



Génie Chimique

ULT Chemical Engineering

Subjects Modules for S3

Semester 1 Year 2

U.3.1 Chemical Engineering Operations

Mass & Energy Balance

Module designation	Chemical Engineering Operations
Module level, if applicable	2 nd year of chemical engineering
Code, if applicable	U.3.1
Subtitle, if applicable	-
Courses, if applicable	- Mass & Energy Balance
Semester (s) in which the module is taught	-Semester 1 (S3)
Person responsible for the module	Dr Khalil ZAGHDOUDI
Lecturer	Mr. Mohamed Ridha KHIARI
Language	French
Relation to curriculum	Professional module (compulsory),
Type of teaching, contact hours	Lecture, 30 hours of classroom courses/semester 12 hours of Project workshop/Semester
Workload	Total 63 hours/semester (21 hours of Self-Study/semester)
Credit points	2.5 credits
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Chemical reaction, endothermic/exothermic reaction, , mathematics, Basics of kinetic reaction, Thermodynamic, Transfer & transport phenomena
Module objectives/intended learning outcomes	<p>Objectives :</p> <ol style="list-style-type: none"> 1. The theoretical bases necessary for understanding the mechanisms of mass transfer in the presence or absence of a phase change. 2. Apply the concepts acquired to solve simple, one-dimensional problems involving transfer processes in the presence or absence of a phase change, using the appropriate correlations <p>Learning Outcomes: Students will be able to :</p> <ol style="list-style-type: none"> 1. Make process material balances 2. Energy balances of process in Steady-state & Transient regime

Content	<p>Classroom Lecture and Guide Work- Mass & energy balance</p> <p>Chapter I. Generalities</p> <p>Chapter II. Transformation of mass</p> <p>Chapter III. Steady state material balance</p> <p>Chapter IV. Material balance without chemical reaction</p> <p>Chapter V. Material balance with chemical reaction</p> <p>Chapter VI. Material balance with phase change</p> <p>Chapter VII. Material balance in transient regime</p> <p>Chapter VIII. Steady state energy balance</p> <p>Chapter IX. Energy balance in transient regime</p> <p>Chapter X. Macroscopic balance of matter, momentum and energy</p> <p>(12 Hours of workshop project/ Semester)</p> <p>Students are divided into groups of 4 students. A project will be assigned to students group early in the semester. The students will be asked to develop a project plan and will work on project throughout the course.</p> <p>Students groups will work on a given project from the list below</p> <p>Project Topics :</p> <p>Proposal 1 : Study of the mass and energy balance on a distillation column</p> <p>Proposal 2: Study of the material and energy balance on a methanol production unit.</p> <p>Proposal 3 : Study of the material and energy balance on a crystallization evaporation unit</p> <p>Proposal 4 : Study of the material and energy balance on a saturated steam production boiler</p>
Study and examination requirements and forms of examination	Format: Written Mid-term Exam (40%) + Final Exam (60%)
Media employed	<p>Course Material (Hard/ Soft copy) for classroom & Online (Moodle ULT)</p> <p>Video projection</p>
Reading list	<p>-Phénomènes de transfert en génie des procédés. Jean-Pierre Couderc et al., Lavoisier, 2008.</p> <p>-Principe fondamental du génie des procédés et de la technologie chimique. Henry Fauduet, Techniques et documentations, 2004 - 2ème édition.</p> <p>- Transport Phenomena. R. Byron Bird, Warren E. Stewart, Edwin N. Lightfoot. (2007). Second Edition. ISBN 10-0470115394.</p>

U.3.1 Chemical Engineering Operations

Unit Operation I: Mechanics

Module designation	Chemical Engineering Operations
Module level, if applicable	2 nd year of chemical engineering
Code, if applicable	U.3.1
Subtitle, if applicable	-
Courses, if applicable	- Unit Operation I : Mechanics
Semester (s) in which the module is taught	-Semester 1 (S3)
Person responsible for the module	Dr Khalil Zaghdoudi
Lecturer	Mr. Mohamed Ridha KHIARI
Language	French
Relation to curriculum	Professional module (compulsory),
Type of teaching, contact hours	Lecture, 33 hours of classroom course/semester 9 hours practical workshop/ Semester
Workload	Total 63 hours/semester (21 hours of Self-Study/semester)
Credit points	2.5 credits
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Fluid mechanics, Mathematics, Thermodynamic, Fundamental physics
Module objectives/intended learning outcomes	<p>Objectives :</p> <ol style="list-style-type: none"> 1. Know the principle of particle size analysis by sieving. 2. Calculate a drag force, 3. Know how to calculate the terminal fall velocity of a particle 4. Apply the laws of discontinuous filtration on support 5. Apply the concepts of particle size distribution and calculate the pressure drops in a depth filter. <p>Learning Outcomes:</p> <p>Students will be able to :</p> <ol style="list-style-type: none"> 1. Know how to size a decanter, 2. Calculate a pressure drop in a porous environment 3. Apply the centrifuge sizing laws 4. Apply a sizing method for a cyclone 5. Choose and size mechanical separation equipment: filters, centrifuges, spinners

Chapter I- SIEVING:

- 1- Notions of particle size analysis
- 2- Effectiveness of a sieve
- 3- Industrial screening

Chapter II- SEDIMENTATION:

- 1- Determination of the limit speed of fall of a particle
- 2- Industrial practice of sedimentation
- 3- Sizing of a simple and lamellar settling tank

Chapter III CENTRIFUGATION:

1. Centrifugation:
2. Theory, Applications and apparatus
3. Discontinuous devices
4. Continuous devices

Chapter IV- CYCLONING:

- 1- Description of the device
- 2- Theoretical study
 - a- Minimum diameter of the separated particles
 - b- Effectiveness of a cyclone
 - c- Sizing of a cyclone

Chapter V - FILTRATION

- 1- Theoretical study of filtration
 - a- Cake resistance
 - b- Poiseuille's law
 - c- Equations of Darcy, Carman- Kozeny, Ergun
- 2- Different filtration modes
 - a- Constant pressure filtration
 - b- Constant flow filtration
- 3- Apparatus

Applications

(9 hours of Practical workshop in Laboratory/ Semester)

1. Particle size analysis by sieving**Objectives**

The objective of this manipulation is to determine the mass distribution of a dry solid matrix as a function of the mesh diameters of the sieves.

- Plotting the mass distribution histogram,
- Calculation of the average sieve diameters,
- Plotting the distribution curve $D_i = f(f_i)$,
- Determination of average diameters: arithmetic, geometric, harmonic and median.
- Plotting the Cumulative Percentage Chart.

2. Industrial sieving**Objectives**

We dispose of a mass m of a solid matrix (in our case sand). At this unknown solid mass, we will analyze the grain size of the crude by determining the mass fractions.

Tables of measurements will be drawn and filled for the determination of the fraction of recovery, the fraction of scrap in order to define the effectiveness of the sieving

3. Media filtration**Objectives**

The objective of filtration is to mechanically separate a fluid continuous phase from a solid dispersed phase.

	We propose to determine the permeability to tap water (saline water) and the resistance R_s of a membrane.
Study and examination requirements and forms of examination	Format: Written Mid-term Exam (25%) + Practical Exam (25%)+ Written Final Exam (50%)
Media employed	Course Material (Hard/ Soft copy) for classroom & Online (Moodle ULT) Practical Workshop in Laboratory Video projection
Reading list	-Génie des procédés : opérations unitaires. Marie Debacq. (2020). ISTE editions : ISBN: 9781784056582. -Computational Methods for Fluid Dynamics, J. H. Ferziger & M. Peric, 2002, Springer-Verlag Berlin Heidelberg.

U.3.2 Chemical Engineering Reaction

Heterogeneous catalysis

Module designation	Chemical Engineering Reaction
Module level, if applicable	2 nd year of chemical engineering
Code, if applicable	U.3.2
Subtitle, if applicable	-
Courses, if applicable	- Heterogeneous catalysis
Semester (s) in which the module is taught	-Semester 1 (S3)
Person responsible for the module	Dr Khalil Zaghdoudi
Lecturer	PhD Feriel Rezouga
Language	French
Relation to curriculum	Professional module (compulsory),
Type of teaching, contact hours	Lecture, 42 hours of classroom course/semester
Workload	Total 63 hours/semester (21 hours of Self-Study/semester)
Credit points	2.5 credits
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Thermodynamic, Kinetics Reaction, organic chemistry & catalysis, material sciences, solid chemistry.

<p>Module objectives/intended learning outcomes</p>	<p>Objectives :</p> <ol style="list-style-type: none"> 1. Present the basics of heterogeneous & homogeneous catalysis. 2. Present the materials used in heterogeneous catalysis 3. Deepen the student's knowledge of eco-compatible chemistry by integrating the concepts of catalysis, heterogeneous. 4. Present the main applications of heterogeneous catalysis for industry and environmental protection 5. Get a general knowledge and importance of heterogeneous catalysis. <p>Learning Outcomes:</p> <p>Students will be able to :</p> <ol style="list-style-type: none"> 1. Deepen and extend the student's knowledge of eco-compatible chemistry by integrating the concepts of homogeneous and heterogeneous catalysis for the development of clean and safe processes for the production of compounds of industrial interest. 2. Analysis of homogeneous ionic, radical, and coordinative and heterogeneous fluid-solids catalytic processes. 3. - Exemplify industrial applications that utilize heterogeneous catalysts,
<p>Content</p>	<ol style="list-style-type: none"> 1. Basics of catalysis 2. Definition, industrial and environmental challenges and issues, history 3. Mechanism of catalytic action 4. Principles of heterogeneous catalysis 5. Stages of heterogeneous catalysis 6. Kinetics of catalyzed reactions 7. Concepts in heterogeneous catalysis 8. Catalytic materials 9. Required properties 10. Texture-property correlations 11. Preparation methods for mesoporous supports 12. Manufacturing methods for heterogeneous catalysts 13. Characterization of heterogeneous catalysts 14. Heterogeneous catalysis processes 15. Refining processes (catalytic cracking and reforming) 16. Biomass recovery 17. Catalysis for the environment and green chemistry 18. Industrial depollution 19. Green chemistry: principles, example
<p>Study and examination requirements and forms of examination</p>	<p>Written Mid-term Exam (40%) + Written Final Exam (60%)</p>
<p>Media employed</p>	<p>Course Material (Hard/ Soft copy) for classroom & Online (Moodle ULT)</p> <p>Video projection</p>

Reading list	<ul style="list-style-type: none"> - Heterogeneous catalysis in industrial practice. 2nd edition. Satterfield, C N. (1991). - Green Chemistry and Catalysis, R. A Sheldon, I. Arends, U. Hanefeld, Wiley-VCH, 2007. - Catalysis, From principles to Applications, M. Beller, A. Renken, R. A. van Santen, Wiley-VCH, 2012. - Concepts of Nanochemistry, L. Cademartiri, G.A. Ozin, Wiley-VCH, 2009. Handbook of Green Chemistry, P. T. Anastas, Vol 1-2, Wiley-VCH, 2013. - Heterogeneous Catalysis: A Central Science for a Sustainable Future. Cynthia M. Friend and Bingjun Xu. <i>Acc. Chem. Res.</i> 2017, 50, 3, 517–521. https://doi.org/10.1021/acs.accounts.6b00510. - Modern Heterogeneous Catalysis: An Introduction. Rutger A. van Santen. (2017). ISBN: 9783527339617.
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U.3.2 Chemical Engineering Reaction

Chemical Reactors

Module designation	Chemical Engineering Reaction
Module level, if applicable	2 nd year of chemical engineering
Code, if applicable	U.3.2
Subtitle, if applicable	-
Courses, if applicable	- Chemical Reactors
Semester (s) in which the module is taught	-Semester 1 (S3)
Person responsible for the module	Dr Khalil ZAGHDOUDI
Lecturer	Mr. Khalil LASFER
Language	French
Relation to curriculum	Professional module (compulsory),
Type of teaching, contact hours	Lecture, 30 hours of classroom course/semester 3 hours practical workshop/ Semester 12 hours of integrated project/semester
Workload	Total 66 hours/semester (21 hours of Self-Study/semester)
Credit points	2.5 credits
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Fluid mechanics, Mathematics, Thermodynamic, Fundamental physics, Kinetics Reaction
Module objectives/intended learning outcomes	<p>Objectives :</p> <ol style="list-style-type: none"> 1. Broad understanding of chemical reactor design and calculation methods 2. Deepen knowledge in catalytic engineering and in the field of multiphase reactors 3. Sizing and optimization calculations for chemical reactors. <p>Learning Outcomes: Students will be able to :</p> <ol style="list-style-type: none"> 1. Size and optimize calculations for chemicals reactors. 2. Know how to develop original models of reactions and catalytic reactors 3. understand the specificities of large industrial reactors 4. write a material balance and a heat balance in the case of ideal reactors

Content	<p>Part I:</p> <p>Chapter 1 -Classification of reactions and chemical reactors</p> <p>Chapter 2 -Stoichiometry. Material balances in ideal reactors</p> <p>Chapter 3 -Optimization of conversion and yield</p> <p>3.1 - Comparison of the performance of ideal reactors in the implementation of a simple reaction</p> <p>3.2 - Association of reactors. Cascade of continuous perfectly agitated reactors</p> <p>3.3 - Recirculating piston reactor</p> <p>3.4 - Yield and selectivity of a multiple stoichiometric transformation</p> <p>3.5 - Optimal distribution of the products of competitive reactions</p> <p>3.6 - Optimal distribution of the products of consecutive reactions</p> <p>3.7 - Mixed transformations</p> <p>3.8 - General conclusion on the optimization of selectivity</p> <p>Chapter 4 -Non-ideal flows. Distribution of residence times, macromixing and micromixing</p> <p>4.1 - Description of real flows: concepts of age, life expectancy and residence time</p> <p>4.2 - Distribution of residence times (DTS)</p> <p>4.3 - Experimental determination of the DTS using tracers</p> <p>4.4 - Visualization of the DTS by the model of the nets in parallel</p> <p>4.5 - DTS in ideal reactors (incompressible fluid)</p> <p>4.6 - Access to hydrodynamic parameters and malfunction diagnostics</p> <p>4.7 - Modeling of non-ideal flows</p> <p>4.8 - Influence of the non-ideality of the flow on the performance of the reactors</p> <p>Chapter 5 -Adjusting the temperature. Thermal balances</p> <p>5.1 - Influence of temperature, pressure and state of dilution on advancement at equilibrium</p> <p>5.2 - Optimal adjustment of the temperature of a reactor</p> <p>5.3 - Energy balances in chemical reactors</p> <p>5.4 - Adiabatic step</p> <p>5.5 - Stability of reactors cooled from the outside</p> <p>Part II : Project (12 hours of Workshop cours /semester)</p> <p>A project will be assigned to students individually early in the semester. The student will be asked to develop a project plan and will work on project throughout the course.</p> <p>Students groups will work on a given project from the list below</p> <p>Project topics:</p> <p>Proposal 1: Design of a modular water treatment unit : (Reacteur,2 pumps,mixer,decanter)</p> <p>Proposal 2: Design study of a double-jacketed stirred tank.</p>
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	<p align="center">3 hours of Practical work-Chemical Reactors <u>Manufacture of borax</u></p> <p><i>Objectives:</i></p> <ul style="list-style-type: none"> -Batch manufacture of borax by dissolving boric acid and a reaction between this acid and Sodium Hydroxide (soda lye). -Concentration by evaporation and crystallization by cooling -Separation of the crystals obtained by filtration.
Study and examination requirements and forms of examination	Format: Written Mid-term Exam (25%) + Practical Exam (25%) Written Final Exam (50%)
Media employed	Course Material (Hard/ Soft copy) for classroom & Online (Moodle ULT) Practical Workshop in Laboratory Video projection
Reading list	<ul style="list-style-type: none"> -www.techniques-ingenieur.fr -Phénomènes de transfert en génie des procédés, J.P. Couderc, C. Gourdon et A. Line, Lavoisier, 2008 -Product and Process Design Principles: synthesis, analysis and evaluation, 3rd edition, Wiley, 2009 W.D. Seider, J.D. Seader, D.R. Lewin, S. Widagdo

U.3.2 Chemical Engineering Reaction

Bioprocess Engineering

Module designation	Chemical Engineering Reaction
Module level, if applicable	2 nd year of chemical engineering
Code, if applicable	U.3.2
Subtitle, if applicable	-
Courses, if applicable	- Bioprocess Engineering
Semester (s) in which the module is taught	-Semester 1 (S3)
Person responsible for the module	Dr Khalil ZAGHDOUDI
Lecturer	Phd Feriel REZOUGA
Language	French
Relation to curriculum	Professional module (compulsory),
Type of teaching, contact hours	Lecture, 21 hours of classroom course/semester 21 hours of classroom Project/ semester 3 hours practical workshop/ Semester
Workload	Total of 80 hours/semester (35 hours of Self-Study/semester)
Credit points	3 credits
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Fluid mechanics, Mathematics, Thermodynamic, Fundamental physics. Kinetics reaction. Applied Heat transfert, Unit operations, Mass & energy balance, Mass transfer, Basics of biochemistry

<p>Module objectives/intended learning outcomes</p>	<p>Objectives :</p> <ol style="list-style-type: none">1. Use microbial strains of industrial interest.2. Characterize and monitor the different microbial kinetics3. Become familiar with the use of bioreactors in food industries.4. Consider unit operations for the separation and purification of microbial cells and metabolite molecules upstream and downstream of a bioreactor <p>Learning Outcomes:</p> <p>Students will be able to :</p> <ol style="list-style-type: none">1. Carry out a partial and global mass material balance on an integrated bioprocess2. Characterize the functioning of any bioprocess conducted in Batch, Fed-Batch and continuously.3. Manage and characterize fermentations carried out in bioprocesses in the food industries
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Content	<p>I. Introduction</p> <p>II. Industrial microorganisms</p> <p>III. Fermentation stoichiometry</p> <ol style="list-style-type: none"> 1. Elementary molar assessments and determination of stoichiometric coefficients 2. Applications <p>IV. Microbial kinetics</p> <p>A/ Microbial growth kinetics.</p> <ol style="list-style-type: none"> 1. Growth curve 2. Metabolic pathways (primary, secondary and tertiary metabolites) 3. Different growth kinetics and formalisms <p>B/Maintenance and endogenous metabolism</p> <p>C/ Phenomenon of "death".</p> <p>D/ Microbial respiration and oxygen transfer</p> <p>E/ Applications</p> <p>V. Fermentation technology</p> <p>A/ Description of a bioreactor</p> <p>B/ Implementation of an integrated bioprocess</p> <p>C/ The fermentation control modes</p> <ol style="list-style-type: none"> 1. Operation in a closed environment (batch) 2. Continuous feed (CSTR) 3. Discontinuous feed (Fed-Batch) 4. Recycling <p>D/ Mass matter balance of fermentations</p> <p>E/ Applications</p> <p>F/ Operations downstream of fermentation and recovery of metabolites (extraction, purification and concentration).</p> <p>3 hours of Practical work-Bioprocess Engineering (6h of practical workshop in Laboratory)</p> <p><u>Monitoring, exploitation and comparison of discontinuous cultures of alcoholic yeast strains</u></p> <p>Project : (21 hours of self-Study hours per semester)</p> <p>Students are divided into groups of 3 students. A project will be assigned to each students group early in the semester. The students will be asked to develop a project plan and will work on project throughout the course.</p> <p>Students groups will work on a given project from the list below:</p> <p><u>Project Topics :</u></p> <p>Proposal 1: Implementation of monitoring and simulation of chemical and biological kinetics of a water treatment process.</p> <p>Proposal 2: Study of fermentation and CO₂ production with Arduino.</p> <p>Proposal 3 : Conduct and follow-up of a synthesis process of an interesting biopolymer</p> <p>Proposal 4: Dimensioning of an activated sludge process.</p> <p>Proposal 5 : Design of a bioreactor aeration system</p> <p>Proposal 6 : Design of a respirometric cell</p>
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Study and examination requirements and forms of examination	Written Mid-term Exam (25%) + Practical Exam (25%)+Written Final Exam (50%)
Media employed	Course Material (Hard/ Soft copy) for classroom & Online (Moodle ULT) Practical Workshop in Laboratory Video projection
Reading list	<p>-SINGLETON PAUL, BACTERIOLOGIE POUR LA MEDECINE, LA BACTERIOLOGIE ET LES BIOTECHNOLOGIES, LIEGE BELGIQUE, DUNOD, 6ème EDITION, 2005.</p> <p>- MICROBIOLOGIE ET QUALITE DANS LES INDUSTRIES AGROALIMENTAIRES, BIOSCIENCES ET TECHNIQUES, 2002</p> <p>- PAVLOVIC, M., BIOENGINEERING : A CONCEPTUAL APPROACH SPRINGER INTERNATIONAL PUBLISHING AG; ÉDITION : 2015 ED., 11 OCTOBRE 2014, 298 PAGES</p> <p>- SHIJIE LIU BIOPROCESS ENGINEERING: KINETICS, BIOSYSTEMS, SUSTAINABILITY, AND REACTOR DESIGN, ESLEVIER ,2013</p>

U.3.3 Process & Simulation

Chromatographic Separation Process

Module designation	Process & Simulation
Module level, if applicable	2 nd year of chemical engineering
Code, if applicable	U.3.3
Subtitle, if applicable	-
Courses, if applicable	- Chromatographic Separation Process
Semester (s) in which the module is taught	-Semester 1 (S3)
Person responsible for the module	Dr. Khalil ZAGHDOUDI
Lecturer	Phd. Khalil ZAGHDOUDI
Language	English
Relation to curriculum	Professional module (compulsory),
Type of teaching, contact hours	Lecture, 36 hours of classroom course/semester 6 hours practical workshop/ Semester
Workload	Total 63 hours/semester (21 hours of Self-Study/semester)
Credit points	2.5 credits
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Structural Organic chemistry, fundamental of experimental chemistry, Fluid mechanics, thermodynamics, mass transfer, control & regulation.
Module objectives/intended learning outcomes	<p>Objectives :</p> <ol style="list-style-type: none"> 1. Familiarize the student with the theory and practice of the state of the art of analytical and preparative chromatographic separation processes. 2. Critical reviews of the current literature will be carried out to expose the students to the latest developments in the field <p>Learning Outcomes:</p> <p>Students will be able to :</p> <ol style="list-style-type: none"> 1. Distinguish between the different chromatography types, 2. Choose the appropriate type of chromatography according to the compounds to be separated 3. Determine the different chromatographic parameters and optimize a chromatographic separation, 4. Have the knowledge of HPLC apparatus specificity and that of the CPG 5. - Quantify analytics from chromatographic separation

Content	<p>Chapter I- Chromatography-General aspects:</p> <ul style="list-style-type: none"> A. Definitions B. Classification according to the nature of the phases C. Principle D. Example: Column chromatography <p>Chapter II- chromatographic Fundamentals :</p> <ul style="list-style-type: none"> A. Retention B. Band Spreading C. Resolution <p><i>Exercise</i> <i>Tutorials</i></p> <p>Chapter III. Dynamics of Chromatography :</p> <ul style="list-style-type: none"> A. Basic mass transfer equations B. Method of moments C. Linear dispersion model D. Linear staged models for chromatography E. Transfer modeling <p>Chapter IV. Instrument Requirements for Chromatography</p> <ul style="list-style-type: none"> A. System design B. Column packing techniques <p>Chapter V. Fundamentals of Adsorption</p> <ul style="list-style-type: none"> A. Gibbs adsorption isotherm B. Adsorption isotherm models C. Local equilibrium theory and solute movement plots <p>Chapter VI. Modes of chromatography</p> <ul style="list-style-type: none"> A. Reversed phase and hydrophobic interaction B. Size exclusion chromatography C. Affinity chromatography D. Ion chromatography E. Partition chromatography <ul style="list-style-type: none"> 1. Normal phase polarity 2. Reverse phase polarity F. Adsorption chromatography G. How do I choose the right type of chromatography? <p>Chapter VII : Detectors in Liquid Chromatography</p> <ul style="list-style-type: none"> A. UV-Vis B. Refractive Index C. Fluorescence D. Mass Spectra <p>Chapter VIII: Preparative Chromatography</p> <ul style="list-style-type: none"> A. Preparative elution B. Frontal C. Gradient D. Displacement chromatography E. Optimization
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	<p>Chapter VIII. Novel Chromatographic Morphologies</p> <p>A. Continuous annular systems B. Radial flow C. Perfusion chromatography D. Membrane chromatography</p> <p>Chapter IX. Chromatography according to the apparatus</p> <p>A. High Performance Liquid Chromatography (HPLC) 1. Introduction 2. Principle / Comparison with conventional Liquid Chromatography 3. Apparatus</p> <p>B. Gas Chromatography (GPC) 1. Introduction 2. Principle / Particularities compared to liquid chromatography 3. Apparatus 4. Optimization of chromatographic separation</p> <p>C. Supercritical phase chromatography 1. Introduction 2. Principle / Particularities compared to liquid chromatography 3. Apparatus</p> <p>Chapter X: Chromatographic applications</p> <p>A. Applications of various modes of operation B. Sequential and continuous multicolumn processes.</p> <p><i>Exercise Tutorials</i></p> <p>Practical workshop-Chromatographic Separation Process <u>Dosage of preservatives in a syrup by HPLC</u></p> <p><i>Objectives :</i> Dose preservatives PHBM and PHBP by High Performance Liquid Chromatography (HPLC). <u>Gas Chromatography (GPC) - Determination of the fatty acid composition of olive oil</u></p> <p><i>Objectives :</i> The objectives of this lab are to determine the fatty acid composition of olive oil.</p>
Study and examination requirements and forms of examination	Format: Written Mid-term Exam (25%) + Practical Exam (25%)+ Written Final Exam (50%)
Media employed	Course Material (Hard/ Soft copy) for classroom & Online (Moodle ULT) Practical Workshop in Laboratory Video projection

Reading list	<p>-Analyse Chimique – Méthodes et techniques instrumentales modernes (6^{ème} édition). Francis Rouessac et Annick Rouessac. DUNOD.</p> <p>-A Handbook of Chromatography. Anna Pratima G. Nikalje (2017). Publisher: Scholar's Press Verlag Omniscryptam, Deutschland, Germany. ISBN: 978-3-330-65032-9</p> <p>- Chromatographic Processes: Modeling, Simulation, and Design. Cambridge University Press. (2015). ISBN-13 : 978-1107082366.</p> <p>-Handbook of Process Chromatography. Development, Manufacturing, Validation and Economics. Lars Hagel, Günter Jagschies and Gail Sofer. ISBN 978-0-12-374023-6.</p> <p>- Chromatographic Methods Development. Gregory K. Webster, Laila Kott. (2019). ISBN 9789814800532.</p>
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U.3.3 Process & Simulation

Methodology of Experimental design

Module designation	U.3.3 Process & Simulation
Module level, if applicable	2 nd year of chemical engineering
Code, if applicable	U.3.3
Subtitle, if applicable	-
Courses, if applicable	- Methodology of Experimental design
Semester (s) in which the module is taught	- Semester 1 (S3)
Person responsible for the module	Dr Khalil Zaghdoudi
Lecturer	Phd. Halim HAMMI
Language	English
Relation to curriculum	Professional module (compulsory),
Type of teaching, contact hours	Lecture, 21 hours of contact hours (lesson) (9 hours of practical lesson/ 12 hours of project workshop)
Workload	Total 42 hours/semester (21 hours of Self-Study/semester)
Credit points	1.5 credits
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Applied statistics, Applied mathematics,
Module objectives/intended learning outcomes	<p>Objectives :</p> <ol style="list-style-type: none"> 1. Understand the plans of experiments and their use 2. Implement an experiment plan 3. Know how to use design of experiments software <p>Learning Outcomes:</p> <p>Students will be able to :</p> <ol style="list-style-type: none"> 1. Apply methodology in order to conduct experimental tests needed for a scientific research or industrial cases studies. 2. Specifications, experimental plans and multi-criteria optimization 3. propose a coherent analysis plan to solve a problem 4. interpret the results of a statistical analysis in the context of an engineering case study 5. Communicate the results of analysis, associated with their statistical treatment, in a professional manner and discuss the significance of these results in the context of a given application.

Content	<p><u>Section 1 (12 hours of practical classroom cours/semester)</u></p> <p>Chapter 1.Introduction.</p> <p>Chapter 2.Design of experiments methodology</p> <ol style="list-style-type: none"> 1. Definition of the problem, 2. construction of the model, 3. selection of factors and responses <p>Chapter 3. Plan Types</p> <ol style="list-style-type: none"> 1. Screening matrices 2. factorial planes 3. fractional planes <ol style="list-style-type: none"> 1. Plan 2k: principle and definitions. 2. Complete plan without interaction. Calculation of effects. 3. Complete plan with interactions. Calculation and graphing of effects. <p>Chapter 4. Statistical calculations and interpretation of the results.</p> <ol style="list-style-type: none"> 1. Modelization 2. Dispersion of the coefficients 3. Influencing factors and interactions <p style="text-align: center;">Scenario with the use of a tool: Excel/NEMROD</p> <p><u>Section 2 (9 hours of project workshop/Semester)</u></p> <p>The themes covered will be of interest to the future engineer: applications in different fields.</p> <p>Different topics will be covered, with context, experimental planning, carrying out experimental work, in-depth data processing, and writing a report. The work will be done in groups. Particular emphasis will be placed on the critical distance from the analysis results and on the ability to communicate them with rigor.</p> <p><u>Project topic :</u></p> <ul style="list-style-type: none"> • Optimization of a given chromatographic separation process • Optimization of extraction yield for a given extraction process. • Optimization of pharmaceutical formulation product. • Optimization of a given reactor batch reaction
Study and examination requirements and forms of examination	Format: Continuous Control, Oral Presentation project (100%)
Media employed	<p>Course Material (Hard/ Soft copy) for classroom & Online (Moodle ULT)</p> <p>Practical Workshop in Laboratory</p> <p>Video projection</p>

Reading list	<p>-Introduction aux plans d'expériences, J. GOUPY et L. CREIGHTON, DUNOD, 2006.</p> <p>-Experiments: Planning, Analysis, and Optimization, 2nd Edition.C. F. Jeff Wu, Michael S.Hamada.(2009).ISBN: 978-0-471-69946-0</p> <p>-Les plans d'expérience par la méthode Taguchi, M. PILLET, Les Editions d'Organisation, 2001.</p>
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ULB Université

U.3.3 Process & Simulation

Simulation ASPEN I

Module designation	Process & Simulation
Module level, if applicable	2 nd year of chemical engineering
Code, if applicable	U.3.3
Subtitle, if applicable	-
Courses, if applicable	- Simulation : Aspen I
Semester (s) in which the module is taught	-Semester 1 (S3)
Person responsible for the module	Dr Khalil ZAGHDOUDI
Lecturer	Mr. Baha Eddine GHARBI
Language	English
Relation to curriculum	Professional module (compulsory),
Type of teaching, contact hours	9 hours practical workshop/ Semester and 12 hours of classroom practical project.
Workload	Total 51 hours/semester (30 hours of Self-Study/semester)
Credit points	2 credits
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Thermodynamic, Fluid mechanics, Applied thermodynamic, Mathematics, kinetics reaction, thermodynamic models
Module objectives/intended learning outcomes	<p>Objectives:</p> <ol style="list-style-type: none"> 1. Introduce ASPEN software to students 2. Understand the modelling techniques used <p>Learning Outcomes: Students will be able to :</p> <ol style="list-style-type: none"> 1. -Use ASPEN Simulation Tools 2. Conduct Simulation of a single and two-stage compressor 3. -Work on real projects as steam engines

Content	<p>Chapter I. General introduction</p> <p>Workshop Exercises On ASPEN HYSYS in Laboratory:</p> <p>Exercise 1: General introduction</p> <p>I.1 Introduction to Aspen Plus software</p> <p> I.2 The main characteristics of Aspen</p> <p> I.3 Comparison between Aspen and HYSYS</p> <p>I.4 Modeling of processes with HYSYS</p> <p>I.5. Application: synthesis of ammonia</p> <p>Exercise 2: Process simulation (separators, mixer, pump, condenser, exchanger)</p> <p>Exercise 3: Reactor simulation</p> <p> III.1 General</p> <p> III.2 Applications</p> <p> III.2.1. Benzene pyrolysis (RCSTR reactor)</p> <p> III.2.2. Modeling of an RGIBBS reactor</p> <p> III.2.3. RPLUG reactor modeling</p> <p> III.2.4 Synthesis of biodiesel (RSTOIC reactor)</p> <p>Exercise 4: TEST</p> <p>Exercise 5: Column simulation</p> <p> V.1 General (DSTUW, RADFRAC)</p> <p> V.2 Applications</p> <p> V.2.1. Distillation Benzene –Toluene</p> <p> V.2.2. Distillation Acetone ethanol</p> <p>Project (12 hours of classroom practical Workshop hours/ Semester)</p> <p>Students are divided into groups of 3students . A project will be assigned to each students group early in the semester. The students will be asked to develop a project plan and will work on project throughout the course.</p> <p>Students groups will work on a given project from the list below</p> <p>Project Topic:</p> <p>Proposal 1 : Installation of a gas depressurisation system: dynamic simulation, sizing, and economic analysis of a gas relieving system (blow-down).</p> <p>Proposal 2 : Natural gas valorization project in LAARICH CPF located in Tataouine: process simulation, sizing, and economic analysis of a natural gas dehydration unit.</p> <p>Proposal 3 : Natural gas valorization project in OUED ZAR CPF located in Tataouine: process simulation, sizing, and economic analysis of a natural gas dew point control unit.</p> <p>Proposal 4 : Natural gas valorization project in LAARICH CPF located in Tataouine (Tunisia): process simulation, sizing, and economic analysis of a natural gas dehydration unit.</p>
Study and examination requirements and forms of examination	Format: Continuous Control, Oral Presentation project (100%)

Media employed	<p>Course Material (Hard/ Soft copy) for classroom & Online (Moodle ULT)</p> <p>Video projection</p> <p>Practical Work on ASPEN plus software in Laboratory</p>
Reading list	<p>-Mike Hansen, ASPEN Tutorial, ChEn 3603 - University of UtahSpring, 2013</p> <p>-Matthew Bernards,RenéOverney, ASPEN PLUS 12.1 Instructional Tutorials</p> <p>-Bor-YihYu, Introduction to Aspen Plus</p>

ULT Université

U.3.4 Material Sciences

Solid Chemistry

Module designation	Material Sciences
Module level, if applicable	2 nd year of chemical engineering
Code, if applicable	U. 3.4
Subtitle, if applicable	-
Courses, if applicable	- Solid Chemistry
Semester (s) in which the module is taught	-Semester 1 (S3)
Person responsible for the module	Dr Khalil ZAGHDOUDI
Lecturer	Pr. Nizar BELAKHEL
Language	French
Relation to curriculum	Professional module (compulsory),
Type of teaching, contact hours	Lecture, 21 hours of classroom course/ Semester
Workload	Total 51 hours/semester (30 hours of Self-Study/semester)
Credit points	2 credits
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Electrochemistry, Physical Chemistry, Material sciences, Solid chemistry.

<p>Module objectives/intended learning outcomes</p>	<p>Objectives :</p> <ol style="list-style-type: none"> 1. Learn about case studies involving several components, materials and forms of corrosion, as well as the main methods of corrosion protection. 2. Become familiar with corrosion resistance testing standards. 3. Acquire general knowledge of the factors favoring corrosion. 4. Make students aware of the different modes of corrosion of metallic materials <p>Learning Outcomes:</p> <p>Students will be able to :</p> <ol style="list-style-type: none"> 1. Explain the processes by which Iron and Steel are made; and describe the effect of alloying elements on Steel. 2. Understand and demonstrate the proper setups, uses and operations associated with industry standard processes for the manufacture, heat treatment and testing of metals/materials 3. Understand various corrosion processes, protection methods and materials selection. 4. Evaluate if corrosion can occur under specific operating conditions in a given equipment or construction.
<p>Content</p>	<ol style="list-style-type: none"> 1. Scope of Metallurgy Various fields of metallurgical engineering, metallurgical industries. 2. Occurrence of important areas, minerals: Sources of metals Basic outline of the principle of production of iron and steel, copper, aluminum, zinc, lead. 3. Metallurgical Fuels and furnaces, common refractories and their classification, Pyrometry-various methods used for measurement, recording and control of temperature. 4. Metallurgical microscope, optical systems, resolution & magnification. Polishing & etching macro & micro examination. 5. Phase Rule Study of simple binary diagrams, different types, Iron-carbon phase diagram, Use of phase diagram as a basis for introduction to the heat treatment of metals & alloys. 6. Introduction to foundry metallurgy, molding, melting and casting methods. 7. Methods of metal forming-Rolling, forging, extrusion, wire drawing, tube drawing and powder metallurgy. 8. Metal joining - welding, soldering, brazing. 9. Testing of metals and alloys, hardness, tensile strength, ductility measurements. Introduction to NDT techniques. 10. Electrolytic conductance 11. Electrolytic cell and Electrodeposition 12. Electrode Kinetics and Passitivity 13. Corrosion 14. Protection Against corrosion 15. Principles of electrometallurgical Processes

Study and examination requirements and forms of examination	Written Mid-term Exam (40%) + Written Final Exam (60%)
Media employed	Course Material (Hard/ Soft copy) for classroom & Online (Moodle ULT) Video projection
Reading list	<ul style="list-style-type: none"> - Elements of Metallurgy by D. Swarup. - Principles of metallographic laboratory practice by G.L. Kehl. - Elements of physical metallurgy by A.G. Gu. - Introduction to Metallurgy by A.R. Bailey - Materials Science and Processes: S.K. Hajra Choudhury, Indian Book Distributing CO., Calcutta

U.3.4 Material Sciences

Applied Electrochemistry

Module designation	Material Sciences
Module level, if applicable	2 nd year of chemical engineering
Code, if applicable	U.3.4
Subtitle, if applicable	-
Courses, if applicable	- Applied Electrochemistry
Semester (s) in which the module is taught	-Semester 1 (S3)
Person responsible for the module	Dr Khalil ZAGHDOUDI
Lecturer	Pr. Nizar BELAKHEL
Language	French
Relation to curriculum	Professional module (compulsory),
Type of teaching, contact hours	Lecture, 21 hours of classroom course/ Semester 21 hours of workshop Project/ Semester 6 hours of Practical workshop/ Semester
Workload	Total 83 hours/semester (35 hours of Self-Study/semester)
Credit points	3 credits
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Fundamental of experimental chemistry, Physical chemistry, kinetics reaction, thermodynamic, chemical equilibrium
Module objectives/intended learning outcomes	<p>Objectives :</p> <ol style="list-style-type: none"> 1. Discussion of the many diverse roles of electrochemical technology in industry 2. Investigate the corrosion and protection of materials 3. Investigate electrochemical water depollution process <p>Learning Outcomes:</p> <p>Students will be able to :</p> <ol style="list-style-type: none"> 1. Investigate the different chemical reactions in aqueous medium, 2. investigate the conductive properties of aqueous solutions 3. Investigate intensity-potential curves 4. Perform electrochemical analysis 5. - Perform ultra-traces analysis

Content	<p>Chapter I- Electrochemical reactions</p> <ol style="list-style-type: none"> 1- Apparent reaction constants 2- Charge transfer reactions 3- Electrode potentials 4- Diffusion and convection 5- Electro-migration <p>Chapter II- Intensity-potential curves</p> <ol style="list-style-type: none"> 1. Prediction of electrochemical reactions 2. Electrochemical analysis cell 3. Morphology of curves $i = f(E)$ 4. Diffusion limit current 5. Equations of the curves $i = f(E)$ 6. Fast and slow redox system 7. Polarographic methods: Classic polarography / Polarography test <p>Chapter III- Conductimetric titrations</p> <ol style="list-style-type: none"> 1. Conductivity of an aqueous solution 2. Conductimetric titration curve 3. Application exercises <p>Chapter I- Coulometric methods</p> <ol style="list-style-type: none"> 1- Generalities and definitions 2- Coulometry with imposed potential 3- Impressed current Coulometry 4- Application examples: industrial preparation of soda and chlorine <p>Chapter IV- Electrochemical depollution processes</p> <ol style="list-style-type: none"> 1- Oxidation and direct electrochemical reduction 2- Advanced oxidation processes: Electro-Fenton, Photo-Fenton.... 3- Electrocoagulation <p>Chapter V- Fuel cells</p> <ol style="list-style-type: none"> 1- Principle of operation 2- Different types of fuel cells 3- Energy use of Dihydrogen <p>Practical workshop in Laboratory-Industrial electrochemistry <u>Determination of a solution of disodium salt of EDTA (Ethylene Diammine TetraAcetic) in the absence and presence of copper (II):</u></p> <p><i>Objectives :</i></p> <ul style="list-style-type: none"> - Represent the predominance diagram of the different acid-base forms. - Draw the curve $pH = f(V_{base})$ - Determine concentrations - Determine the solubility product K_S
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	<p style="text-align: center;"><u>Cyclic Voltammetry</u></p> <p><i>Objectives :</i> The aim of this practical work is to make an electrochemical study of the Fe (III) / Fe (II) redox couple and to verify its speed criterion if it is a fast or slow system.</p> <p>The Voltammogram of the electrochemical cell is plotted at different speeds.</p> <p style="text-align: center;"><u>Section 2 (21 hours of Project workshop/Semester)</u></p> <p>The topics covered will be of interest to the future engineer: applications in industrial electrochemistry process field.</p> <p>Students are divided into groups of 3. A project will be assigned to each students group early in the semester. The students will be asked to develop a project plan and will work on project throughout the course.</p> <p>Students groups will work on a given project from the list below during 6 weeks.</p> <p><u>Project Topic:</u></p> <p>Proposal 1 : Corrosion and protection of petroleum product tanks (STIR : Tunisian Society of Refining Industries)</p> <p>Proposal 2 : Aluminum anodizing (TPR : Tunisia Aluminum Profiles)</p> <p>Proposal 3 : Performance monitoring and optimization of surface treatment and painting processes in the aeronautical sector (MecaProtec Aero Industry).</p> <p>Proposal 4 : Substitution of electrolysis bath components and study of the detoxification of surface treatment sludge.</p> <p>Proposal 5 : Study of the electrochemical interface using monocrystalline surfaces characterized in situ</p> <p>Proposal 6 : Comparative study and optimization of the different ranges of surface treatment of aluminum parts (SurfaProtec Industry).</p>
Study and examination requirements and forms of examination	Written Mid-term Exam (25%) + Practical Exam (25%) + Written Final Exam (50%)
Media employed	Course Material (Hard/ Soft copy) for classroom & Online (Moodle ULT) Video projection Practical Work in Laboratory Industrial Visit to MecaProtec Aero industry

Reading list	<ul style="list-style-type: none">-Electrochimie: des concepts aux applications. Fabien Miomandre, Pierre Audebert et Saïd Sadki. (2019). Sciences Sup, Dunod. 4^{ème} Edition. EAN 9782100790241.-Electrochimie des solides. Abdelkader Hammou et Samuel Georges. Grenoble Sciences. (2011).-Chimie Analytique en Solution, Jean-Louis Brisset, maison Lavoisier 2005.-Pesticides, Mehmet Oturan, Presses Ponts et chaussées 2007.
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UT Université

U.3.5 Languages & Management

English (TOEIC) I

Module designation	Languages & Management
Module level, if applicable	2 nd year of chemical engineering
Code, if applicable	U.3.5
Subtitle, if applicable	-
Courses, if applicable	- English (TOEIC) I
Semester (s) in which the module is taught	-Semester 1 (S3)
Person responsible for the module	Dr Khalil ZAGHDOUDI
Lecturer	Mr. Nourdine ZAALOUNI & Miss Nadia ZARDI
Language	English
Relation to curriculum	Professional module (compulsory),
Type of teaching, contact hours	Lecture, 42 hours of classroom course/semester
Workload	Total 63 hours/semester (21 hours of Self-Study/semester)
Credit points	2.5 credits
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of non attendance = elimination for exams
Recommended prerequisites	Upper intermediate level in both listening and reading skills.
Module objectives/intended learning outcomes	<p>Objectives:</p> <ol style="list-style-type: none"> 1. Prepare students to take TOEIC test by providing related necessary linguistic knowledge. 2. Focus is put on how to approach the different parts of test items and to develop test taking skills, in order to reach the highest score possible. <p>Learning Outcomes: Students will be able to :</p> <p>Competencies:</p> <p>General Competencies</p> <ol style="list-style-type: none"> 1. Reach the highest score possible 2. Develop at most his/her Listening and reading skills. <p>Specific Competencies</p> <ol style="list-style-type: none"> 1. Recognize the different parts of TOEIC. 2. Develop tactics and strategies appropriate to each type of activity, (ex: skimming and scanning). 3. Distinguish tasks to be performed in every activity. 4. Establish a proper pace to follow throughout the exam. 5. Manage allocated time. 6. Follow steps

Content	<p><u>Unit 1 Careers</u> Vocabulary builder:</p> <ul style="list-style-type: none"> • Professions • Recruitment, job interview, temp agency • Job fair talks, training <p>Grammar check:</p> <ul style="list-style-type: none"> • Present simple/continuous • Wh Questions • Suffixes <p><u>Unit 2 Workplaces</u> Vocabulary builder:</p> <ul style="list-style-type: none"> • Office description (architecture, law, chemistry, mechanical Engineering, industry) • Technology and communication at work: hardware/ electrical equipment <p>Grammar check:</p> <ul style="list-style-type: none"> • Count/ non-count nouns • Prepositions: place, movement, time. <p><u>Unit 3 Communication</u> Vocabulary builder:</p> <ul style="list-style-type: none"> • Internet (information technology) • Media: print media, broadcasting, news bulletin, postal services • Advertising: Commercials, banners, flyers... <p>Grammar check:</p> <ul style="list-style-type: none"> • Present perfect/ past simple <p>Compound nouns</p>
Study and examination requirements and forms of examination	Format: Written Mid-term Exam (40%) + Final Exam (60%)
Media employed	Course Material (Hard/ Soft copy) for classroom & Online (Moodle ULT) Video projection Exercises, videos, recording speech, computer,
Reading list	- Market leader, David Cotton, David Falvey, Simon Ken; FINANCIAL TIMES (Pearson Longman) - Tactics for TOEIC® Listening and Reading Test: Grant Trew, OUP Oxford, 2007. - Target Score Student's: A Communicative Course for TOEIC® Test Preparation, Charles Talcott & Graham Tullis, Cambridge University Press, 2007 - Understanding and Using English Grammar, Betty Schramper Azar; Prentice Hall Regents; - YouTube Videos

U.3.5 Languages & Management

Industrial Production Management

Module designation	Languages & Management
Module level, if applicable	2 nd year of chemical engineering
Code, if applicable	U.3.5
Subtitle, if applicable	-
Courses, if applicable	- Industrial Production Management
Semester (s) in which the module is taught	-Semester 1 (S3)
Person responsible for the module	Dr Khalil ZAGHDOUDI
Lecturer	Phd. Amine OULHA
Language	French
Relation to curriculum	Professional module (compulsory),
Type of teaching, contact hours	21 hours Seminar/ Projects
Workload	Total 42 hours/semester (21 hours of Self-Study/semester)
Credit points	1.5 credits
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	No recommended prerequisites
Module objectives/intended learning outcomes	<p>Objectives :</p> <ol style="list-style-type: none"> 1. Introduce in general the main aspects of the industrial production management function 2. Introduce the student to the main concepts of production Management 3. Formalize and structure the major problems in production management <p>Learning Outcomes: Students will be able to :</p> <ol style="list-style-type: none"> 1. Identify industrial excellence strategy, 2. Have knowledge on management principles (tension of flows, total quality, planning), 3. Define the appropriate methods (MRP2, Kanban...) 4. Define the appropriate tools (SMED, SPC....)

Content	<p>Chapter 1: The evolution of production management</p> <ol style="list-style-type: none"> 1. Evolution of the company's competitiveness 2. Context of the new production management 3. Production and flow management 4. Production management and financial aspect 5. Place of production management in the company 6. Production management and human aspect <p>Chapter2: Production typology</p> <ol style="list-style-type: none"> 1. Classification according to the importance of series and repetitiveness 2. Classification according to the organization of the production flow 3. Classification according to the relationship with the client <p>Chapter3: Different organizations of production</p> <ol style="list-style-type: none"> 1. Layout in homogeneous sections 2. Establishment in production lines 3. Establishment in manufacturing cells <p>Chapter4: Design of a modern production unit</p> <ol style="list-style-type: none"> 1. Basic principles 2. Problems of layouts in homogeneous sections 3. Separation of factories 4. Geographical separation of the manufacturing of different products <p>Chapter 5: Methods of resolution</p> <ol style="list-style-type: none"> 1. Logic and methods of resolution 2. Search for production islands (Kusiack method / King method) 3. Online posting method (Priority method / Average rank method) <p>Chapter 6: Demand forecasting</p> <ol style="list-style-type: none"> 1. Objectives and constraints of demand forecasting 2. Forecasting methods <p>Chapter 7: Project management methods</p> <ol style="list-style-type: none"> 1. Gantt method 2. The PERT method <p>Chapter 8: Traditional inventory management</p> <ol style="list-style-type: none"> 1. Inventory classification 2. Inventory management operations 3. Replenishment methods <p>Chapter 9: Tools to Improve productivity and quality: MRP2, SMED, SPC, Kanban</p>
Study and examination requirements and forms of examination	Format: Continuous Control, Evaluation & Oral Presentation (100%)
Media employed	Course Material (Hard/ Soft copy) for classroom & Online (Moodle ULT) Video projection, Practices & oral presentation
Reading list	Books and handouts, websites, https://www.projectengineer.net/tutorials/project-management/

U.3.5 Languages & Management

Scientific writing

Module designation	Languages & Management
Module level, if applicable	2 nd year of chemical engineering
Code, if applicable	U.3.5
Subtitle, if applicable	-
Courses, if applicable	- Scientific writing
Semester (s) in which the module is taught	-Semester 1 (S3)
Person responsible for the module	Dr Khalil ZAGHDOUDI
Lecturer	Dr. Khalil ZAGHDOUDI
Language	English
Relation to curriculum	Professional module (compulsory),
Type of teaching, contact hours	21 hours Seminar/ Projects
Workload	Total 51 hours/semester (30 hours of Self-Study/semester)
Credit points	2 credits
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	No prerequisites Recommended.
Module objectives/intended learning outcomes	<p>Objectives:</p> <p>1. Learn how to write a clear and concise article that will appeal to a broad audience.</p> <p>Learning Outcomes:</p> <p>Students will be able to :</p> <ol style="list-style-type: none"> 1. Write an abstract 2. Structure project data 3. Write a full publication (in Poster session)

Content	<p style="text-align: center;">Classroom Lecture</p> <p>Chapter 1. Elements of writing style In this chapter student will learn:</p> <ul style="list-style-type: none"> • some simple changes you can make when writing to make your papers easier to read • how to use different paragraph types and transitions to create focus and flow in your manuscript • How to improve your writing style through exercises. <p style="text-align: center;">Chapter 2. Titles and abstracts In this chapter student will learn:</p> <ul style="list-style-type: none"> • what makes a good title • two easy-to-use abstract templates that you can apply directly to your own writing • What to avoid when writing titles and abstracts. <p style="text-align: center;">Chapter 3. From introduction to conclusion In this chapter student will learn:</p> <ul style="list-style-type: none"> • what should be included in, or excluded from, each section of the paper • how to organize your ideas effectively and avoid common mistakes • How to create a narrative flow to help readers follow your argument. <p style="text-align: center;">Chapter 4. Data management In this chapter student will learn:</p> <ul style="list-style-type: none"> • why it is important to accurately record, share and preserve your data • the best approaches to managing your research data • The importance of sharing your data and who might use it. <p style="text-align: center;">Chapter 5. Data presentation In this chapter student will learn:</p> <ul style="list-style-type: none"> • the four principles of creating clear and engaging figures for your paper • how to choose which figures to include in your manuscript • best practices in raw data processing and image preparation • Tips to ensure that your figures are clear and informative for your readers. <p style="text-align: center;">Project : Content: Each Student will prepare a publication for the Poster session organized every year at the end of the Annual Project.</p>
Study and examination requirements and forms of examination	Format: Continuous Control, Evaluation of Publication, Poster and oral presentation (100%)
Media employed	Course Material (Hard/ Soft copy) for classroom & Online (Moodle ULT) Video projection
Reading list	1. UC Berkeley Student Learning Center https://slc.berkeley.edu/writing-worksheets-and-other-writing-resources