



جامعة القادسية  
كلية الهندسة  
قسم الهندسة الكيماوية



# BACHELOR OF SCIENCE DEGREE CURRICULUM

## COURSES PROGRAM 2021 – 2022

برنامج البكالوريوس لعلم الهندسة الكيماوية

مقررات نظام الكورسات

2021 – 2022

**AL - QADISIYAH UNIVERSITY****COLLEGE OF ENGINEERING****CHEMICAL ENGINEERING DEPARTMENT****BACHELOR OF SCIENCE DEGREE CURRICULUM****COURSES PROGRAM****2021 - 2022**

Chemical engineering is a branch of engineering that deals with the chemical and physical processes used to develop and make products such as pharmaceuticals, artificial organs, semiconductors, oil refineries, solar panels, clean water, and biocompatible polymers. Chemical engineers have made major contributions to modern society. With the additional knowledge of biology, chemical engineers are devising new ways for living organisms to perform molecular transformations, and discovering new schemes for delivery of medicines to specific sites in the body.

The chemical engineering program intends to prepare chemical engineers for life-long achievement through education in the principles of chemical engineering, and to encourage development of communication, teamwork, and leadership skills.

**1. Introduction:****1.1 Overview of Department of Chemical Engineering**

The Chemical Engineering Program in the College of Engineering at the University of Al-Qadisiyah was first accredited in 2008 and has maintained accreditation since that time. We have continued to make appropriate revisions in the curriculum to better serve student needs and to ensure success in their chosen careers. The chemical Engineering department curricular assessment and revision process has had a positive impact on the Chemical Engineering Program. The undergraduate study at the department is four years in length; from the moment of receiving the freshman year students whose average grades qualify them to join it up till to the graduation of the senior year students where they get their Bachelor of Science degree in Chemical engineering.

**1.2 Program Educational Objective:**

The Chemical Engineering curriculum requirements is designed to provide its graduates a solid educational foundation on which they can build successful and sustainable careers in chemical engineering or a related field. In particular, all graduates of the Chemical Engineering curriculum requirements will be prepared to do the following:

1. Graduates will be able to use chemical engineering principles to solve problems of practical importance to industry.
2. An ability to apply knowledge of mathematics, science, and engineering.

3. Graduates will be productive and informed citizens of society as well as of their professional community and will be positioned for a lifetime of success.
4. To be employed or pursuing an advanced degree in the field of chemical engineering or other related disciplines.

### 1.3 Program Curriculum

The Bachelor of Science (B.Sc.) in Chemical Engineering approved by the Department, and the student can choose it by the competition in the average of primary school. Throughout the first and second years all student take a general subjects, and specialties starting from the third year of study by adding a pure specialties subjects.

### 1.4 Program Outcomes

The Chemical Engineering Student Outcomes are characteristics that a successful chemical engineer should have at the time of graduation, and are listed below.

- 1- Each graduate will have the ability to apply knowledge of mathematics, science and engineering fundamentals.
- 2- Each graduate will have the ability to design and conduct experiments, and to analyze and interpret experimental results.
- 3- Each graduate will have the ability to design systems, components, or processes to meet specified objectives within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability in chemical engineering.
- 4- Each graduate will have the ability to work as a member of multidisciplinary teams, and have an understanding of team leadership
- 5- Each graduate will have the ability to identify, formulate, and solve chemical engineering problems.
- 6- Each graduate will have the ability to communicate effectively in written, oral, and graphical forms.
- 7- Each graduate will have the ability to use the techniques, skills and modern engineering tools necessary for engineering practice.
- 8- Each graduate will have a thorough grounding in chemistry and a working knowledge of advanced chemistry, including organic and physical and either inorganic or analytical, depending upon their individual educational goals.
- 9- Each graduate will have a working knowledge of chemical process safety.

## 2. Course Description

The units are calculated such as, the theory hours (1 hour per semester = 1 unit), practical hours (2-3 hours per semester = 1 unit), and the tutorial hours (units = 0). Prerequisites, if any, are indicated at the course description. These have been established to assure an adequate and uniform background for students in advanced classes.

Course code is presented according to three requirements:

- 1- University requirement started by the letters **UNV**
  - 2- Engineering College requirement is started by the letters **ENG**
  - 3- Department Requirement (**C**hemical Engineering) is started by the letters **CHE**
- Course code started by capital letters followed by number of 3-digits as following:
- 1st digit represents the class number
  - 2nd digit represents the semester number
  - 3rd digit represents the subject number

<b>First Year</b>
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<b>First Semester</b>
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الرياضيات ١	ENG111
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ENG 111 MATHMEMTICS I

Curriculum:

1. General - review.
2. Functions.
3. Inequalities.
4. Composite numbers.
5. Function differentiation.
6. Implicit differentiation.
7. Application of derivatives
8. Graph of maxima and minima
9. Limits.

الكيمياء التحليلية	CHE111
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CHE 111 ANALYTICAL CHEMISTRY

Curriculum:

1. Atoms and Molecules,
2. the Periodic Table,
3. the Mole Concept, molarity, normality
4. Stoichiometry calculation,
5. Titration and PH calculation
6. Equilibrium in acids and bases
7. Graphs of titration
8. Equilibrium in precipitation
9. Thermodynamics Chemistry,
10. Chemical Equilibrium.
11. Fundamentals of Spectrophotometry.
12. Gravimetry; Introduction to Analytical Separations,
13. Aqueous solution equilibrium calculations,
14. Fundamental of electrochemistry
15. Kinetic Methods Potentialmetry,
16. Molecular Spectroscopy,

مبادئ الهندسة الكيميائية ١	CHE112
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CHE 112 PRINCIPLES OF CHEMICAL ENGINEERING 1

Curriculum:

1. Introduction.
2. Units and Dimensions.
3. Choosing A Basis
4. Temperature and pressure.
5. Introduction to material balance
6. Material balance without chemical reaction

7. Material balance Involving chemical reactions
8. Material balance for Multi – Unit Systems

ميكانيك السكون	CHE113
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## CHE 113 STATIC MECHANICS

## Curriculum:

1. Principles of static.
2. Resultant.
3. Momentum and coupled momentum.
4. Equilibrium of force systems in one, two and three dimensions.
5. Friction.
6. Analysis of structure.
7. Centroids and centers of gravity.

اللغة الانكليزية ١	UNV111
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## UNV 111 ENGLISH LANGUGE 1

## Curriculum:

1. Basic introduction
2. Reading skills
3. Listening skills
4. Making notes during lectures
5. Understanding English Grammar
6. Reading skills
7. Listening skills
8. Making notes during lectures

علم الحاسوب ١	CHE114
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## CHE 114 COMPUTER SCIENCE 1

## Curriculum:

1. Introduction of Mathcad
2. Functions.
3. Integrations.
4. Functions by Mathcad
5. Draw by Mathcad
6. Draw Functions.
7. Array by Mathcad
8. Advance math by Mathcad

الرياضة	UNV112
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## UNV 112 SPORTS

## Curriculum:

1. Introduction
2. Ball games
3. Arena games
4. Dietitian

5. Coaching
6. Swimming

اللغة العربية	UNV113
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UNV 113 Arabic Language

Curriculum

1. قواعد اللغة العربية
2. فن المقالة
3. قواعد واساسيات البحث العلمي
4. الادب العربي
5. الشعر العربي

ورشة عمل	ENG112
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ENG 112 WORKSHOP

Curriculum:

1. Foundry
2. Welding
3. Fitting & Sheet Metal Work
4. Carpentry Shop
5. Black-smithy shop

<b>First Year</b>
<b>Second Semester</b>

الرسم الهندسي	CHE121
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CHE 121 ENGINEERING DRAWING

Curriculum:

1. Introduction to the drawing tools and how to use them.
2. Composition of the engineering drawings.
3. Lettering.
4. Numbers.
5. Dimensions.
6. Projections.
7. Sectioning.
8. Isometric drawing.
9. Auto cad drawing (computer lab.)

الرياضيات ٢	ENG121
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ENG 121 MATHMEMTICS 2

Curriculum:

1. L ' Hopital's rule.
2. Trigonometric functions.
3. Hyperbolic functions.
4. Integration.
5. Transcendental functions.

6. Improper integrals.
7. Differential equations.
8. Determinates.
9. Matrices.

الكيمياء العضوية	CHE122
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## CHE 122 ORGANIC CHEMISTRY

## Curriculum:

1. Introduction
2. Review of Lewis Bonding Theory
3. Acids and Basis
4. Nomenclature, physical properties and representation of structure
5. Alkanes
6. Cycloalkanes
7. Isomers Stereochemistry
8. Free Radical Reactions
9. Substitution and Elimination Reactions of Alkyl Halides
10. Structure and Synthesis of Alkenes
11. ALKENES: Recap and Reactions
12. ALKYNES: Structure and bonding
13. ALKYNES: Synthesis and Reactions
14. ALCOHOLS: Structure, synthesis and reactions
15. AROMATIC COMPOUNDS: Structure and Reactions
16. CARBONYL COMPOUNDS:
17. Amino Acids, Peptides and Proteins
18. The Organic Chemistry of Vitamins
19. The Organic Acid Lipids

مبادئ الهندسة الكيميائية ٢	CHE123
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## CHE 123 PRINCIPLES OF CHEMICAL ENGINEERING 2

## Curriculum:

1. Ideal gases
2. Introduction to Equations of state
3. Introduction Multiphase Equilibrium
4. Phase Diagrams and the Phase Rule
5. Single Component Two-Phase Systems (Vapor Pressure)
6. Two-Component Gas/Single-Component Liquid Systems
7. Introduction to Energy Balances
8. Types of Energy to Be Included in Energy Balances
9. Introduction to Humidity (Psychrometric) Charts and Their Use
10. Introduction to Heats of Solution and Mixing
11. Liquids and Gases in Equilibrium with Solids

مقاومة المواد	CHE124
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## CHE 124 STRENGTH OF MATERIALS

## Curriculum:

1. Principles of static.
2. Resultant.
3. Momentum and coupled momentum.
4. Equilibrium of force systems in one, two and three dimensions.
5. Friction.
6. Analysis of structure.
7. Centroids and centers of gravity.
8. Composite figures.
9. Moment of inertia.
10. Strength of materials definitions.
11. Simple stress.
12. Shear stress.
13. Stress in cylinders.
14. Simple strain.
15. Thermal stress.
16. Deformation in beams.
17. Equations of stress and momentum in beams.
18. Curves of stress and momentum in beams.

علم الحاسوب ٢	CHE125
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## CHE 125 COMPUTER SCIENCE 2

## Curriculum:

1. Computer definition ( Computer generation , computer components , numerical systems , algorithms and charts )
2. Algorithms.
3. Flow Charts.
4. Introduction to visual basic
5. Forms: Control tools, name selection of the control tools, explorer project, properties, events, project, save project, applications.
6. Menus, building and writing the code, dialogue box, message box, file dialogue box, line dialogue box, color dialogue box, printer dialogue box.
7. Programming statements.
8. Drawing.
9. Engineering applications.
10. برنامج الحاسبات حسب متطلبات وزارة التعليم العالي

كيمياء احيائية	CHE126
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## CHE 126 BIOCHEMICAL

## Curriculum:

1. Basics of Biology;
2. Overview of Biotechnology;
3. Diversity in Microbial Cells,
4. Cell Constituents,
5. How do cells work?



6. Chemicals for Life
7. Biomolecules, and
8. Enzymes
9. Metabolism and Bioenergetics

السلامة الصناعية والحماية البيولوجية والاشعاعية	UNV121
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UVV 121 INDUSTRIAL SAFETY AND SECURITY OF BIOLOGICAL AND RADIOLOGICAL

Curriculum:

حسب متطلبات وزارة التعليم العالي

<b>Second Year</b>
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<b>First Semester</b>
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الرياضيات الهندسية المتقدمة ١	ENG211
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ENG 211 ADVANCED ENGINEERING MATHEMATICS 1

Curriculum:

1. Review:
2. Conic sections
3. Polar coordinates
4. Hyperbolic functions
5. Vectors
6. Equation of plane
7. Functions with more than one variable
8. Multiple integrals & Inverse integral
9. Change of multiple integral to polar coordinates
10. Differential equations first order
11. Differential equations Second order
12. Introduction & ODE Review
13. Scalar and Vector Fields
14. Scalar and Vector Fields
15. Series
16. Fourier Series
17. Fourier Transforms
18. Series and Special Functions

مبادئ الهندسة الكيماوية ٣	CHE211
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CHE 211 PRINCIPLES OF CHEMICAL ENGINEERING 3

Curriculum:

1. General review
2. Review of Material balance
3. Real Gases: Equations of State
4. Real Gases: Compressibility Charts
5. Real Gas Mixtures
6. Introduction to Multiphase Equilibrium

7. Two-Component Gas/Single-Component Liquid Systems
8. Two Component Gas/Two Component Liquid Systems
9. Multicomponent Vapor-Liquid Equilibrium
10. Energy Balance

اللغة الانكليزية ٢	UNV211
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## UNV 211 ENGLISH LANGUGE 2

## Curriculum:

1. Basic introduction
2. Reading skills
3. Listening skills
4. Making notes during lectures
5. Understanding English Grammar
6. Reading skills
7. Listening skills
8. Making notes during lectures

برمجة الحاسوب ١	CHE212
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## CHE 212 COMPUTER PROGRAMMING 1

## Curriculum:

1. Introduction
2. arrays, which are the basic building blocks in MATLAB;
3. file usage, built in math functions,
4. user defined functions;
5. programming using branch and loop constructs;
6. 2-D and 3-D plots,
7. Fitting data to models.
8. Microsoft Excel used with MATLAB for solving linear and nonlinear equations and function optimization.
9. Process simulation in chemical engineering design using software.
10. برنامج الحاسبات حسب متطلبات وزارة التعليم العالي

جريان الموائع	CHE213
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## CHE 213 FLUID FLOWS

## Curriculum:

1. Introduction
2. One - dimensional analysis
3. Static fluids
4. Pressure of fluids
5. Force applied by a fluid
6. Immersed bodies
7. Types of flow
8. Bernoulli's equation
9. Reynolds number
10. Dimensional analysis and similarity: Buckingham Pi theorem

11. Friction factor and pressure drop
12. Pressure drops in fittings
13. Equivalent diameter for non - circular pipes
14. Flow in open channels
15. Compressible flow: Isothermal flow, adiabatic flow and Choked flow
16. Pumps
17. Pumps in parallel and series
18. Positive displacement pumps
19. Pump efficiency
20. Flow and pressure measurements
21. Fluid flow in the presence of solid particles
22. Non-Newtonian and viscoelastic fluids

الكيمياء الفيزيائية ١	CHE214
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## CHE 214 PHYSICAL CHEMISTRY 1

## Curriculum:

1. First law of thermodynamics
2. Second and third laws of thermodynamics
3. Gibbs free energy
4. Chemical equilibrium
5. Chemical reactions
6. Rate of reaction equations
7. Phase equilibria in ideal solutions
8. Phase equilibria in non-ideal solutions

اقتصاديات الهندسة الكيميائية	CHE215
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## CHE 215 CHEMICAL ENGINEERING ECONOMIES

## Curriculum:

1. Economics
2. Estimation of cost of the industrial projects
3. Factors affecting the production cost and investment
4. Capital investment
5. Cost index
6. Calculation of capital investment
7. Profit and cost of investment
8. Types of profits payment
9. Depreciation
10. Optimum design
11. Rate of optimum production
12. Detailed cost of Chemical plant
13. Profit calculation

الديمقراطية وحقوق الانسان	UNV212
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## UNV 212 DEMOCRACY AND HUMAN RIGHTS

## Curriculum:

1. مقدمة في تعريف الديمقراطية
2. الفساد الاداري وتأثيره على حقوق الانسان والمجتمع
3. حقوق الانسان في عهد الامام علي (ع) لمالك الاشر
4. الانظمة السياسية من حيث ممارسة السلطة
5. نشاة الديمقراطية
6. انواع الديمقراطية
7. الديمقراطية في الاسلام
8. البرلمان
9. الانتخابات
10. العراقيل التي تواجه الانتخابات
11. مقدمة في تعريف حقوق الانسان
12. الفساد الاداري وتأثيره على حقوق الانسان والمجتمع
13. حقوق الانسان في عهد الامام علي (ع) لمالك الاشر
14. ماهية حقوق الانسان
15. حقوق الانسان في الاديان والحضارات القديمة والعصور الوسطى (في اوربا)
16. قانون حقوق الانسان
17. تطبيق قانون حقوق الانسان.
18. حقوق الانسان فرع من القانون
19. انتهاك قانون حقوق الانسان
20. تصنيفات حقوق الانسان

التلوث	CHE216
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## CHE 216 POLLUTION

## Curriculum:

1. Environmental Pollution
2. Water pollution
3. Air pollution
4. Treatment of pollution
5. Pollution Control
6. Effect of air pollutants on human health

## Second Year

## Second Semester

الرياضيات الهندسية المتقدمة ٢	ENG221
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## ENG 221 ADVANCED ENGINEERING MATHEMATICS 2

## Curriculum:

1. Partial Differential Equations
2. PDE: Diffusion Equation & Separation of Variables
3. PDE: Wave and Laplace's Equation
4. PDEs, the wave equation
5. PDEs, Laplace's equation
6. Linear algebra: Gaussian elimination and vectors

7. Vectors and Matrices
8. Matrices
9. The Eigenvalue Problem
10. The Eigenvalue Problem, extension to complex case
11. Complex variables
12. Conformal mapping
13. finite Element

مبادئ الهندسة الكيميائية ٤	CHE221
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## CHE 221 PRINCIPLES OF CHEMICAL ENGINEERING 4

## Curriculum:

1. Energy Balances without Reaction
2. The Standard Heat (Enthalpy) of Formation
3. The Heat (Enthalpy) of Reaction
4. Integration of Heat of Formation and Sensible Heat
5. The Heat (Enthalpy) of Combustion
6. The Humidity (Psychrometric) Chart
7. Applications of the Humidity Chart
8. Heats of Solution and Mixing
9. The Mechanical Energy Balance
10. Liquids and Gases in Equilibrium with Solids
11. Solving Material and Energy Balances Using Process Simulators (Flowsheeting Codes)
12. Unsteady-State Material and Energy Balances

الكيمياء الفيزيائية ٢	CHE222
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## CHE 222 PHYSICAL CHEMISTRY 2

## Curriculum:

1. Phase equilibria in ideal solutions
2. Phase equilibria in non-ideal solutions
3. Electrochemical equilibrium
4. Surface thermodynamics
5. Experimental gas kinetics
6. Liquid kinetics
7. Viscosity of liquids
8. Electrical conductance
9. Electrolytes

برمجة الحاسوب ٢	CHE223
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## CHE 223 COMPUTER PROGRAMMING 2

## Curriculum:

برنامج الحاسبات حسب متطلبات وزارة التعليم العالي

هندسة الكيمياء الحياتية	CHE224
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## CHE 224 BIOCHEMICAL ENGINEERING

## Curriculum

1. Immobilized Enzymes: effects of intra and inter-phase mass transfer on enzyme kinetics
2. Major Metabolic Pathways: Bioenergetics, Glucose Metabolism, Biosynthesis.
3. Microbial Growth: Continuum and Stochastic Models.
4. Design, Analysis and Stability of Bioreactors.
5. Kinetics of Receptor-Ligand Binding.
6. Receptor-mediated Endocytosis.
7. Multiple Interacting Microbial Population: Prey-Predator Models.
8. Bio-product Recovery & Bio-separations, Manufacture of Biochemical Products.

خواص المواد الهندسية
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CHE225
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#### CHE 225 PROPERTIES OF ENGINEERING MATERIALS

##### Curriculum:

1. Introduction to how molecular structure
2. Microstructure of Materials
3. Atomic/molecular morphology
4. Molecular perturbations
5. Interfacial phenomena
6. Properties of Materials :
7. Chemical Thermal Morphological
8. Bulk vs. Surface Properties
9. Surface analytical techniques
10. Bulk material analysis
11. High Performance Metals: Types/ classes
12. Defect structures
13. Unique Ceramics (3 classes)
14. Machinable ceramics
15. Superconductors
16. Specialty Polymers (3 classes)
17. Electronically and ionically conductive polymers
18. High strength composites
19. Photopolymers
20. Electronic and Optical Materials (3 classes)
21. Semiconductors
22. Nonlinear optical materials
23. Biomaterials (3 classes)
24. Hydrogels
25. Controlled drug delivery materials
26. Implantable materials
27. Futuristic Materials

الإحصاء الهندسي
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CHE226
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#### CHE 226 ENGINEERING STATISTICS

##### Curriculum:

1. Statistics
2. Statistical operations and frequency tables

3. Graphs
4. Central limit theorem
5. Measures of differences
6. Theory of probabilities
7. Distributions
8. Confidence interval
9. Normal distribution
10. Two-sided
11. Poisson
12. Tests (Z, t, F,  $\chi^2$ )
13. Design of experiments and analysis
14. Programming using SPSS software.

الهندسة الكهربائية	CHE227
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## CHE 227 ELECTRICAL ENGINEERING

## Curriculum:

1. Electric Circuits,
2. Kirchoff's Laws,
3. Superposition theorem,
4. Substitution theorem.
5. Thevenin's theorem,
6. Norton's theorem,
7. Rosen's theorem of star / mesh transformation,
8. Proof for DC circuits and their application to circuit analysis,
9. Magnetic Circuit, Series and parallel circuits,
10. Principles of calculation of ampere turns for magnetic circuits of electromagnets,
11. Transformers, Bipolar and multipolar DC machines
12. Inductances in series and parallel, Hysteretis loss ,
13. Eddy current loss, Lifting power of magnet.

<b>Third Year</b>
<b>First Semester</b>

الترموديناميك ١	CHE311
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## CHE 311 THERMODYNAMICS 1

## Curriculum:

1. Basic definitions
2. First law of thermodynamics for open and closed systems under steady and unsteady flow
3. Heat content and internal energy with thermodynamic properties
4. Reversible process
5. Heat capacity
6. Relations of temperature, pressure and volume with critical point
7. Ideal gas behavior
8. Maxwell's relations
9. Throttling process

## 10. Second law of thermodynamics

انتقال الحرارة ١	CHE312
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## CHE 312 HEAT TRANSFER 1

## Curriculum:

1. Heat transfer by conduction, convection and radiation
2. Heat conductance
3. One - dimensional steady state conduction
4. Radial systems (cylinder and sphere)
5. Overall heat transfer coefficient
6. Critical thickness of the insulator
7. Heat source systems
8. Resistance to heat contact
9. Unsteady state conduction
10. Complete heat capacity system
11. Application and Hessler's diagrams
12. Multi dimensions systems

هندسة التفاعلات	CHE313
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## CHE 313 REACTION ENGINEERING

## Curriculum:

1. Thermodynamic of chemical reactions
2. Reaction kinetics
3. Rate of reaction equation
4. Dependence of rate equation on concentration and temperature
5. Analysis of information from constant and variable volume batch reactor
6. Ideal reactors
7. Single ideal reactor
8. Ideal batch reactor
9. Steady state continuous stirred reactor
10. Plug flow reactor
11. Operation of reactors at different temperatures
12. Adiabatic operation of batch reactor
13. Exothermic reactions in continuous stirred reactor

انتقال المادة ١	CHE314
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## CHE 314 MASS TRANSFER 1

## Curriculum:

1. Diffusion
2. Reverse diffusion
3. Diffusion in stagnant layer
4. Diffusion coefficient
5. Mass transfer theories
6. Mass transfer coefficients
7. Diffusion in gas, liquids and solids



8. Diffusion with chemical reaction
9. Interphase Mass Transfer
10. Gas Liquid contacting Equipment
11. Gas Absorption and stripping

تصميم العمليات الكيميائية	CHE315
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## CHE 315 CHEMICAL PROCESS DESIGN

## Curriculum:

1. Introduction
2. Flow sheet of process design
3. PFD and material balance
4. PFD and Energy Balance
5. Piping system and control systems (P&ID)
6. Utility design for flow sheet
7. Plant and Units layout
8. Cost estimation
9. Piping, valves selection
10. Pumps design
11. Material of constriction

اللغة الانكليزية ٣	UNV311
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## UNV 311 ENGLISH LANGUGE 3

## Curriculum:

1. Basic introduction
2. Reading skills
3. Listening skills
4. Making notes during lectures
5. Understanding English Grammar
6. Reading skills
7. Listening skills
8. Making notes during lectures

مختبر الهندسة الكيميائية ١	CHE316
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## CHE 316 Chemical Engineering Lab. 1

## Curriculum:

1. Introduction,
2. Laboratory Safety Rules,
3. Report Writing
4. Selected Fluid flow experiments
5. Selected Heat transfer experiments
6. Selected mass transfer experiments
7. Selected thermodynamics experiments

الرياضيات التطبيقية للهندسة الكيميائية ١	CHE317
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## CHE 317 APPLIED MATHEMATIC FOR CHEMICAL ENGINEERING 1

## Curriculum:

1. First order differential equations
2. Homogeneous
3. Linear
4. Bernoulli's
5. Second order differential equations
6. Non linear
7. Linear and its solution using D – operator
8. Solution of differential equations by Frobenius method

<b>Third Year</b>
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<b>Second Semester</b>
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الثرموديناميك ٢	CHE321
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## CHE 321 THERMODYNAMICS 2

## Curriculum:

1. Heat engine
2. Carnot cycle
3. Entropy and the second law of thermodynamic
4. Lost work
5. Entropy calculations
6. Systems of generating electrical energy
7. Freezing system and heat pump
8. Systems with varying concentrations
9. Fugacity and its calculation
10. Vapor - liquid equilibrium
11. Chemical equilibrium
12. Effect of temperature and pressure on chemical equilibrium conversion

انتقال الحرارة ٢	CHE322
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## CHE 322 HEAT TRANSFER 2

## Curriculum:

1. Heat transfer by convection
2. Boundary layer for laminar and turbulent flow
3. Thermal boundary layer for laminar and turbulent flow
4. Analogy between fluid friction and heat transfer
5. Experimental relations of heat transfer by forced convection inside pipes
6. Flow through bundle of tubes
7. Heat exchangers Dsign
8. NTU method
9. Heat transfer by radiation
10. Relation between coefficient and the body
11. Heat exchange between non black bodies

تصميم المفاعلات	CHE323
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## CHE 323 REACTOR DESIGN

## Curriculum:

1. Adiabatic and non adiabatic operation of plug flow reactor
2. Design of single reaction bioreactors
3. System of single bioreactor
4. Connection of plug flow reactors in series or in parallel
5. Connection of continuous stirred reactors with the same or different volumes in series
6. Connection of different types of reactors in series
7. Recycle bioreactor
8. Self catalytic bioreactor
9. Introduction to design of bioreactors with heterogeneous reactions
10. analysis of the reactor (solid-fluid)
11. Height of the bioreactor unit
12. Activity of biocatalyst

انتقال المادة ٢	CHE324
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## CHE 324 MASS TRANSFER 2

## Curriculum:

1. Distillation
2. Extraction (liquid - liquid)
3. Leaching (solid - liquid)
4. Humidification and Cooling
5. Drying
6. Evaporation
7. Membrane separation
8. Application of separation process in computers

تصميم المعدات الكيميائية	CHE325
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## CHE 325 CHEMICAL EQUIPMENT DESIGN

## Curriculum:

1. Vessel and Tank
2. Absorption columns
3. Reactor design
4. Distillation Column
5. Evaporators
6. Heat exchangers
7. Extraction columns
8. Crystallizer Design
9. Filter Design
10. Spray Dryer Design

مختبر الهندسة الكيميائية ٢	CHE326
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## CHE 326 Chemical Engineering Lab. 2

## Curriculum:

1. Introduction,
2. Laboratory Safety Rules,
3. Report Writing
4. Selected Fluid flow experiments
5. Selected Heat transfer experiments
6. Selected mass transfer experiments
7. Selected thermodynamics experiments

الرياضيات التطبيقية للهندسة الكيميائية ٢	CHE327
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## CHE 327 APPLIED MATHEMATIC FOR CHEMICAL ENGINEERING 2

## Curriculum:

1. Error, Gamma, Beta, and Bell functions
2. Partial differential equations
3. Solution by separation of variables
4. Laplace transform
5. Mathematical modeling
6. Application on chemical engineering steady and unsteady state systems
7. Finite differences
8. Application on chemical engineering multi steps systems

صناعات كيميائية	CHE328
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## CHE 328 CHEMICAL INDUSTRIES

## Curriculum:

1. Water conditioning and treatment processes, softening and demineralization of water
2. Amorphous and crystalline forms of carbon, manufacture and applications of carbon black and graphite; activated carbon and its manufacture by gaseous oxidation and chemical activation methods.
3. Various kinds of cements and their major constituents, cement manufacture by cement rock (limestone) beneficiation and Portland process.
4. Nature, types, composition and uses of glass, its manufacture: melting, shaping, annealing and finishing operations.
5. Products and raw materials of chlor-alkali industry, manufacturing soda ash, caustic soda and chlorine manufacture by electrolytic process.
6. Major phosphorous products; dry (electric furnace) method of recovering elemental phosphorus; phosphoric acid manufacture by dry and wet (sulphuric acid leaching or HCl digestion) methods; manufacture of phosphatic fertilizers: calcium phosphates, ammonium phosphate, nitro phosphate and sodium phosphate
7. Manufacture of ammonia, urea, nitric acid and ammonium nitrate.
8. Sulphur-its forms, properties and sources, sulphur mining by Frasch process, sulphur recovery from pyrite ore by Finnish process, sulphur recovery from natural gas and petroleum refinery streams by Claus process; sulphuric acid manufacture by Contact process.

<b>Fourth Year</b>
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<b>First Semester</b>
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ديناميكية العمليات والسيطرة ١
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CHE411
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**CHE 411 PROCESS DYNAMICS AND CONTROL 1**

Curriculum:

1. Laplace transform
2. Transforming of nonlinear equations to linear
3. Effective functions
4. First order response
5. Calculation of time delay
6. Steady state coefficient
7. Final value theorem
8. Pure time delay
9. Response of first order systems
10. Reacted and non reacted systems
11. Second order system
12. Characteristics and response
13. Closed loop systems
14. Transfer function
15. Flow diagram
16. Transfer of signals between the elements of system

تكرير النفط ١
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CHE412
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**CHE 412 PETROLEUM REFINING 1**

Curriculum

1. Crude oils and their chemical composition
2. Physical and chemical characteristics of crude oil and its products
3. Evaluation of crude oil
4. Preparation of crude oil for refining
5. Crude oil refining
6. Thermal processes
7. Cracking
8. Coking
9. Steam cracking
10. Catalytic processes in oil refineries
11. Catalytic cracking
12. Hydro cracking
13. Desulphurization by hydrogen
14. Reforming
15. Isomerization
16. Polymerization
17. Steam reforming
18. Conventional chemical treatment of refinery products
19. Treatment with sulfuric acid

20. Treatment with earth

21. Lubricating oils

وحدات تشغيلية ١	CHE413
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#### CHE 413 UNIT OPERATIONS 1

Curriculum:

1. Introduction to transport phenomena
2. Vector and tensor calculus
3. Mechanisms of momentum transport
4. Shell momentum balances
5. 1-D problems on velocity distribution in laminar flow
6. Equations of change for isothermal systems
7. Applications of equations of change to solve 1- D problems on velocity distribution in
8. laminar flow
9. Transport phenomena in polymeric liquids
10. Mechanisms of energy transport

اللغة الانكليزية ٤	UNV411
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#### UNV 411 ENGLISH LANGUGE 4

Curriculum

1. Academic writing skills
2. Skills of writing a report, advanced skills with Microsoft word
3. Strengthen your report skills
4. Plagiarism, referencing and citations
5. What is research?
6. Resources types
7. Research Design
8. Data Presenting and treatment
9. Plagiarism
10. Citations and Referencing

المشروع ١	ENG411
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#### ENG 411 PROJECT 1

Curriculum:

1. Introduction
2. Theoretical Review
3. PFD
4. PI&D
5. Material Balance
6. Energy Balance
7. Full report

الطاقة المتجددة	CHE414
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#### CHE 414 RENEWABLE ENERGY

Curriculum:

1. Introduction to energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternate energy sources and their technology and application.
2. Society's present needs and future energy demands, examine conventional energy sources and systems, including fossil fuels and nuclear energy.
3. Alternate, renewable energy sources such as solar, biomass (conversions), wind power, geothermal, and hydro.
4. Energy conservation methods.

اخلاقيات هندسية	ENG412
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#### ENG 412 ENGINEERING ETHICS

##### Curriculum:

1. Introduction to the Course: Purpose, Objectives, Scope, Methods, Discussion
2. Introduction to Ethics I
3. Introduction to Ethics II;
4. Introduction to Philosophy of Engineering I
5. Introduction to Philosophy of Engineering II
6. Introduction to Engineering Ethics: Codes of Ethics, Whistle Blowing, Case Study Methodology
7. Case Studies: Finish Challenger Case; Ford Pinto Case

ادارة صناعية	CHE415
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#### CHE 415 INDUSTRIAL MANAGEMENT

##### Curriculum:

1. Linear programming
2. Graphical method
3. Standard form
4. Simplex method
5. Big M technique
6. Two phase method
7. Algebraic method
8. Special cases of linear programming
9. Dual form
10. Dual simplex method
11. Sensitivity analysis by graphical method
12. Postoptimally analysis by simplex method
13. Transport problem
14. Network assignments.

صناعات بتروكيمياوية	CHE416
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#### CHE 416 PETROCHEMICAL INDUSTRIES

##### Curriculum:

1. Polymer Science and Technology
2. Natural rubber production, processing and properties
3. Tire Technology

4. Rubber Technology
5. Plastics Technology
6. Synthetic Rubbers
7. Specialty Polymers
8. Adhesives and Coatings
9. Composites
10. Chemical Engineering
11. Mould and Die Design
12. Products Design

<b>Fourth Year</b>
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<b>Second Semester</b>
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ديناميكية العمليات والسيطرة ٢	CHE421
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## CHE 421 PROCESS DYNAMICS AND CONTROL 2

## Curriculum:

1. Symbols of control and measuring devices
2. Air control valve
3. Control system
4. Discontinuous
5. Proportional
6. Integral
7. Differential
8. Optimum control by Ziegler - Nickes method
9. Stability
10. Routh's method
11. Frequency response
12. Bode and Niquist diagram
13. Control of some chemical processes
14. Introduction to the control by computer
15. Measuring devices of temperature, pressure, concentration and fluid flow

الطرق العددية	CHE422
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## CHE 422 NUMERICAL METHODS

## Curriculum:

1. Types of errors
2. Roots of equations
3. Newton's method & bisection method
4. Solution of linear equations (Jacobi & Gauss – Seidel)
5. Elimination by Gauss
6. Iteration
7. Numerical differentiation and integration
8. Taylor's series( Runge Kutla, Interpolation, Lagrange method, Newton & Niefel)
9. Finding minimum and maximum
10. Elimination method of finite element equations



11. Lagrange method of finite element equations
12. Lagrange method for polynomials o(variables)
13. Kohcn - Togger method
14. Section method
15. Fybothassi method
16. Method of Flitcher – Reef
17. Simplex method

تكرير النفط ٢	CHE423
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## CHE 423 PETROLEUM REFINING 2

## Curriculum:

1. Properties and needs
2. Production techniques
3. Removal of asphalt by solvents
4. Extraction by furfural
5. Dewaxing
6. Production of different types of fuels and oil products
7. Gas oil
8. Solvents
9. Car and aero plane gasoline
10. Jet fuel
11. Kerosene
12. Diesel
13. Asphalt
14. Wax
15. Practical:
16. Density
17. Flash point
18. Viscosity
19. Aniline point
20. Sulfur content
21. Water content
22. Carbon content
23. Salt content

وحدات تشغيلية ٢	CHE424
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## CHE 424 UNIT OPERATIONS 2

## Curriculum:

1. Shell energy balances
2. 1-D problems on temperature distribution in solids and in laminar flow
3. Equations of change for non- isothermal systems
4. Applications of equations of change to solve 1- D problems on temperature
5. distribution in solids and in laminar flow
6. Mechanisms of mass transport
7. Shell mass balances

8. Applications of shell mass balances to solve 1- D problems on concentration
9. distributions in solids and in laminar flow
10. Equations of change for multi- component systems
11. 1-D problems on concentration distributions in solids and in laminar flow
12. Methods of solution of momentum, heat and mass transfer problems with more than
13. one independent variable.

المشروع ٢	ENG421
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## ENG 421 PROJECT 2

## Curriculum:

1. Selected Equipment's Design
2. Mechanical Equipment's Design
3. Total Project cost
4. Final Report

الوقود والطاقة	CHE425
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## CHE 425 Fuel and Energy

## Curriculum:

1. Analysis of energy conversion in thermomechanical, thermochemical, electrochemical, and photoelectric processes in existing and future power and transportation systems, with emphasis on efficiency, environmental impact and performance.
2. Systems utilizing fossil fuels, hydrogen, nuclear and renewable resources, over a range of sizes and scales.
3. Applications include fuel reforming, hydrogen and synthetic fuel production, fuel cells and batteries, combustion, hybrids, catalysis, supercritical and combined cycles, photovoltaics.
4. Different forms of energy storage and transmission, and optimal source utilization and fuel-life cycle analysis.

مختبر الهندسة الكيماوية ٣	CHE426
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## CHE 426 CHEMICAL ENGINEERING LAB. 3

## Curriculum:

1. Introduction,
2. Laboratory Safety Rules,
3. Report Writing
4. Selected Unit operation experiments
5. Selected Process Control experiments
6. Selected Petroleum experiments