit of the Course			5

COURSE INFORMATON					
Course Title	Code	Semester	L+P Hour	Credits	ECTS
Fundamentals of Bioreactor Engineering	CHBE 475	6,7,8	3 + 0	3	5

Prerequisites	CHBE 362

Language of Instruction	English
Course Level	Bachelor's Degree
Course Type	Technical Elective
Course Coordinator	Tuğba Davran-Candan
Instructors	Tuğba Davran-Candan
Assistants	(to be announced)
Goals	This course aims to help the students to gain knowledge about bioreactors and their applications in addition to the ability of basic bioreactor design.
Content	Enzymatic reactors; mechanisms and kinetics; immobilized systems: continuous and batch reactor types such as fixed, expanded, fluidized bed reactors, trickling filters, tubular reactors; microbial changes: classes and uses of microorganisms; bioreactors for funghi, bacteria, yeasts, cells, vegetable and animal tissues; oxygen transfer, various applications.

Learning Outcomes	**Program Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Ability to apply a suitable computational method for the solution of a specific problem, with the estimation of the accuracy and the error	1	1,2	A,B
2) Ability to derive iterative procedure for the common chemical engineering problems and apply them in a computer algorithm to obtain the solution.	2	1,2	A,B
3) Ability to analyze discrete plant data statistically and approximate it as continuous functions where necessary.	4,8	1,2	B,C

Teaching Methods:	1: Lecture, 2: Homework, 3: Laboratory
Assessment Methods:	A: Midterm and final exams, B: Homework, C: In-class practice

COURSE CONTENT		
Week	**Topics**	**Study Materials**

1	Introduction to continuous and discrete functions	textbook
2	Error analysis	textbook
3	Root finding in single nonlinear equations, bracketing methods	textbook
4	Root finding in single nonlinear equations, open methods	textbook
5	Root finding in system of nonlinear equations, open methods	textbook
6	Solution methods for system of linear equations	textbook
7	Midterm Exam I	textbook
8	Approximation of discrete functions	textbook
9	Forward and backward differentiation methods	textbook
10	Central differentiation and integration methods	textbook
11	Regression and statistical analysis of collected data	textbook
12	Midterm Exam II	textbook
13	Iterative solution of initial value problems (ODE)	textbook
14	Iterative solution of boundary value problems (ODE)	textbook

RECOMMENDED SOURCES	
Textbook	Applied Numerical Methods With Matlab For Engineers And Scientists, 3rd Ed., S. Chapra, McGraw Hill 2012.
Additional Resources	Numerical Methods for Engineers, 6th Ed. by S. Chapra and R. Canale, McGraw Hill 2006. Numerical Methods and Modeling for Chemical Engineers, M. E. Davis, Wiley 1984. Problem Solving in Chemical Enineering With Numerical Methods, M. B. Cutlib, M. Shacham, Prentice Hall 1999.

MATERIAL SHARING	
Documents	Lecture notes, related links
Assignments	Homeworks
Exams	Exams and solutions (exluding the final)

ASSESSMENT

IN-TERM STUDIES	NUMBER	PERCENTAGE
Mid-terms	2	40
Assignment	6	30
	Total	**70**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		30
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		70
	Total	**100**

COURSE CATEGORY	Expertise / Field Courses

COURSE'S CONTRIBUTION TO PROGRAM							
No	Program Learning Outcomes	Contribution					
		NA	1	2	3	4	5
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.				**X**		
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.						**X**
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.	**X**					
4	Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.					**X**	
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.	**X**					
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams. Ability to work individually.	**X**					
7	Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.	**X**					
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.			**X**			
9	Awareness of professional and ethical responsibility.	**X**					
10	Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.	**X**					

11	Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.	**X**	

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Including the exam week: 12 weeks)	12	4	48
Hours for off-the-classroom study (Pre-study, practice)	14	2	28
Mid-terms	2	3	6
Homework	6	5	30
Final examination	1	3	3
Total Work Load			115
Total Work Load / 25 (h)			4.6
ECTS Credit of the Course			5

T.C. YEDİTEPE ÜNİVERSİTESİ
Mühendislik ve Mimarlık Fakültesi

Ders Çıktı Değerlendirme Anketi

Please use the following scale to rate how the outcomes are served by this course:

(Note to the instructor: If an outcome is not served by this course, please ask your students to rate it as **"NA"** before filling out the rest of the evaluation).

NA: Not Applicable (does not serve)

1. Very little 2. Little 3. Moderately 4. Well 5. Very well

Lütfen aşağıdaki puanlama sistemini kullanarak bu dersin çıktılara nasıl hizmet verdiğini değerlendiriniz:

(Öğretim üyesine not: Öğrencilerinizin anketin geri kalanını değerlendirmeden önce dersinizin hizmet vermediği çıktıları **"ID"** şeklinde işaretlemelerini sağlayınız).

İD: İlgili değil (hizmet vermiyor)

1. Çok az 2. Az 3. Orta 4. İyi 5. Çok iyi

DERS KODU

Kod	No	Şube	Dönem	Yıl
CSE 0	0 0 0	0 0	Güz 0	0 0
BME 1	1 1 1	1 1	Bahar 1	1 1
EE 2	2 2 2	2 2		2 2
GBE 3	3 3 3	3 3		3 3
FDE 4	4 4 4	4 4		4 4
CE 5	5 5 5	5 5		5 5
CHBE 6	6 6 6	6 6		6 6
ME 7	7 7 7	7 7		7 7
SYE 8	8 8 8	8 8		8 8
	9 9 9	9 9		9 9

		NA / ID	ÇOK AZ	AZ	ORTA	İYİ	ÇOK İYİ
i	**Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied information in these areas to model and solve engineering problems.** (Matematik, fen bilimleri ve kendi dalları ile ilgili mühendislik konularında yeterli bilgi birikimi; bu alanlardaki kuramsal ve uygulamalı bilgileri mühendislik problemlerini modelleme ve çözme için uygulayabilme becerisi.)	○	1	2	3	4	5
ii	**Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.** (Karmaşık mühendislik problemlerini saptama, tanımlama, formüle etme ve çözme becerisi; bu amaçla uygun analiz ve modelleme yöntemlerini seçme ve uygulama becerisi.)	○	1	2	3	4	5
iii	**Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to 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.)** (Karmaşık bir sistemi, süreci, cihazı veya ürünü gerçekçi kısıtlar ve koşullar altında,belirli gereksinimleri karşılayacak şekilde tasarlama becerisi; bu amaçla modern tasarım yöntemlerini uygulama becerisi. (Gerçekçi kısıtlar ve koşullar tasarımın niteliğine göre, ekonomi, çevre sorunları, sürdürülebilirlik, üretilebilirlik, etik, sağlık, güvenlik, sosyal ve politik sorunlar gibi öğeleri içerirler).	○	1	2	3	4	5
iv	**Ability to devise, select, and use modern techniques and tools needed for engineering practice; ability to employ information technologies effectively.** (Mühendislik uygulamaları için gerekli olan modern teknik ve araçları geliştirme, seçme ve kullanma becerisi; bilişim teknolojilerini etkin bir şekilde kullanma becerisi.)	○	1	2	3	4	5
v	**Ability to design and conduct experiments, gather data, analyze and interpret results for investigating engineering problems.** (Mühendislik problemlerinin incelenmesi için deney tasarlama, deney yapma, veri toplama, sonuçları analiz etme ve yorumlama becerisi.)	○	1	2	3	4	5
vi	**Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.** (Disiplin içi ve çok disiplinli takımlarda etkin biçimde çalışabilme becerisi; bireysel çalışma becerisi.)	○	1	2	3	4	5
vii	**Ability to communicate effectively both orally and in writing; knowledge of a minimum of one foreign language.** (Sözlü ve yazılı etkin iletişim kurma becerisi; en az bir yabancı dil bilgisi.)	○	1	2	3	4	5
viii	**Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.** (Yaşam boyu öğrenmenin gerekliliği bilinci; bilgiye erişebilme, bilim ve teknolojideki gelişmeleri izleme ve kendini sürekli yenileme becerisi.)	○	1	2	3	4	5
ix	**Awareness of professional and ethical responsibility.** (Mesleki ve etik sorumluluk bilinci.)	○	1	2	3	4	5
x	**Information about business life practices such as project management, risk management, and change management; awareness of entrepreneurship, innovation, and sustainable development.** (Proje yönetimi ile risk yönetimi ve değişiklik yönetimi gibi iş hayatındaki uygulamalar hakkında bilgi; girişimcilik, yenilikçilik ve sürdürebilir kalkınma hakkında farkındalık.)	○	1	2	3	4	5
xi	**Knowledge about contemporary issues and the global and societal effects of engineering practices on health, environment, and safety; awareness of the legal consequences of engineering solutions.** (Mühendislik uygulamalarının evrensel ve toplumsal boyutlarda sağlık, çevre ve güvenlik üzerindeki etkileri ile çağın sorunları hakkında bilgi; mühendislik çözümlerinin hukuksal sonuçları konusunda farkındalık.)	○	1	2	3	4	5

Program Learning Outcomes vs. Courses

Course	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11
CHEM 111 General Chemistry I	5	0	0	0	0	5	5	0	0	0	0
ES 115 Fundamentals of Scientific Programming	4	4	0	5	0	2	3	0	0	0	0
PHYS 101 Physics I	5	5	3	4	5	1	3	1	3	3	3
CHEM 112 General Chemistry II	5	4	0	4	0	5	4	0	0	0	4
CHEM 113 General Chemistry Laboratory	5	0	0	5	5	5	5	5	3	0	0
CHBE 102 Introduction to Chemical and Bioprocess Engineering	5	0	0	0	0	0	5	0	0	0	0
PHYS 102 Physics II	5	5	3	4	5	1	3	1	3	3	3
CHBE 203 Organic Chemistry	3	0	0	0	3	4	4	0	4	0	2
CHBE 204 Biorganic Chemistry	5	0	0	0	5	5	5	5	0	0	0
CHBE 211 Physical Chemistry	5	4	0	0	0	4	5	0	0	0	0
CHBE 213 Physical Chemistry Laboratory	5	3	0	3	5	4	5	3	0	0	0
CHBE 214 Chemical Engineering Thermodynamics	4	4	0	0	0	4	4	0	0	0	0
CHBE 215 Material and Energy Balances	5	0	0	0	0	0	5	0	0	0	0
CHBE 232 Chemical and Bioprocess Engineering I : Fluid Mechanics	5	0	5	5	3	4	3	0	0	0	3
CHBE 301 Experimental Chemical and Bioprocess Engineering I	5	0	0	0	5	5	5	5	0	0	0
CHBE 302 Experimental Chemical and Bioprocess Engineering II	5	0	5	5	5	5	5	0	0	0	0
CHBE 331 Chemical and Bioprocess Engineering II : Heat Transfer	4	4	0	0	0	4	4	0	0	0	0
CHBE 333 Chemical and Bioprocess Engineering III : Mass Transfer	5	0	0	0	0	0	5	0	0	0	3
CHBE 361 Materials in Chemical and Biological Applications	5	0	4	0	0	5	5	5	0	0	5
CHBE 362 Reactor Design	5	5	5	4	0	4	0	0	0	0	0
CHBE 378 Elements of Sustainable Chemical Engineering	5	5	5	5	2	4	3	0	0	2	4
CHBE 381 Chemistry and Engineering of Polymers	5	0	0	0	0	5	5	5	0	0	5
CHBE 386 Mathematical Modeling in CHBE	5	0	5	5	0	5	0	5	0	0	0
ES 231 Introduction to Probability and Statistics	5	3	0	0	5	0	0	0	0	0	5
ES 301 Engineering Management	5	5	0	0	0	5	0	0	5	5	5
CHBE 400 Summer Practice	5	0	5	5	0	5	5	0	5	5	5
CHBE 401 Experimental Chemical and Bioprocess Engineering III	5	0	5	5	5	5	5	0	0	0	0
CHBE 415 Instrumental Methods of Analysis	3	0	0	3	3	4	4	4	0	0	0
CHBE 441 Process Dynamics and Control	5	0	0	5	0	0	0	0	0	0	0
CHBE 463 Chemical and Biochemical Process Design I	4	4	5	3	0	4	4	2	3	4	3

CHBE 464 Chemical and Biochemical Process Design II	5	5	5	3	0	4	4	2	3	3	2
CHBE 468 Surface Chemistry in Nanoscience	5	4	0	4	4	3	0	5	0	0	5
CHBE 492 Engineering Project	5	0	0	5	0	3	5	5	0	0	4

Level of Qualification:

This department is subjected to first cycle program with 240 ECTS credits for the university degree in the field of Chemical Engineering.
Students who complete the program successfully with all the program requirements receive an undergraduate degree in Chemical Engineering

Admission Requirements:

In accordance with the academic and legal procedures of the university, students who apply for admission to the program should follow the process governed by ÖSYM and succeed in the university entrance examination. Students who have started an equivalent programme in Turkey or abroad may apply for transfer to the program. Application of the student is evaluated before the semester starts considering the credentials of the student and the degree for which s/he is applying. Detailed information regarding admission to the university is available in the university catalogue.

Students, who come to the university from abroad through exchange programmes whose conditions have been drawn by an aggreement and approved by the university may take the courses offered in the programme. To take a course, the student should demonstrate that s/he has completed its prerequisite courses or their equivalents. All courses in the programme curriculum are conducted in English.

Employment Opportunities and Promotion

Our graduates are employed in executive, production, R&D and quality-control positions in chemical and related industries or pursue Master's or Ph.D. degrees at high-quality national and foreign educational institutions.

Graduation Requirements

To earn Bachelor of Science degree in Chemical Engineering, students must complete 43 compulsory and 6 elective courses (140 credits, 240 ECTS) with a minimum CGPA of 2.0 (out of 4.0), and must fulfill the requirement of 20 days of summer practice in chemical and/or related industries.

Course Category List	ECTS
Field Courses	
CHEM 111 General Chemistry I	6
ES 115 Fundamentals of Scientific Programming	6
PHSY 101 Physics I	6
CHEM 112 General Chemistry II	6
CHEM 113 General Chemistry Laboratory	5
CHBE 102 Introduction to Chemical and Bioprocess Engineering	6
PHYS 102 Physics II	6
CHBE 203 Organic Chemistry	5
CHBE 204 Biorganic Chemistry	6
CHBE 211 Physical Chemistry	5
CHBE 213 Physical Chemistry Laboratory	4
CHBE 214 Chemical Engineering Thermodynamics	6
CHBE 215 Material and Energy Balances	6
CHBE 232 Chemical and Bioprocess Engineering I : Fluid Mechanics	6
CHBE 301 Experimental Chemical and Bioprocess Engineering I	5
CHBE 302 Experimental Chemical and Bioprocess Engineering II	5
CHBE 331 Chemical and Bioprocess Engineering II : Heat Transfer	6
CHBE 333 Chemical and Bioprocess Engineering III : Mass Transfer	6
CHBE 361 Materials in Chemical and Biological Applications	5
CHBE 362 Reactor Design	6
CHBE 386 Mathematical Modeling in CHBE	5
ES 231 Introduction to Probability and Statistics	5
ES 301 Engineering Management	4
CHBE 400 Summer Practice	1
CHBE 401 Experimental Chemical and Bioprocess Engineering III	5
CHBE 441 Process Dynamics and Control	5
CHBE 463 Chemical and Biochemical Process Design I	7
CHBE 464 Chemical and Biochemical Process Design II	6
CHBE 492 Engineering Project	8
Total	**158**
Expertise Courses	
CHBE 378 Elements of Sustainable Chemical Engineering	5
CHBE 381 Chemistry and Engineering of Polymers	5
CHBE 415 Instrumental Methods of Analysis	5
CHBE 468 Surface Chemistry in Nanoscience	5
Total	**20**
Total ECTS of all courses	**178**

İletişim Bilgileri:

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