| | | |
|---|---|---|
| 1. | **School** | **Engineering** |
| 2. | **Department** | **Chemical** |
| 3. | **Program title (Arabic)** | **بكالوريوس في الهندسة الكيميائية** |
| 4. | **Program title (English)** | **B.Sc. in Chemical Engineering** |

## 5. Components of Curriculum:

The curriculum for the bachelor's degree in Chemical Engineering consists of (162) credit hours distributed as follows:

| Number | Type of Requirement | Credit Hours |
|---|---|---|
| First | University Requirements | **27** |
| Second | Faculty Requirements | **23** |
| Third | Department Requirements | **112** |
| **Total** | | **162** |

الخطة الدراسية المعتمدة

THE UNIVERSITY OF JORDAN
School of Engineering

THE UNIVERSITY OF JORDAN
School of Engineering
Department of Chemical Engineering

## 6. Numbering System:

### A- Department Number

| Number | Department |
|---|---|
| 1 | Civil Engineering |
| 2 | Architectural Engineering |
| 3 | Electrical Engineering |
| 4 | Mechanical Engineering |
| 5 | Chemical Engineering |
| 6 | Industrial Engineering |
| 7 | Computer Engineering |
| 8 | Mechatronics Engineering |

### B- Course Number

الخطة الدراسية المعتمدة

| Course Number | Subject |
|---|---|
| 0 | Miscellaneous |
| 1 | Chemical Engineering Principles |
| 2 | Thermodynamics and Chemical Reaction Engineering |
| 3 | Chemical Engineering Analysis |
| 4 | Transport Operations |
| 5 | Chemical Industries |
| 6 | Chem. Eng. Laboratories |
| 7 | Engineering Sciences |
| 8 | Design |
| 9 | Project |

THE UNIVERSITY OF JORDAN School of Engineering

THE UNIVERSITY OF JORDAN School of Engineering Department of Chemical Engineering

**C- Course Number consists of 7 digits**

| School | | Department | | Level | Specialty | Serial |
|---|---|---|---|---|---|---|
| 0 | 9 | 0 | 5 | 2 | 3 | 1 |

**First: University Requirements: 27 Credit Hours.**

| Main Group : Compulsory Requirements (18 Credit Hours) | | | | | |
|---|---|---|---|---|---|
| **No.** | **Course Title** | **Course No.** | **Credit Hours** | **Prerequisites** | **Notes** |
| 1 | Military Sciences | 2220100 | 3 | --- | |
| 2 | National Culture | 3400100 | 3 | --- | |
| 3 | Learning & Research SKILLS | 3400101 | 3 | 1932099<br>3201099<br>3202099 | |
| 4 | Communication Skills | 3400102 | 3 | 3400101 | |
| 5 | Introduction to Philosophy and Critical Thinking | 3400103 | 3 | 3400101 | |
| 6 | Human Civilization | 3400104 | 3 | --- | |
| 7 | Campus Life and Ethics | 3400105 | 3 | --- | |

الخطة الدراسية المعتمدة

THE UNIVERSITY OF JORDAN School of Engineering

THE UNIVERSITY OF JORDAN School of Engineering Department of Chemical Engineering

| Main Group: Electives Requirements<br>(9 Credit Hours chosen by the student from the following table) | | | | | |
|---|---|---|---|---|---|
| **Sub Group: _ Min. Limit: 3** | | **Max. Limit : 3** | | | |
| **No.** | **Course Title** | **Course No.** | **Credit Hours** | **Prerequisites** | **Notes** |
| 1 | Islam and Contemporary Issues | 0400101 | 3 | -- | |
| 2 | Arab-Islamic Civilization | 2300101 | 3 | -- | |
| 3 | Jordan : History and Civilization | 2300102 | 3 | -- | |
| 4 | Great Books | 3400107 | 3 | -- | |
| 5 | Jerusalem | 3400108 | 3 | -- | |
| **Sub Group: _ Min. Limit: 3** | | **Max. Limit : 3** | | | |
| 6 | Environmental Culture | 0300102 | 3 | -- | |
| 7 | Islamic Culture | 0400102 | 3 | -- | |
| 8 | Health Culture | 0720100 | 3 | -- | |
| 9 | Legal Culture | 1000102 | 3 | -- | |
| 10 | Physical Fitness Culture | 1100100 | 3 | -- | |
| **Sub Group: _ Min. Limit: 3** | | **Max. Limit : 3** | | | |
| 11 | Electronic Commerce | 1600100 | 3 | -- | |
| 12 | Management Skills | 1601105 | 3 | -- | |
| 13 | Social Media | 1900101 | 3 | -- | |
| 14 | Appreciation of Art | 2000100 | 3 | -- | |
| 15 | Foreign Language | 2200103 | 3 | -- | |
| 16 | Special Subject | 3400106 | 3 | -- | |
| 17 | Entrepreneurship & Creativity | 3400109 | 3 | -- | |

الخطة الدراسية المعتمدة

THE UNIVERSITY OF JORDAN School of Engineering

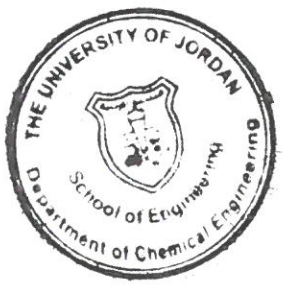
THE UNIVERSITY OF JORDAN School of Engineering Department of Chemical Engineering

**Second: School Courses: distributed as follows:**

A. **Obligatory School Courses: (23) credit hours**
B. **Elective School Courses: (Zero) credit hours**

| Course No. | Course title | Contact Hours | | Credit Hours | Prerequisite |
|---|---|---|---|---|---|
| | | Theoretical | Practical | | |
| 0301101 | Calculus (1) | 3 | - | 3 | - |
| 0301102 | Calculus (2) | 3 | - | 3 | 0301101 |
| 0302101 | General Physics (1) | 3 | - | 3 | - |
| 0302111 | Practical Physics(1) | - | 3 | 1 | 0302101 or concurrently |
| 0901420 | Engineering Economy | 3 | - | 3 | - |
| 0904131 | Engineering Graphics and Descriptive Geometry | 2 | 2 drawing 2 computer | 3 | - |
| 0908200 | Introduction to Engineering | 2 | - | 2 | - |
| 0966111 | Engineering Workshops | - | 3 | 1 | - |
| 0966201 | Technical Writing | 1 | - | 1 | 3202100 |
| 1931102 | Computer Skills for scientific Faculties | 3 | - | 3 | 1932099 1902098 |

الخطة الدراسية المعتمدة

الخطة الدراسية المعتمدة

**Third:** Specialty Courses: (112) credit hours distributed as follows:

## A. Obligatory Specialty Courses: (91) credit hours:

| Course No. | Course Title | Credit Hours | Contact Hours | | Prerequisite |
|---|---|---|---|---|---|
| | | | *Theoretical* | *Practical* | |
| 0301201 | Calculus (3) | 3 | 3 | - | 0301102 |
| 0302102 | General Physics (2) | 3 | 3 | - | 0302101 |
| 0303101 | General Chemistry (1) | 3 | 3 | - | - |
| 0303102 | General Chemistry (2) | 3 | 3 | - | 0303101 |
| 0303216 | Experimental Analytical Chemistry | 1 | - | 3 | 0333211* |
| 0303239 | Practical Organic Chemistry (For None Chemistry Major) | 1 | - | 4 | 0333233* |
| 0333109 | Experimental General Chemistry | 1 | - | 3 | 0303101* |
| 0333211 | Analytical Chemistry | 3 | 3 | - | 0303101 |
| 0333233 | Organic Chemistry (For None Chemistry Major) | 3 | 3 | - | 0303102 |
| 0903203 | Electrical Engineering | 3 | 3 | - | 0302102 |
| 0905211 | Chemical Engineering Principles (1) | 3 | 2 | 3 | 0303101 |
| 0905231 | Mathematical Methods in Chemical Engineering | 3 | 3 | - | 0301201 |
| 0905241 | Fluid Mechanics | 3 | 3 | - | 0905211 |
| 0905323 | Thermodynamics (2) | 3 | 3 | - | 0935322 |
| 0905324 | Physical Chemistry | 3 | 3 | - | 0905323 |

THE UNIVERSITY OF JORDAN School of Engineering

School of Engineering Department of Chemical Engineering

| | | | | | |
|---|---|---|---|---|---|
| 0905343 | Process Heat Transfer | 3 | 3 | - | 0905241 |
| 0905421 | Chemical Reaction Engineering (1) | 3 | 3 | - | 0905324* |
| 0905422 | Chemical Reaction Engineering (2) | 2 | 2 | - | 0905421 |
| 0905477 | Process Safety Engineering | 2 | 2 | - | 0935342 |
| 0905481 | Process Design | 3 | 3 | - | 0901420<br>0935441 |
| 0935212 | Chemical Engineering Principles (2) | 2 | 2 | - | 0905211 |
| 0935301 | Numerical Methods in Chemical Engineering | 3 | 2 | 3 | 0965201 |
| 0935322 | Thermodynamics (1) | 3 | 3 | - | 0935212 |
| 0935342 | Solid Particulates | 3 | 3 | - | 0905241 |
| 0935441 | Mass Transfer Operations | 3 | 3 | - | 0905323 |
| 0935442 | Heat and Mass Transfer Operations | 3 | 3 | - | 0905343<br>0935441 |
| 0935461 | Chemical Engineering Laboratory (1) | 1 | - | 3 | 0905241<br>0905323 |
| 0935462 | Chemical Engineering Laboratory (2) | 1 | - | 3 | 0935342<br>0905343 |
| 0935463 | Chemical Engineering Laboratory (3) | 1 | - | 3 | 0935442* |
| 0935473 | Environmental Engineering | 3 | 3 | - | 0935342 |
| 0935561 | Chemical Engineering Laboratory (4) | 1 | - | 3 | 0905421<br>0935571 |
| 0935571 | Process Dynamics and Control | 3 | 3 | - | 0935442* |
| 0935582 | Chemical Plant Design | 3 | 3 | - | 0901420<br>0955451 |

الخطة الدراسية المعتمدة

THE UNIVERSITY OF JORDAN School of Engineering

THE UNIVERSITY OF JORDAN School of Engineering Department of Chemical Engineering

| | | | | | |
|---|---|---|---|---|---|
| 0955331 | Modelling Process by Statistical Methods | 3 | 3 | - | 0905231 |
| 0955451 | Local Chemical Industries | 3 | 2 | 3 | 0935442* |
| 0965201 | Computer Applications in Chemical Engineering | 1 | - | 3 | 1932099<br>1902098 |
| 0900500 | Practical Training | 0 | - | - | ** |
| 0975598 | Project (1) | 1 | - | - | *** |
| 0975599 | Project (2) | 2 | - | - | *** |

* Or Concurrently

** The student is required to undertake practical training after completing the required number of credit hours in accordance with the relevant regulations for training at the Faculty of Engineering and Technology.

*** Project duration is two regular semesters, Students are allowed to register in the project after completion of 120 credit hours.

الخطة الدراسية المعتمدة

THE UNIVERSITY OF JORDAN School of Engineering

School of Engineering Department of Chemical Engineering

الخطة الدراسية المعتمدة

**B. Elective Specialty Courses: (21) Credit Hours to be chosen from the following:**

| Course No. | Course Title | Credit Hours | Contact Hours | | Prerequisite |
|---|---|---|---|---|---|
| | | | Theoretical | Practical | |
| 0905351 | Engineering Materials Science | 3 | 3 | - | 0935212 |
| 0905371 | Fuel and Energy | 3 | 3 | - | 0905343 |
| 0905423 | Biochemical Engineering | 3 | 3 | - | 0905421 |
| 0905453 | Ore Dressing | 3 | 3 | - | 0905343 |
| 0905502 | Quality Control and Management | 3 | 3 | - | 0955451 |
| 0905509 | Selected Topics in Chemical | 3 | 3 | - | 4th year level |
| 0905531 | Process Optimization | 3 | 3 | - | 0935301 |
| 0905542 | Water Desalination | 3 | 3 | - | 0935442 |
| 0905551 | Metal Extraction | 3 | 3 | - | 0905343 |
| 0905554 | Fertilizer Technology | 3 | 3 | - | 0935441 |
| 0905597 | Practical Project | 3 | - | - | 0935441 |
| 0935401 | Management for Chemical Engineering | 3 | 3 | - | 0935212 |
| 0935452 | Corrosion Engineering | 3 | 3 | - | 0905324 |
| 0935472 | Petroleum Refining Engineering | 3 | 3 | - | 0935441 |
| 0935474 | Waste Water Treatment | 3 | 3 | - | 0935473 |
| 0935475 | Air Pollution | 3 | 3 | - | 0905421 |
| 0935541 | Separation Processes | 3 | 3 | - | 0935441 |
| 0935573 | Solid Waste Management | 3 | 3 | - | 0935473 |
| 0945471 | Energy Conservation and Management | 3 | 3 | - | 0905371 |
| 0945552 | Polymers and Plastics Engineering | 3 | 3 | - | 0905421 |
| 0945553 | Composites | 3 | 3 | - | 0945552 |
| 0955431 | Process Analysis and Simulation | 3 | 3 | - | 0935301<br>0905421 |

**Fourth**: Advisory Study Plan

**First Year**

| First Semester | | | Second Semester | | |
|---|---|---|---|---|---|
| **Course Number** | **Course Title** | **Credit Hours** | **Course Number** | **Course Title** | **Credit Hours** |
| 0301101 | Calculus (1) | 3 | 0301102 | Calculus (2) | 3 |
| 0302101 | General Physics (1) | 3 | 0302102 | General Physics (2) | 3 |
| 0302111 | Practical Physics(1) | 1 | 0904131 | Engineering Graphics and Descriptive Geometry | 3 |
| 0303101 | General Chemistry (1) | 3 | 0303102 | General Chemistry (2) | 3 |
| 0333109 | Experimental General Chemistry | 1 | | | |
| 0966111 | Engineering Workshops | 1 | | | |
| 1931102 | Computer Skills ( for scientific faculties ) | 3 | | | |
| | **Total** | **15** | | **Total** | **12** |

الخطة الدراسية المعتمدة

THE UNIVERSITY OF JORDAN School of Engineering

Journal of Engineering Department of Chemical Engineering

**Second Year**

| First Semester | | | Second Semester | | |
|---|---|---|---|---|---|
| **Course Number** | **Course Title** | **Credit Hours** | **Course Number** | **Course Title** | **Credit Hours** |
| 0905211 | Chemical Engineering Principles (1) | 3 | 0905231 | Mathematical Methods in Chemical Engineering | 3 |
| 0301201 | Calculus (3) | 3 | 0905241 | Fluid Mechanics | 3 |
| 0333211 | Analytical Chemistry | 3 | 0935212 | Chemical Engineering Principles (2) | 2 |
| 0303216 | Experimental Analytical Chemistry | 1 | 0903203 | Electrical Engineering | 3 |
| 0965201 | Computer Applications in Chemical Engineering | 1 | 0333233 | Organic Chemistry (For None Chemistry Major) | 3 |
| | University Elective | 3 | 0303239 | Practical Organic Chemistry (For None Chemistry Major) | 1 |
| | University Elective | 3 | 0908200 | Introduction to Engineering | 2 |
| | **Total** | **17** | | **Total** | **17** |

**Third Year**

| First Semester | | | Second Semester | | |
|---|---|---|---|---|---|
| **Course Number** | **Course Title** | **Credit Hours** | **Course Number** | **Course Title** | **Credit Hours** |
| 0935301 | Numerical Methods in Chemical Engineering | 3 | 0905323 | Thermodynamics (2) | 2 |
| 0935322 | Thermodynamics (1) | 3 | 0901420 | Engineering Economics | 3 |
| 0905343 | Process Heat Transfer | 3 | 0905xxx | Department Elective | 3 |
| 0935342 | Solid Particulates | 3 | 0955331 | Process Modelling by Statistical Methods | 3 |
| 0966201 | Technical Writing | 1 | | University Elective | 3 |
| | University Elective | 3 | | University Elective | 3 |
| | **Total** | **16** | | **Total** | **17** |

**Fourth Year**

| First Semester | | | Second Semester | | |
|---|---|---|---|---|---|
| **Course Number** | **Course Title** | **Credit Hours** | **Course Number** | **Course Title** | **Credit Hours** |
| 0905324 | Physical Chemistry | 3 | 0935442 | Heat and Mass Transfer Operations | 3 |
| 0905421 | Chemical Reaction Engineering (1) | 3 | 0935473 | Environmental Engineering | 3 |
| 0935441 | Mass Transfer Operations | 3 | 0905422 | Chemical Reaction Engineering (2) | 2 |
| 0935461 | Chemical Engineering Lab. (1) | 1 | 0935462 | Chemical Engineering Lab. (2) | 1 |
| 0905477 | Process Safety Engineering | 2 | 0905481 | Process Design | 3 |
| 0905xxx | Department Elective | 3 | 0955451 | Local Chemical Industries | 3 |
| 0905xxx | Department Elective | 3 | 0905xxx | Department Elective | 3 |
| | **Total** | **18** | | **Total** | **18** |

**Fifth Year**

| *First Semester* | | | *Second Semester* | | |
|---|---|---|---|---|---|
| ***Course No.*** | ***Course Title*** | **Credit Hours** | ***Course No.*** | ***Course Title*** | **Credit Hours** |
| 0935582 | Chemical Plant Design | 3 | 0935561 | Chemical Engineering Lab. (4) | 1 |
| 0935463 | Chemical Engineering Lab. (3) | 1 | 0975599 | Project(2) | 2 |
| 0935571 | Process Dynamics and Control | 3 | 0905xxx | Department Elective | 3 |
| 0975598 | Project(1) | 1 | 0905xxx | Department Elective | 3 |
| 0905xxx | Department Elective | 3 | | University Elective | 3 |
| | University Elective | 3 | | University Elective | 3 |
| | University Elective | 3 | | | |
| | | | | | |
| | | | | | |
| | **Total** | **17** | | **Total** | **15** |

الخطة الدراسية المعتمدة

**Department of Chemical Engineering**
**Course Description**

**0301101 Calculus I** **(3 Credit Hours)**

**Prerequisite: (None)**

Functions: domain, operations on functions, graphs of functions; trigonometric functions; limits: meaning of a limit; computational techniques, limits at infinity, infinite limits; continuity; limits and continuity of trigonometric functions; the derivative: techniques of differentiation, derivatives of trigonometric functions; the chain rules; implicit differentiation; differentials; Roll's Theorem; the mean value theorem; the extended mean value theorem; L'Hopital's rule; increasing and decreasing functions; concavity; maximum and minimum values of a function; graphs of functions including rational functions (asymptotes) and functions with vertical tangents (cusps); antiderivatives; the indefinite integral; the definite integral; the fundamental theorem of calculus; the area under a curve; the area between two curves; transcendental functions: inverse functions, logarithmic and exponential functions; derivatives and integrals; limits (the indeterminate forms); hyperbolic functions and their inverses; inverse trigonometric functions.

**0301102 Calculus II** **(3 Credit Hours)**

**Prerequisite: 0301101**

Techniques of integration: integration by substitution; integration by parts, integrating powers of trigonometric functions, trigonometric substitutions, integrating rational functions, partial fractions, rationalization, miscellaneous substitution; improper integrals; application of definite integral: volumes, length of a plane curve, area of a surface of revolution polar coordinates and parametric equations: polar coordinates, graphs in polar coordinates, area in polar coordinates; infinite series: sequences, infinite series, convergence tests, absolute convergence, conditional convergence; alternating series; power series: Taylor and Maclurine series, differentiation and integration of power series.

**0301201 Calculus III** **(3 Credit Hours)**

**Prerequisite: 0301102**

Three dimensional space and vectors rectangular coordinates in 3-space; spheres, cylindrical surfaces; quadric surfaces; vectors: dot product, projections, cross product, parametric equations of lines. Planes in 3-spaces; vector-valued functions: calculus of vector valued functions, change of parameters, arc length, unit tangent and normal vectors, curvature, functions of two or more variable: domain, limits, and continuity; partial derivatives; differentiability; total differentials; the chain rule; the gradient; directional derivatives; tangent planes; normal lines; maxima and minima of functions of two variables; Lagrange multipliers; multiple integrals: double integral, double integrals in polar coordinates; triple integrals; triple integrals in cylindrical and spherical coordinates; change of variables in multiple integrals; Jacobian.

THE UNIVERSITY OF JORDAN School of Engineering

THE UNIVERSITY OF JORDAN School of Engineering Department of Chemical Engineering

**0302101 General Physics-1** **(3 Credit Hours)**
**Prerequisite: (None)**
Motion in one dimension; motion in two dimensions; the laws of motion; circular motion; conservation of energy; linear momentum and collisions; rotation of a rigid object about a fixed axis; angular momentum; static equilibrium; universal gravitation; fluid mechanics; oscillatory motion.

**0302111 Practical Physics-1** **(1 Credit Hour)**
**Prerequisite: 0302101 or Co-requisite**
11 experiments each of 3 hrs/week duration: collection and analysis of data; measurements and uncertainties; vectors: force table; kinematics of rectilinear motion; force and motion; collision in two dimensions; rotational motion; simple harmonic motion: simple pendulum; gas's Laws; ballistic pendulum; specific heat capacity of metals.

**0302102 General Physics-2** **(3 Credit Hours)**
**Prerequisite: 0302101**
Electric field; Gauss's law; electric potential; capacitance and dielectrics, current and resistance; direct current circuits; magnetic field; sources of the magnetic field; Faraday's law, inductance; alternating current circuits; the nature of light and the principles of ray optics; image formation.

**0901420 Engineering Economy** **(3 Credit Hours)**
**Prerequisite: (None)**
Major elements of feasibility studies. Principles of engineering economy. Equivalence and compound interest formulas. Single payment model. Uniform payment model. Gradient payment model. Exponential payment model. Decision criteria for single and multiple alternatives: present worth, annual worth, future worth, internal rate of return, benefit cost ratio and payback methods. Income-tax effect on decision making.

**0904131 Engineering Graphics and Descriptive Geometry** **(3 Credit Hours)**
**Prerequisite: (None)**
Drawing equipment and use of instruments. Lettering, Geometric construction, Sketching and shape description. Basic descriptive geometry, Developments and intersections. Axonometric, oblique and perspective drawings, Multiview projection, Principal views, Conventional practice, and sectional views. Auxiliary views. Dimensioning techniques. Parallel: Introduction to computer drawing, Drawing aids, Geometrical construction, and the appropriate commands of text, editing, plotting, sections, layers, pictorial views, and dimensioning. Auxiliary views.

الخطة الدراسية المعتمدة

THE UNIVERSITY OF JORDAN School of Engineering

THE UNIVERSITY OF JORDAN School of Engineering Department of Chemical Engineering

**0966111 Engineering Workshops** **(1 Credit Hour)**
**Prerequisite: (None)**
General safety, materials and their classifications, measuring devices and their accuracy, fits and tolerances, theoretical background for the practical exercises including fitting, forging, carpentry, casting, welding, mechanical saws, shearers, drills, lathes, milling machines, shapers and grinders.

**0303101 General Chemistry-1** **(3 Credit Hours)**
**Prerequisite: (None)**
Measurements and significant figures, chemical reactions; stoichiometry; the gaseous state; thermochemistry; electronic structure and periodicity; chemical bonding; molecular shapes; states of matter and intermolecular forces.

**0303102 General Chemistry-2** **(3 Credit Hours)**
**Prerequisite:0303101**
Physical properties of solutions; chemical kinetics; chemical equilibrium; acids and bases; acid-base equilibria in aqueous solutions; solubility and complex ion equilibria; chemical thermodynamics; electrochemistry.

**0333109 Experimental General Chemistry** **(1 Credit Hours)**
**Prerequisite: 0303101 or Co-requisite**
The course includes experiments dealing with the following topics:
Safety and laboratory rules; chemical observations; Avogadro's number; stoichiometry; volumetric analysis; oxidation and reduction; colligative properties; thermochemistry and equilibrium.

**0333211 Analytical Chemistry** **(3 Credit Hour)**
**Prerequisite: 0303101**
The scope and importance of analytical chemistry; errors and statistical evaluation of data; equilibrium and equilibrium calculations; gravimetric analysis; volumetric analysis: precipitation titrations, complexometric titrations, acid-base titrations.

**0303216 Experimental Analytical Chemistry** **(1 Credit Hours)**
**Prerequisite: 0333211 Co-requisite**
The course includes experiments dealing with the following topics: statistical treatment of data; gravimetric analysis; acid-base titrations; precipitation titrations; complexometric titrations; redox titrations, analysis of real samples.

**0333233 Organic Chemistry (Non Chemistry Majors)** **(3 Credit Hours)**
**Prerequisite: 0303102**
Hydrocarbons: alkanes, cycloakanes, alkenes, alkynes; aromatic compounds; stereochemistry; halides; alcohols; phenols; ethers; amines; carbonyl compounds and carboxylic acids.

**0303239 Practical Organic Chemistry 1 ( Non Chemistry Majors) (1 Credit Hours)**
**Prerequisite: 0333233 or Co-requisite**
The course involves separation, purification of and identification of organic compounds through their physical properties: melting point, distillation, crystallization, extraction, and chromatography; preparation of simple organic compounds; qualitative tests for selected classes of organic compounds.

**0965201 Computer Applications in Chemical Engineering (1 Credit Hour)**
**Prerequisite: (1932099, 1902098)**
An applied course focusing on use of Internet resources and computer packages to equip the students with the essentials of using computers in chemical engineering. Internet: Use of Web search engines; Useful chemical engineering links and databases; World Wide Virtual Libraries. Computer Packages: Getting started with some available packages used in typical modern chemical engineering textbooks, e.g., EZ-Solve, Polymath, and Matlab. Students will undertake a number of assignments involving solving problems utilizing Internet acquired information as well as the numerical, symbolic and graphical capabilities of the computer packages.

**0905211 Chemical Engineering Principles (1) (3 Credit Hours)**
**Prerequisite: (0303101)**
The role of the chemical engineer. Units and dimensions. Conversion of units. Systems of units. Dimensional homogeneity. Process data representation. Processes and process variables. Degrees of freedom analysis. Elementary mathematical tools for solving balance equations. Material balances for non reactive and reactive systems. Material balance on single phase and multiphase systems.

**0935212 Chemical Engineering Principles (2) (2 Credit Hours)**
**Prerequisite: (0905211)**
The first law of thermodynamics. Energy balance on closed system. Energy balance on open systems at steady state. Energy balances on non reactive and reactive systems. Material and energy balances. Balances on transient systems.

**0905231 Mathematical Methods in Chemical Engineering (3 Credit Hours)**
**Prerequisite: (0301201)**
Concepts of differential equations. First, second and higher order ordinary differential equations. System of ordinary differential equations. Eigen values and eigenvectors. Solution of ordinary differential equations using various analytical techniques including series and Laplace transform methods and application in chemical engineering. Partial differential equations, types, solutions of first order partial differential equation and applications in chemical engineering.

**0905241 Fluid Mechanics** **(3 Credit Hours)**

**Prerequisite: (0905211)**

Introduction of fluid mechanics. Physical properties of fluids. Types of fluids. Fluid statics: Basic hydrostatic equation, Buoyancy and manometers. Bernouli's equation. Fluid flow measurements. Fluid friction in steady flow. Macroscopic momentum balances. Shell momentum balances. Deferential momentum balance. Open channel flow. Pumping of fluids and pump selection, fluid mixing.

**0935301 Numerical Methods in Chemical Engineering** **(3 Credit Hours)**

**Prerequisite: (0965201)**

Introduction to floating point arithmetic and error analysis. Numerical solution of nonlinear algebraic equations. Solution of linear and nonlinear systems of algebraic equation. Fitting and interpolating polynomials. Numerical differentiation and integration. Numerical solutions of ordinary and partial differential equations. Solution of different applications in chemical engineering using MATLAB.

**0935322 Thermodynamics (1)** **(3 Credit Hours)**

**Prerequisite: (0935212)**

Introduction to engineering thermodynamics. Analytical and generalized equations of state. Applications of the first law of thermodynamics: conservation of energy, flow and non-flow processes, work calculations. Applications of the second law of thermodynamics: reversible and irreversible processes, entropy relations. Departure functions based on analytical and generalized relationships. Thermodynamic cycles for common energy systems.

**0905323 Thermodynamics (2)** **(2 Credit Hours)**

**Prerequisite: (0935322)**

Relationships among thermodynamic properties: equations, tables, diagrams. Estimation of auxiliary physical properties. Properties of mixtures and solutions: fugacity of gases and liquids, ideal and non-ideal solutions, activity and standard states, Gibbs-Duhem equation. Physical equilibria among phases: phase rule, vapor-liquid equilibria for various systems. Equilibrium phase diagrams. Chemical reactions equilibria.

الخطة الدراسية المعتمدة

THE UNIVERSITY OF JORDAN School of Engineering

THE UNIVERSITY OF JORDAN School of Engineering Department of Chemical Engineering

**0905324 Physical Chemistry** **(3 Credit Hours)**

**Prerequisite: (0905323)**

Review of gases behaviour and thermodynamics. Chemical equilibrium in solutions. Heterogeneous equilibrium. Shifts of equilibrium and its dependence on temperature and pressure. Electrolyte solutions, weak and strong electrolytes, transport numbers, ion conductivity, activity coefficient. Electrochemical cells, standard electrode potential, types of electrochemical cells, fuel cells, photogalvanic cells, batteries. Basic ideas of chemical kinetics, rate of reaction, Arhenius equation, empirical rate equation. Surface chemistry and colloids: adsorption, surface tension and capillary, gels, emulsions and electrical properties of colloidal system.

**0955331 Process Modelling by Statistical Methods** **(3 Credit Hours)**

**Prerequisite: ( 0905231)**

Introduction to stochastic and deterministic modeling of simple chemical engineering processes. Essential probability and statistical methods: probability laws, random variables and distributions. Descriptive statistics, estimation and tests of hypotheses, regression and correlation analysis.

**0935342 Solid Particulates** **(3 Credit Hours)**

**Prerequisite: (0905241)**

Characterisation of solids: solid properties, size analysis, solids in bulk, handling and flow of solids, size reduction. Fluid particle systems: packings and packed columns, seolimentation, filtration, centrifugation, mixing, flotation, fluidization.

**0905343 Process Heat Transfer** **(3 Credit Hours)**

**Prerequisite: (0905241)**

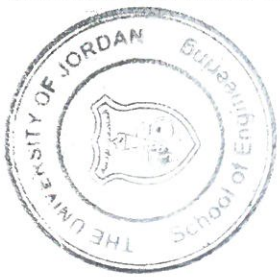
Conduction heat transfer. Forces convection heat transfer in laminar and turbulent flow (internal and external). Natural convection heat transfer. Boiling and condensation heat transfer. Radiation heat transfer. Heat exchangers.

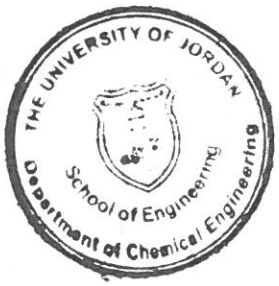
**0905351 Engineering Materials Science** **(3 Credit Hours)**

**Prerequisite: (0935212)**

Structure of solid phases. Crystal geometry. Structural disorder. Solid solutions and phase diagrams. Types of materials. Mechanical and thermal behaviour of materials. Stability of materials in service. Corrosion and material selection. Phase diagrams and phase changes, thermal treatment.

الخطة الدراسية المعتمدة



**0905371 Fuel and Energy** **(3 Credit Hours)**

**Prerequisite: (0905343)**

Energy classification, sources and utilization. Non-renewable Energy: fossil fuels and Nuclear energy. Renewable Energy: solar energy, wind power, tidal power, and geothermal energy. Fossil-fuel systems and applications. Energy storage: chemical storage, thermal storage and fuel cells.

**0935401 Management for Chemical Engineering** **(3 Credit Hours)**

**Prerequisite: (0935212)**

Theories of management, Forecasting, Organisation of chemical engineering projects, Breakeven analysis, project evaluation and cashflow diagrams. Critical path method, Decision trees and alternatives, Iventory control.

**0905502 Quality Control and Management** **(3 Credit Hours)**

**Prerequisite: (0955451)**

Quality improvement; its importance, dimensions and costs. Statistical quality control: basic statistical tools, control charts (x-bar, S, and charts), analysis of charts, process capability. Principles of TQM and trend in quality management. The IOS model and its requirements and specifications, and ISO application.

**0905421 Chemical Reaction Engineering (1)** **(3 Credit Hours)**

**Prerequisite: (0905324 or concurrently)**

Rate equations and conservation equation applied to homogeneous reaction system in batch, continuous stirred tank and tubular reactors. Conversion, yield and selectivity for isothermal reactors with multiple reactions: Choice of reactor for various reactions. Non-ideal flow reactors. Residence time distributions and measurement. Effects of micromixing. Design of single phase reactor configurations.

**0905422 Chemical Reaction Engineering (2)** **(2 Credit Hours)**

**Prerequisite: (0905421)**

Introduction to multiphase reaction systems. Non-catalytic fluid solid reactions and reactors. Gas/liquid and liquid/liquid reactions, concept of rate controlling step. Catalysis and kinetic-catalytic models. Mass transfer and reaction in porous solids. Catalytic heterogeneous reactors-packed and fluidized bed types. Thermal characteristics. Design techniques.

الخطة الدراسية المعتمدة

THE UNIVERSITY OF JORDAN School of Engineering

UNIVERSITY OF JORDAN School of Engineering Department of Chemical Engineering

**0905423 Biochemical Engineering** **(3 Credit Hours)**

**Prerequisite: (0905421)**

Introduction to Biotechnology. Elementary Biochemistry and Microbiology. Major Metabolic pathways. Introduction to genetic engineering. Kinetics and mechanism of enzymatic reactions, enzyme inhibition, and enzyme immobilization. Kinetics of microbial growth, substrate utilization and product formation. Methods of cell cultivation (batch, continuous and fed batch). Transport phenomena in bioprocesses. Design, analysis and scale-up of biochemical reactors.

**0955431 Process Analysis and Simulation** **(3 Credit Hours)**

**Prerequisite: (0935301, 0905421)**

Techniques for analysis, modelling and simulation of typical process equipment and integrated processes, both continuous and non-continuous. Application of necessary analytical and numerical mathematical algorithms to selected cases.

**0935441 Mass Transfer Operations** **(3 Credit Hours)**

**Prerequisite: (0905323)**

Diffusivity and mechanism of mass transfer interphase mass transfer and mass transfer coefficients. Equilibrium stage concept and use of multistages. Equilibrium data and calculations related to binary systems (and introductory to multicomponent) used in design and analysis of following unit operations: **Distillation**: steady state, flash, batch, multistage column. **Gas absorption**: multistage continuous contacting, introductory to non isothermal system, design of packed column. **Liquid-liquid extraction and leaching**: stage wise calculations, transfer units.

**0935442 Heat and Mass Transfer Operations** **(3 Credit Hours)**

**Prerequisite: (0905343, 0935441)**

Humidification: equilibrium data, adiabatic and non-adiabatic operations, Evaporative cooling, drought towers. Drying: definitions, batch, mechanism f drying, drying at low temperature, continuous drying, material and enthalpy balances, design of driers. Crystallization: theory, batch and continuous, equilibrium enthalpy balances, design of different types of crystallizers. Evaporation: single and multiple effects, and flow arrangements, heat pumps, barometric condensers. Adsorption and ion-exchange: stagewise adsorption, continuous adsorption, design using LUB concept and regeneration. Dialysis and reverse osmosis.

الخطة الدراسية المعتمدة

**0955451 Local Chemical Industries** **(3 Credit Hours)**

**Prerequisite: (0935442or concurrently)**

Studying the basic principles, raw materials and process description for a number of industries such as, industrial gases, inorganic acids, sodium, potassium and phosphates industries. Cement; Ceramic; Glass; Oil and Fat; Soap and Detergents; Surface coating industries; Specifications and Standards. Local Regulations.

**0935452 Corrosion** **(3 Credit Hours)**

**Prerequisite: (0905324)**

Fundamental, principles and laws of electrochemistry. Thermodynamics and kinetics of electrochemical cells. Heat and Mass transfer in electrochemical reactors. Theory and applications of electrodeposition of metals. Theory of corrosion. Types and mechanisms of corrosion processes. Corrosion control by preventative methods, chemical additives, and electrical techniques.

**0905453 Ore Dressing** **(3 Credit Hours)**

**Prerequisite: (0905343)**

Formation of minerals. Occurrence of economically important minerals. Identification of ores and minerals and their properties. Various ore dressing operations such as Comminution, sizing and sorting, classifiers jigging, tabling, heavy media separation, floatation, magnetic and electrostatic separation, filtration, calcinations.

**0935461 Chemical Engineering Laboratory (1)** **(1 Credit Hour)**

**Prerequisite: (0905241, 0905323)**

Selected experiments drawn from (0905241), (0935322), (0905323). For example pumps, fans, jets, pressure drops in closed and open conduits, flow measurements and refrigeration, Stirling cycle, air conditioning, vapor-liquid equilibrium, liquid-liquid equilibrium.

**0935462 Chemical Engineering Laboratory (2)** **(1 Credit Hour)**

**Prerequisite: (0935342, 0905343)**

Selected experiments drawn from (0935342) and (0905343). For example crushing and grinding, screening, sedimentation, flotation, fluidization, filtration, mixing and heat conduction, free and forced convection, plain and finned exchangers, fluidized beds, two-phase heat transfer.

الخطة الدراسية المعتمدة

**0935463 Chemical Engineering Laboratory (3)** **(1 Credit Hour)**

**Prerequisite: (0935442 or concurrently)**

Selected experiments drawn from (0935441), (0935442). For example: Wetted wall column, ion exchange, absorption, air-water simulator, distillation, extraction, cooling tower performance, tray drier, evaporation, crystallization, and adsorption.

**0945471 Energy Conservation and Management** **(3 Credit Hour)**

**Prerequisite: (0905371)**

Review of energy sources and their applications. Energy auditing. Energy conservation in industrial and commercial sectors. Choice of fuel. Waste heat recovery systems. Energy economics and economic use of electricity. Process integration for efficient use of electricity. Process integration for efficient use of energy including energy cogeneration, selection of heat transfer equipment and enhancement of heat transfer.

**0935472 Petroleum Refining Engineering** **(3 Credit Hours)**

**Prerequisite: (0935441)**

Origin and occurrence of petroleum, and its constituents. Refining feedstocks and refining products. Industrial use of refinery products and the need for refining operations. Crude oil distillation. Chemical reactions and refinery operations of: delayed coking, catalytic reforming and isomerization, catalytic cracking, hydrorteating, catalytic hydrocracking, alkylation. Product blending and production of lubricating oil. Asphalt technology. Supporting processes. Cost
Estimation and economic evaluation.

**0935473 Environmental Engineering** **(3 Credit Hours)**

**Prerequisite: (0935342)**

Concepts and terminology. Sources and impacts of water pollutants. Conventional water and wastewater treatment processes: Sedimentation, flocculation, softening, filtration, disinfection and biological systems. Sources and impacts of air pollutants. Air pollution control through gas cleaning devices: cyclones and wet scrubbers. Solid waste classification, handling and ultimate disposal.

**0935474 Wastewater Treatment** **(3 Credit Hours)**

**Prerequisite: (0935473)**

Overview of water pollutants. Local and international standards for wastewater from industry effluents. Standard methods for wastewater treatment. Primary, secondary and tertiary treatment methods for wastewater such as flocculation, settling, flotation, filtration chemical treatment, biological treatment, sludge treatment and disposal. Membrane separation and adsorption.

الخطة الدراسية المعتمدة

**0935475 Air Pollutions** **(3 Credit Hours)**

**Prerequisite: (0905421)**

Air pollutants and sources of air pollution. Ventilation of confined space. Air streams including stack emissions and exhaust fans. Introduction to air dispersion, Gauss model. Local and international standards for air pollutants. Wet and dry air pollution control methods. Air pollution control instruments. Air sampling and measurement of pollutants.

**0905477 Process Safety Engineering** **(2 Credit Hours)**

**Prerequisite: (0935342)**

Safe handling of hazardous chemicals and toxic materials. Theories of ignition, flames, fire and explosion. Methods of protection and prevention of hazards: containment, suppression, explosion relief, inerting. Safety codes and check lists considerations in design and operation. Case studies.

**0905481 Process Design** **(3 Credit Hours)**

**Prerequisite: (0901420, 0935441)**

Process synthesis and analysis. Development of a conceptual design: batch versus continuous arrangements, flow configurations, structure of flowsheet. Separation and heat exchanger networks and their optimization. Computer aided design software.

**0905509 Selected Topics in Chemical Engineering** **(3 Credit Hours)**

**Prerequisite: ($4^{th}$ year level)**

Coverage of the various aspects of a special topic of interest to chemical engineers. The title of the topic to be covered at each offering of the course will be pre-announced by the Department. As a guideline, topics could include one of the following: water desalination, food engineering, experimental design, mixing, project engineering, applied surface chemistry, process instrumentation and measurements, analysis and simulation of chemical processes, mineral processing, process catalysis.

**0905531 Process Optimization** **(3 Credit Hours)**

**Prerequisite: (0935301)**

Structure and formulation of optimization problems in chemical engineering. Optimality criteria, single and multivariable methods for unconstrained optimization. Linear programming. Optimality criteria and techniques for constrained optimization. Selected applications in chemical engineering.

الخطة الدراسية المعتمدة

THE UNIVERSITY OF JORDAN School of Engineering

School of Engineering Department of Chemical Engineering

**0935541 Separation Processes** **(3 Credit Hours)**

**Prerequisite: (0935441)**

Multicomponent distillation .Azeotropic and extractive distillation. Liquid-Liquid separation processes. Membrane separation processes including reverse osmosis and ultrafiltration. Dialysis, chromatography etc...

**0905542 Water Desalination** **(3 Credit Hours)**

**Prerequisite: (0935442)**

Need for water desalination: Review of local, regional and worldwide water resources, Drinking water standards, Types and properties of saline waters. Water desalination technologies and criteria for process selection. Detailed description and design and operational aspects of commercial desalination methods mainly MSF, MEE, VC, and RO including scale formation problems and pretreatment requirements. Post treatment of product water.

**0905551 Metal Extraction** **(3 Credit Hours)**

**Prerequisite: (0905343)**

Scope of extractive metallurgy. Ores and mineral: natural resources in Jordan, Beneficiation and products. Application of thermodynamics and reaction kinetics in metal extraction. Hydrometallurgical processes. Industrial applications in production of common ferrous and nonferrous metals, including the iron blast furnace, theory and practice and modern iron-ores direct reduction technologies. Hydro- and electrometallurgy. Applications from the production of copper,
Aluminium, manganese, magnesium and uranium industries.

**0945552 Polymers and Plastics Engineering** **(3 Credit Hours)**

**Prerequisite: (0905421)**

Raw materials. Types of polymers. Role of polymer and plastics industries. Polymer reaction engineering. Polymer properties. Analysis of polymer processing in terms of elementary steps and shaping methods. Transport phenomena. Polymer melts rheology. Extrusion. Injection molding. Blow molding. Film blowing.Calendering.

الخطة الدراسية المعتمدة

THE UNIVERSITY OF JORDAN School of Engineering

THE UNIVERSITY OF JORDAN School of Engineering Department of Chemical Engineering

**0945553 Composites** **(3 Credit Hours)**

**Prerequisite: (0945552)**

The course covers both fundamental and applied aspects of composite materials. Basic concepts of composites. Fibers used in composites. Manufacturing process of composites: vacuum bagging, compression molding, prepregging, pultrusion, filament winding, and resin transferring molding. Experimental analysis of composites. Mechanics and design of composites: mechanical properties, strength, design principles, joining, failure modes, thermal and environmental effects. Laminates, metallic, ceramic, and polymeric composites.

**0905554 Fertilizer Technology** **(3 Credit Hours)**

**Prerequisite: (0935441)**

Nature, purpose and function of fertilizers. The new trends in fertilizer manufacturing including new or modified fertilizer products and new techniques. Preparation of raw materials. Fundamentals and design of processes common to fertilizer industries (phosphatic, potash and nitrogenous fertilizers). Pollution and corrosion problems and the use of waste streams.

**0935561 Chemical Engineering Laboratory (4)** **(1 Credit Hour)**

**Prerequisite: (0905421, 0935571)**

Selected experiments drawn from (0905421), (0905422), (0905571). For example: determination of reaction kinetics, use of plug flow and continuous flow stirred tank reactors, measurement of residence time distributions. Gas absorption with chemical reaction. Selected experiments on temperature, pressure, level and pH control. Simulation and analogue computing, servomechanisms, and instrumentation.

**0935571 Process Dynamics and Control** **(3 Credit Hours)**

**Prerequisite: (0935442 or concurrently)**

Introduction to control systems. Modelling of dynamic behaviour of chemical processes. Transfer functions. Dynamic behaviour of first and second order systems. Analysis and design of control systems: types of controllers, closed loop response, stability, design of feedback controllers. Analysis of frequency response of linear systems. Design using frequency response techniques.

**0935573 Solid Waste Management** **(3 Credit Hours)**

**Prerequisite: (0935473)**

This course examines methods of managing solid and hazardous waste, with an emphasis on pollution prevention. Topics covered include relevant local and international legislation, recycling, incineration, landfill operations, and management of radioactive waste, remediation of waste sites and site worker health and safety.

الخطة الدراسية المعتمدة

**0935582 Chemical Plant Design** **(3 Credit Hours)**

**Prerequisite: (0955451, 0901420)**

Principles of Engineering Economy. Estimation of capital and manufacturing costs. Profitability and feasibility analysis. Process conception and definition. Process flowsheet preparation, including symbols, piping and instrumentation diagram. Materials of construction and corrosion. Selection of equipment: alternatives, and capacity; and cost considerations Utilities. Plant location and layout Safety considerations. Case study. Introduction to engineering optimization.

**0905597 Practical Project** **(3 Credit Hours)**

**Prerequisite: (0935441)**

An individually chosen project. This project should allow an element of original work by each student, and will be drawn from the facilities available in the Department. A full report covering all aspects of the work must be submitted.

**0975598 Project (1+2)** **(3 Credit Hours)**
**0975599**

**Prerequisite: Project duration is two semesters. Students are allowed to register in the project after completion of 120 credit hours**

Each student performs a detailed study of a chemical engineering problem from the selected process chosen in project (1). The final report submitted by the group should include mass and energy balances, process flow diagram and detailed design of one or more items of equipment and other equivalent tasks.

الخطة الدراسية المعتمدة

THE UNIVERSITY OF JORDAN School of Engineering

UNIVERSITY OF JORDAN School of Engineering Dept. of Chemical Engineering