TIKRIT UNIVERSITY

جامعة تكريت

Bachelor of Science – Chemical Engineering

بكالوريوس علوم - هندسة كيمياوية

Table of Contents

1. Overview

This catalogue is about the courses (modules) given by the program of Chemical Engineering to earn the Bachelor of Science degree. The program delivers (48) Modules with (6000) total student workload hours and 240 total ECTS in addition to graduation project and internship requirements. The module delivery is based on the Bologna Process.

نظره عامة

يتناول هذا الدليل المواد الدراسية التي يقدمها برنامج الهندسة الكيمياوية للحصول على درجة بكالوريوس العلوم. يقدم البرنامج (48) مادة دراسية مع (٦٠٠٠) إجمالي ساعات حمل الطالب و ٢٤٠إجمالي وحدات أوروبية اضافة الى متطلبات مشروع التخرج و التدريب الصيفي. يعتمد تقديم المواد الدراسية على عملية بولونيا.

2. Undergraduate Courses 2023-2024

1

Code	Course/Module Title	ECTS	Semester
CHEM_ENG 101	Introduction to Chemical Engineering	6	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	1	75	75
Description			
This subject builds a strong foundation for the professional development of its students via deep understanding of the basic concepts of chemical engineering principles. Topics that will be covered include the definition of chemical engineering, dimensions, units, symbols and conversion factors of temperature, pressure, also, basis of calculation, Principles and expressions of Ideal gas law.			

2

Code	Course/Module Title	ECTS	Semester
MATH-101	Calculus I	6	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	2	90	60
Description			
This course covers topics of differential and integral calculus including limits and continuity, higher-order derivatives, curve sketching, differentials, definite and indefinite integrals (areas and volumes), and applications of derivatives and integrals. In addition, students review and extend their knowledge of trigonometry and basic analytic geometry. Important objectives of the calculus sequence are to develop and strengthen the students' problem-solving skills and to teach them to read, write, speak, and think in the language of mathematics. In particular, students learn how to apply the tools of calculus to a variety of problem situations.			

3

Code	Course/Module Title	ECTS	Semester
CHEM 101	Organic Chemistry	5	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2/1	75	50
Description			
This course offers students the opportunity to learn the nature of carbon in organic compounds. It presents general principles of organic chemistry related to nomenclature, structure, stereochemistry, uses and synthesis.			

4

Code	Course/Module Title	ECTS	Semester
ENG-102	Engineering Mechanics	6	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	65	85
Description			
The course covers the following topics; statics of particles: forces in plane, forces in space, equilibrium, moment of a force, moment of a couple, equivalent systems of forces on rigid bodies, equilibrium in two dimensions, equilibrium in three dimensions, distributed forces: centroids and center of gravity, analysis of structures: trusses, frames and machines, internal forces in beams and cables, friction, moments of inertia of areas, moments of inertia of masses.			

5

Code	Course/Module Title	ECTS	Semester
CHEM_ENG 102	Laborstory Safety	4	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	45	55
Description			
This course provides an introduction to laboratory safety concepts, including chemical, biological, and physical hazards, for sophomore Chemical & Biomolecular Engineering students. Students will acquire a level of safety knowledge appropriate to enter laboratories in the Chemical Engineering department, to ask intelligent questions about laboratory safety, and to understand further training in laboratory-specific hazards. Training in the ethical dimension of safety is included.			

6

Code	Course/Module Title	ECTS	Semester
ENG-107	English I	3	1
Lectures (hr/w)	**Lab./Prac./Tutor.**	**SSWL (hr/sem)**	**USSWL (hr/w)**
1	1	30	45
Description			
This course is designed to provide engineering students with the necessary oral and written skills required for effective communication in academic and workplace contexts, both with experts in their field and lay persons. It begins by introducing them to the principles of good academic practice, which are also presented as a model for ethical workplace practice, and thus help them to avoid issues such as plagiarism. The main part then leads on to developing research and summarizing skills that form the basis for the later activities. Students next learn to apply these skills to conducting technical presentations, as well as in group discussions that culminate in project planning activities.			

7

Code	Course/Module Title	ECTS	Semester
CHEM_ENG 103	Mass Balance	6	2
Lectures (hr/w)	**Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USSWL (hr/w)**
4	2	90	60
Description			

This subject builds a strong foundation for the professional development of its students via deep understanding the concepts of material balances. Topics that will be covered include the strategy for solving problems with and without chemical reactions. Identify the limiting and excess reactants in stoichiometric equations. Employ some concepts such as (orsat analysis, dry basis, wet basis, theoretical air and excess air), in combustion problems. Understand in a general sense how material balances in industry process include recycle, bypass and purge streams.

8

Code	Course/Module Title	ECTS	Semester
MATH-102	Calculus II	6	2
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
4	2	90	60
Description			

A continuation of Calculus I. This is a study of multivariable calculus including vector-valued functions and the calculus of curves in space, differential calculus of multivariate functions, integral calculus of multivariate functions, spherical and cylindrical coordinates, line and surface integrals.

9

Code	Course/Module Title	ECTS	Semester
CHEM 102	Analytical Chemistry	6	2
Lectures (hr/w)	**Lab./Prac./Tutor.**	**SSWL (hr/sem)**	**USSWL (hr/w)**
3	2/1	90	60
Description			

This course aims to know and understand the principle of analytical chemistry and understand the procedures and applications of chemical reactions and analysis of substances through the use of automated analytical equipment prepared for this purpose. An in-depth study of analytical chemistry for a wide range of chemical reactions and their development through laboratory experiments, developing skills in titrimetry, volumetric and gravimetric analysis, and instrumental analysis.

10

Code	Course/Module Title	ECTS	Semester
ENG-106	Engineering Workshops	3	2
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
1	2	45	30
Description			

The engineering workshop course focuses on identifying risks in the work environment and industrial safety guidelines. And training on how to measure and determine, and the use of filing tools and their work. Learn about the types of wood used in carpentry, the process of shaping it, and the use of carpentry tools and machines. Training in welding work, its types, and the process of joining metals by welding. Training on various casting works and training on mechanical operation, which includes turning, milling, and grinding. Training on pipe knowledge, how to connect, sanitary engineering works, and training on the basics of electrical workshops.

11

Code	Course/Module Title	ECTS	Semester
CHEM 102	Computer Science	5	2
Lectures (hr/w)	**Lab./Prac./Tutor.**	**SSWL (hr/sem)**	**USSWL (hr/w)**
2	2	60	65
Description			

This course offers students a comprehensive exploration of the fundamental concepts and principles that underpin the field of computer science. By delving into various subjects including the historical development of computing, data representation, computer components, algorithms, programming languages, operating systems, applications, internet and networking, and cyber-security, students will develop a well-rounded understanding of the discipline. By examining the evolution of computer science over time, students will acquire a broad perspective on the field and its significance in contemporary society. Through a combination of theoretical knowledge and practical applications, this module equips students with the necessary foundation to pursue further studies or careers in computer science.

12

Code	Course/Module Title	ECTS	Semester
ENG-101	Engineering Drawing	4	2
Lectures (hr/w)	**Lab./Prac./Tutor.**	**SSWL (hr/sem)**	**USSWL (hr/w)**
2	2	60	40
Description			

An engineering drawing course focuses on usage of drawing instruments, lettering, construction of geometric shapes, etc. Students study use of dimensioning, shapes and angles or views of such drawings. Dimensions feature prominently, with focus on interpretation, importance and accurate reflection of dimensions in engineering drawing. Other areas of study in this course may include projected views and development of surfaces.

13

Code	Course/Module Title	ECTS	Semester
MATH-102	Engineering Analyses	6	1
Lectures (hr/w)	**Lab./Prac./<u>Tutor</u>(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
4	1	75	75
Description			

This course is offered to undergraduates and introduces students to the techniques for analytical solution of engineering problems. Ordinary and partial differential equations are considered. Throughout the course, an advanced mathematical methods are used in solution of the problems.

14

Code	Course/Module Title	ECTS	Semester
CHEM_ENG 201	Energy Balance	6	1
Lectures (hr/w)	**Lab./Prac./<u>Tutor</u>(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
3	2	75	75
Description			

This course introduces students to the fundamental principles and applications of energy balance in chemical engineering. It focuses on the analysis and quantification of energy flows within chemical processes and the optimization of energy usage for improved efficiency and sustainability. Through lectures, problem-solving exercises, and laboratory work, students develop a comprehensive understanding of energy conservation, heat transfer mechanisms, and the application of energy balance equations.

15

Code	Course/Module Title	ECTS	Semester
CHEM_ENG 201	Fluid Flow I	6	1
Lectures (hr/w)	**Lab./Prac./<u>Tutor</u>(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
4	2	90	60
Description			

The course begins with fluid flow applied to a range of problems in chemical engineering, including Fluid properties, Static fluid and its application, kinematic fluid, Dynamic fluid, flow pattern, flow in pipes, friction in multiple pipe connection, continuity equation, energy equation, pressure drop in pipes and its fitting, equivalent diameter, flow measurements, Students will work to formulate the models necessary to study, analyses, and design fluid systems through the application of these concepts, and to develop the problem-solving skills essential to good engineering practice of fluid mechanics in practical applications.

16

Code	Course/Module Title	ECTS	Semester
CHEM 201	Physical chemistry	6	1
Lectures (hr/w)	**<u>Lab.</u>/Prac./<u>Tutor</u>(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
3	2/1	90	60
Description			

The course begins with chemical kinetic applied to a range of problems in chemical kinetics, the physical chemistry course covered the Energetic introduction to these concepts, and to develop the problem-solving skills essential to good engineering practice of physical chemistry in practical applications. And how to calculate the order of any simple reaction also included rate of reaction method for measuring order of reaction for sim;le and complex reaction, also to know the theory of reaction.

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Code	Course/Module Title	ECTS	Semester
CHEM_ENG 203	Pollution	3	1
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
1	1	30	45
Description			
To understand the problems of pollution, loss of forest, solid waste disposal, degradation of environment, loss of biodiversity and other environmental issues and create awareness among the students to address these issues and conserve the environment in a better way.			

18

Code	Course/Module Title	ECTS	Semester
ENG-108	Democracy and Human Rights	3	1
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
1	1	30	45
Description			
مادة دراسية تعرف الطلبة بحقوق الانسان التي يجب يتمتع بها جميع مكونات البشر لمجرد اننا من ابناء البشر, وهذه الحقوق متأصلة في جميع البشر مهما كان عرقهم او جنسهم او قوميتهم او مذهبهم ولاتمنح من أي دولة، وتتضمن حقوق الانسان والطفل في الحضارات القديمة والاسلام، المواثيق الدولية ، مصادر وضمانات حقوق الانسان ، القوانين والدساتير، مجلس حقوق الانسان، العولمة، التقدم التكنولوجي واثره على حقوق الانسان. و كذلك تعرف هذه المادة بالديمقراطية و التطرق الى مفهومها ومعرفة الجذور التاريخية لها ، المكونات ، الخصائص ، المميزات ، الضمانات ، علاقة الديمقراطية ب (الدستور ، مؤسسات المجتمع المدني ، حقوق الانسان ، الحكم الرشيد، الانتخابات) ، الديمقراطية المعاصرة.			

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Code	Course/Module Title	ECTS	Semester
CHEM_ENG 204	Industrial & Petrochemical Processes	5	2
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
3	2	75	50
Description			

This course considers processing of raw materials into useful and profitable products. These products are used both as consumer goods and as intermediates for further chemical and physical modification to yield consumer products. This course considers the functional area in which chemical engineers are employed in different industrial fields (production, maintenance, quality control, process, design, administration, research, development, consulting, others).

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Code	Course/Module Title	ECTS	Semester
ENG-109	Numerical Analyses	3	1
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2/2	90	60
Description			

Topics covered are: the mathematical and computational foundations of the numerical approximation and solution of scientific problems; simple; vectorization; clustering; polynomial and spline interpolation; regression; pattern recognition; integration and differentiation; solution of large scale systems of linear and nonlinear equations; modelling and solution with sparse equations; explicit schemes to solve ordinary differential equations and partial differential equations.

21

Code	Course/Module Title	ECTS	Semester
CHEM_ENG 206	Fluid Flow II	6	2
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
3	2/1	90	60
Description			

The course begins with fluid flow applied to a range of problems in chemical engineering, including dimensional analysis, Pumps, pumps types, calculation of the energy required to pumping the liquid through the pipes, compressible fluids, compressor, mixing and their ranges of application, flow in the presence solid particle.

Students will work to formulate the models necessary to study, analyses, and design fluid systems through the application of these concepts, and to develop the problem-solving skills essential to good engineering practice of fluid mechanics in practical applications.

22

Code	Course/Module Title	ECTS	Semester
CHEM_ENG 206	Engineering Materials	5	2
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2/1	75	50
Description			

This course aims to establish fundamental knowledge of Engineering Materials. Presentation of the course starts with principles of bonding, structure, and structure/property relationships for metals and their alloys, ceramics, polymers and composites. Emphasis on properties and how processes change structure. Study deeply the phase diagrams, diffusion and materials failure

23

Code	Course/Module Title	ECTS	Semester
ENG-105	Computer Programming	5	2
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	60	65
Description			

This module introduces students to the Python programming language, its syntax, and its use in solving programming problems. The module covers the basic programming concepts of condition statements and iteration statements, along with the design and implementation of functions. The module also covers the basic data structures of Python, including lists, tuples, dictionaries, and sets. The module concludes with an introduction to string manipulation and regular expressions in Python.

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Code	Course/Module Title	ECTS	Semester
ENG 109	English II	6	2
Lectures (hr/w)	**Lab./Prac./Tutor/Semn(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
1	1/1	45	30
Description			

This course develops the business communication skills required for the chemical engineer in the global economy. This includes topics like delivering presentations, writing emails, or speaking in meetings. This gives you the ability to communicate across departments with a strong ability in reading, writing, speaking, and listening.

25

Code	Course/Module Title	ECTS	Semester
CHEM_ENG 301	Process modelling	5	1
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	60	65
Description			

This course is offered to undergraduates and introduces students to the mathematical modeling and applied mathematics. It necessitates both a sound understanding of the chemical engineering fundamentals and a quite sophisticated engineering analysis. It also requires a computer program to solve problems that are not tractable by hand.

26

Code	Course/Module Title	ECTS	Semester
CHEM_ENG 302	Thermodynamics I	5	1
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
3	1	60	65
Description			

This course is aimed to establish fundamental knowledge of heat transfer. Presentation of the course starts by introducing the heat transfer method and then utilizes it to solve problems in steady-state conduction, with and without heat generation, in three geometries: plane wall, cylinder and sphere. The thermal resistance calculation in these geometries is presented. In addition, the temperature prediction in semi-infinite bodies at unsteady-state conditions is discussed.

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Code	Course/Module Title	ECTS	Semester
CHEM_ENG 303	Heat Transfer I	6	1
Lectures (hr/w)	**Lab./Prac./<u>Tutor</u>(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
3	2	75	75
Description			

This course is aimed to establish fundamental knowledge of heat transfer. Presentation of the course starts by introducing the heat transfer method and then utilizes it to solve problems in steady-state conduction, with and without heat generation, in three geometries: plane wall, cylinder and sphere. The thermal resistance calculation in these geometries is presented. In addition, the temperature prediction in semi-infinite bodies at unsteady-state conditions is discussed.

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Code	Course/Module Title	ECTS	Semester
CHEM_ENG 304	Mass Transfer I	6	1
Lectures (hr/w)	**Lab./Prac./<u>Tutor</u>(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
3	2	75	75
Description			

This course aims to cover the fundamentals of the basic concepts of mass transport and understanding the separation processes such as gas absorption, stripping, and leaching.

29

Code	Course/Module Title	ECTS	Semester
CHEM_ENG 305	Chemical Process Safety and Professional Ethics	5	2
Lectures (hr/w)	**Lab./Prac./Tutor/Sem(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	1/1	60	65
Description			

A study of the technical fundamentals of chemical process safety: includes impact of chemical plant accidents and concepts of societal and individual risk; hazards associated with chemicals and other agents used in chemical plants, including toxic, flammable and reactive hazards: concepts of inherently safer design; control and mitigation of hazards to prevent accidents, including plant procedures and designs; major regulations that impact safety of chemical plants; consequences of chemical plant incidents due to acute and chronic chemical release and exposures; hazard identification procedures; introduction to risk assessment. It also introduces the studets to AIChE code of chemical engineers ethics and social responsibilities.

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Code	Course/Module Title	ECTS	Semester
MATH 302	Statistics and Probability	3	2
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	1	45	30
Description			

Students are introduced to: Introduction to statistics; Frequency Tables; Measures of central tendency: Average, mode, and median; Measures of dispersion: Variance and standard deviation; Introduction to probabilities: Sample space, Events, axioms of probability; Conditional probabilities and Independence; Random variables.

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Code	Course/Module Title	ECTS	Semester
CHEM_ENG 306	Process Simulation	5	2
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	60	65
Description			

This course represents the outlines of process simulation/process simulators. It focused on the chemical engineering applications of Aspen Plus simulator by explaining the simulation of different unit operations: separators, reactors, heat exchangers, pumps, etc.

32

Code	Course/Module Title	ECTS	Semester
CHEM_ENG 307	Thermodynamics II	5	2
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
3	1	60	65
Description			

In this course, students learn some details of present the laws of thermodynamics, showing their application to the study of thermal effects in chemical processes and the analysis of power cycles. Study and evaluate the thermodynamic properties of pure fluids. Principal To impart the detail concepts of thermodynamics and so on.

33

Code	Course/Module Title	ECTS	Semester
CHEM_ENG 308	Heat transfer II	6	2
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
3	2/2	90	60
Description			

This course is aimed to establish fundamental knowledge of convection heat transfer. Presentation of the course starts by introducing the forced convection heat transfer then utilizes it to solve problems in the systems contain fluid flow. The applications of empirical relations for forced convection in different geometries are presented. In addition, natural convection heat transfer relations are discussed. The heat transfer and design calculations of heat exchanges are presented.

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Code	Course/Module Title	ECTS	Semester
CHEM_ENG 309	Mass transfer II	6	2
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
3	1/2	90	60
Description			

This course provides an introduction to separation processes in general, but with particular emphasis on equilibrium staged separations of binary mixtures. Processes covered include binary distillation, liquid-liquid extraction, evaporation and drying.

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Code	Course/Module Title	ECTS	Semester
CHEM_ENG 310	Unit Operation	6.0	2
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
3	2/1	90	60
Description			

In this course, the aim is to provide students with a basic knowledge of separation processes in unit operations, which is important for understanding the structure, operation, and design of chemical reactions.

Learn the diluted and concentrated slurry in sedimentation systems and properties of filtration methods including cake filters, discontinuous pressure filters, filter presses, continuous vacuum filters, rotary drum filters, characteristics of fluidized, liquid-solids, and gas-solids systems; and applications centrifugation processes.

36

Code	Course/Module Title	ECTS	Semester
ENG-110	Engineering eonomics	2.0	2
Lectures (hr/w)	**Lab./Prac./Tutor/Semn(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
1	1	30	20
Description			

After completing this course, students will be able to conduct simple economic studies. They will also be able to make evaluation of engineering projects and make decisions related to investment.

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Code	Course/Module Title	ECTS	Semester
CHEM_ENG 401	Chemical Reactor I	5.0	1
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
3	1	60	65
Description			

This course aims to establish fundamental knowledge of chemical reactor design and engineering. Presentation of the course starts by introducing the chemical reaction engineering algorithm and then utilizes it to solve problems in steady state isothermal reactors. Elementary and non elementary reactions are discussed. Catalytic reactions are also introduced.

38

Code	Course/Module Title	ECTS	Semester
CHEM_ENG 402	Petroleum Refining I	6.0	1
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
3	2/1	90	60
Description			

This course presents a comprehensive introduction to petroleum refining technology and calculations. The focus is on transportation fuels refineries. The program includes an overview classification of crude oils, composition of crude oils, physical and chemical properties of crude oil and oil products, evaluation of crude oils, crude oil pre-treatment, fractionation of crude oil (Atmospheric and Vacuum Distillation, Light End Fractionation, Process Description) and thermal cracking and coking processes.

39

Code	Course/Module Title	ECTS	Semester
CHEM_ENG 403	Chemical Eng. Equipment Design I	5.0	1
Lectures (hr/w)	**Lab./Prac./<u>Tutor</u>(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	60	65
Description			

This subject covers the outline of projects requirements and the basic design for the equipment, including vessels that content a process inside (like, distillation, reactor, heat exchanger etc.), pumps, compressors.

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Code	Course/Module Title	ECTS	Semester
CHEM_ENG 404	Chemical Process Dynamic	5.0	1
Lectures (hr/w)	**Lab./Prac./<u>Tutor</u>(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
3	1	60	65
Description			

This subject covers the outline of projects requirements and the basic design for the equipment, including vessels that content a process inside (like, distillation, reactor, heat exchanger etc.), pumps, compressors.

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Code	Course/Module Title	ECTS	Semester
CHEM_ENG 405	Graduation project I	4.0	1
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
0	2	30	70
Description			

Preparatory studies of the literature and data collection for the graduation project in a particular area of concentration and under the supervision of one of the faculty members. The course covers directed readings in the literature of chemical engineering, introduction to research methods, seminar discussions dealing with special engineering topics of current interest. Planning, design, construction and management of an engineering project. Writing a technical report.

42-a

Code	Course/Module Title	ECTS	Semester
CHEM_ENG 406	Corrosion	4.0	1
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	60	40
Description			

Corrosion is the destructive attack of a metal by its reaction with environment. Thus corrosion refers to the degradation of a metal by its environment. The course content include: Fundamentals of electrochemical thermodynamics and kinetics pertinent to corrosion processes; Corrosion inhibition; passivity; anodic and cathodic protection; pitting; stress corrosion and hydrogen embrittlement.

42-b

Code	Course/Module Title	ECTS	Semester
CHEM_ENG 407	Polymer technology	4.0	1
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	60	100
Description			

In this course, basic methods in the synthesis of polymers are addressed and discussed, including the various types of polymerizations and their applications toward both common and new promising polymer products. This class presents the most common synthetic methods used in polymerization, the basic differences in the kinetics of these methods, the final end-products obtained, and the synthetic processing techniques that might be used for various applications.

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Code	Course/Module Title	ECTS	Semester
CHEM_ENG 408	Chemical Reactor II	5.0	2
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
3	1	60	65
Description			

This course aims to establish fundamental knowledge of chemical reactor design and engineering. Presentation of the course starts by introducing the chemical reaction engineering algorithm and then utilizes it to solve problems in steady state isothermal reactors. Elementary and non elementary reactions are discussed. Catalytic reactions are also introduced.

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Code	Course/Module Title	ECTS	Semester
CHEM_ENG 409	Petroleum Refining II	5.0	2
Lectures (hr/w)	**Lab./Prac./<u>Tutor</u>(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
3	1	60	65
Description			

This course presents a comprehensive introduction to petroleum refining technology and calculations. The focus is on transportation fuels refineries. The program includes overview catalytic operations, fluid catalytic cracking, hydrocracking, hydrotreating, catalytic reforming, isomerization, alkylation and catalytic dewaxing). Also, describing the lubricating oils (specifications, production process and calculations), solvent refining processes and oil products productions with the main properties and specifications and operations, and product blending. Finally, this course will take into accounts the safety and environmental aspects in refining industries.

45

Code	Course/Module Title	ECTS	Semester
CHEM_ENG 410	Chemical Eng. Equipment Design II	5.0	2
Lectures (hr/w)	**Lab./Prac./<u>Tutor</u>(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	60	65
Description			

This course presents a comprehensive introduction to petroleum refining technology and calculations. The focus is on transportation fuels refineries. The program includes overview catalytic operations, fluid catalytic cracking, hydrocracking, hydrotreating, catalytic reforming, isomerization, alkylation and catalytic dewaxing). Also, describing the lubricating oils (specifications, production process and calculations), solvent refining processes and oil products productions with the main properties and specifications and operations, and product blending. Finally, this course will take into accounts the safety and environmental aspects in refining industries.

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Code	Course/Module Title	ECTS	Semester
CHEM_ENG 411	Chemical Process Control	5.0	2
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
3	2/1	90	60
Description			

This course aims to establish fundamental knowledge of process control. It starts by introducing the process control followed by explaining the Feedback Controllers and Control System Instrumentation. Dynamic Behavior/Stability of Closed-Loop Control Systems and PID Controller Tuning are also discussed in this course. Finally, Frequency Response Analysis and Advanced Process Control are introduced in this course.

47

Code	Course/Module Title	ECTS	Semester
CHEM_ENG 412	Graduation project part II	4.0	1
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
0	2	30	70
Description			

Literature and data collection for the graduation project in a production of a product under the supervision of one of the faculty members. This is in continuation with CHEM_ENG405. The course covers energy balance of the prodcution unit, design of equipments, control of the units, safety and handling of pollution emitted from the unit. It also deals with economical calacuation for the capital and operation cost. Also writing a technical report.

48-a

Code	Course/Module Title	ECTS	Semester
CHEM_ENG 413	Sustainable energy systems	4.0	2
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	60	40
Description			

This course is intended to give mainly but not exclusively an engineering and scientific perspective about conventional energy resources, energy challenges and our endeavors on the development of future, sustainable, clean and renewable energy sources.

48-b

Code	Course/Module Title	ECTS	Semester
CHEM_ENG 414	Biochemical engineering	4.0	2
Lectures (hr/w)	**Lab./Prac./Tutor(hr/w)**	**SSWL (hr/sem)**	**USSWL (hr/sem)**
2	2	60	40
Description			

Biochemical Engineering involves the application of Chemical Engineering principles and approaches to biologically based systems and processes. Biochemical Engineering is central to the area of environmental engineering, and to biotechnology processes which produce pharmaceuticals, fine chemicals, and genetically engineered products. The course involves a systematic and quantitative description of medium formulation and sterilization, microbial kinetics and bioreactor design, product isolation and purification, and examples of current industrial practices and processes.