Academic Program Description Form
2024-2025

University Name: University of Anbar
Faculty/Institute: Faculty of Engineering
Scientific Department: Chemical and Petrochemical
Academic or Professional Program Name: Chemical and Petrochemical
Final Certificate Name: Chemical and Petrochemical Engineering
Academic System: Courses
Description Preparation Date:15/1/2025
File Completion Date: 25/1/2025

Signature:

Head of Department Name:

Asst. Prof Dr .Ghalib R.Ibrahim

Date:3 / 2/2025

Signature: M. A. Ahmed

Scientific Associate Name:

prof. Dr. M. A. Ahmed

Date:3 / 2 /2025

The file is checked by:
Department of Quality Assurance and University Performance
Director of the Quality Assurance and University Performance

Department:
Date: 3/2/ 2025
Ass. Prof. Haitham Kamil Dawood
Signature: H. K. Dawood

Approval of the Dean
3/2/2025

1. Program Vision

The Department of Chemical and Petrochemical Engineering aims to achieve excellence and foster creativity on a local, regional, and global scale. This is to be realized through the production of high-caliber graduates and the conduct of research that aligns with the evolving needs of society.

2. Program Mission

Preparing teams in the Chemical and Petrochemical Engineering department involves ensuring scientific excellence, providing comprehensive training, and qualifying individuals to meet market needs. This is achieved through conducting applied research aimed at solving industry-related problems.

3. Program Objectives

Program Educational Objectives (PEOs) for undergraduate students in chemical engineering typically outline the expected accomplishments and career development goals that graduates of the program should achieve within a few years of completing their degree. While specific PEOs can vary among institutions, here is a general set of objectives for Chemical and Petrochemical engineering undergraduates:

1- Professional Competence: Graduates will apply fundamental principles of chemical engineering to analyze and solve complex engineering problems in various industries.
2- Continuous Learning: Graduates will engage in lifelong learning, keeping abreast of advancements in chemical engineering and related fields through professional development activities and further education.
3- Sustainability: Graduates will apply sustainable practices in the design, operation, and optimization of chemical processes, recognizing the importance of minimizing environmental impact and resource use.

4. Program Accreditation

No accreditation- We prepared for it

5. Other external influences

None

6. Program Structure

Program Structure	Number of Courses	Credit hours	Percentage	Reviews*
Institution Requirements	**5**	**12**	**5%**	
College Requirements	**12**	**62**	**26%**	
Department Requirements	**32**	**166**	**69%**	
Summer Training				
Other				

* This can include notes whether the course is basic or optional.

7. Program Description

Year/Level	Course Code	Course Name	Credit Hours	
			theoretical	practical
1st/1	UOA 001	Arabic language I	2	0
	UOA 005	Human rights and Democracy	2	0
	ENG 002	Chemistry	2	2
	ENG 003	Calculus I	4	
	ENG 005	Fundamental of Electrical Engineering	2	2
	CHE 001	Principles of Chemical Engineering I	3	0
1st/2	UOA 003	English Language I	2	0
	UOA 007	Computer Science I	1	2
	ENG 004	Calculus II	3	0
	ENG 007	Engineering Drawing	1	3
	CHE 002	Physical Chemistry I	2	0
	CHE 003	Principles of Chemical engineering II	3	0
2nd/1	UOA 006	The Crimes of Baath Regime in Iraq	2	0
	ENG 001	Physics	2	2
	ENG 008	Calculus III	3	0
	CHE 004	Physical Chemistry II	2	0
	CHE 005	Fluid Mechanics I	3	1
	CHE 006	Thermodynamic I	2	2
	CHE 007	Mass Transfer I	2	0
2nd/2	ENG 006	Engineering Mechanics (Static)	3	0
	ENG 009	Calculus IV	3	0
	CHE 008	Organic Chemistry	2	1
	CHE 009	Fluid Mechanics II	3	1
	CHE 010	Thermodynamic II	3	1
	CHE 011	Mass Transfer II	2	0
3rd/1	ENG 010	Engineering Statiscs	2	0

	CHE 012	Egineering Analysis	**2**	**0**
	CHE 013	Reactor Design I	**3**	**0**
	CHE 014	Unit Operation I	**3**	**0**
	CHE 015	Heat Transfer I	**3**	**1**
	CHE 016	Engineering Material	**2**	**2**
3rd/2	ENG 011	Engineering Numerical Methods	**2**	**1**
	CHE 017	Reactor Design II	**3**	**0**
	CHE 018	Unit Operation I	**3**	**0**
	CHE 019	Heat Transfer II	**3**	**0**
	CHE 020	Environment Engineering	**2**	**0**
	CHE 021	Chemical & Petrochemical Industry	**4**	**0**
4th/1	ENG 012	Ethics and Leadership Skills	2	
	CHE 022	Petroleum and Natural Gas Engineering	3	1
	CHE 023	Transport Phenomena	3	
	CHE 024	Equipment Design	3	
	CHE 025	Control Porcesses I	2	
	CHE 026	Project I	**0**	
4th /2	CHE 027	Technology of Catalyst	2	
	CHE 028	Petroleum Refinery	4	
	CHE 029	Engineering Economy	2	
	CHE 030	Corrosion Engineering	3	1
	CHE 031	Control Processes II	3	
	CHE 032	Project II	0	

8. **Learning outcomes Program**

#	Student Learning Outcome	Category	Reason
i	An ability to distinguish, identify, define, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.	**Skills**	This focuses on applying theoretical concepts to solve real-world problems, which is a demonstrable ability.
ii	An ability to produce engineering designs that meet desired needs within certain constraints by applying both analysis and synthesis in the design process.	**Skills**	Involves applying knowledge to perform design tasks—clearly an action-oriented, skill-based outcome.
iii	An ability to create and carry out proper measurement and tests with quality assurance, analyze and interpret results, and utilize engineering judgment to make inferences.	**Skills**	Centers on hands-on experimentation and analysis, requiring practical abilities.

#	Student Learning Outcome	Category	Reason
iv	An ability to skillfully communicate orally with a gathering of people and in writing with various managerial levels.	**Skills**	Communication is a core transferable skill, especially across contexts and audiences.
v	An ability to perceive ethical and professional responsibilities in engineering cases and make brilliant judgments taking into account the consequences in worldwide financial, ecological and societal considerations.	**Values**	This deals with ethics, responsibility, and decision-making in a broader societal context—core value-based learning.
vi	An ability to perceive the continual necessity for professional knowledge growth and how to find, assess, assemble and apply it properly.	**Values** (with a **Skill** component)	Reflects a value for lifelong learning, but also includes research skills. Still, the primary emphasis is on **valuing continuous improvement**.
vii	An ability to work adequately on teams and to set up objectives, plan activities, meet due dates, and manage risk and uncertainty.	**Skills**	Teamwork, project planning, and risk management are all practical competencies—thus a skills-based outcome.

- Knowledge: None directly, though knowledge is embedded across all outcomes.
- Skills: i, ii, iii, iv, vii
- Values: v, vi

9. Teaching and Learning Strategies

1. Lectures and Tutorials
2. Laboratory Sessions
3. Project-Based Learning (PBL)
4. Field Trips and Industrial Visits

5. Evaluation methods

1. **Written Examinations**
   Midterm and Final Exams: Traditional exams are used to assess students' understanding of core theoretical concepts, such as thermodynamics, fluid mechanics, material balances, and reaction kinetics.
2. **Quizzes and Short Tests**
   Frequent Assessment: Quizzes, both in-class and online, are used for continuous assessment of students' understanding throughout the course. They may cover recently taught material or foundational concepts.
3. **Laboratory Reports and Practical Assessments**

Lab Performance: Students are evaluated on their ability to conduct experiments safely and accurately, following proper protocols, using instrumentation, and collecting data.

6. Faculty

Faculty Members

Academic Rank	Specialization		Special Requirements/Skills (if applicable)		Number of the teaching staff	
	General	Special			Staff	Lecturer
Ghalib R. Ibrahim	Chemical	Advanced Material and thermal system			×	
Hamid A. Fayadh	Chemical	Advanced Material and thermal system			×	
Mustafa B. Al-Hadithi	Mechanical Engineering	Thermals			×	
Sufyan F. Ahmed	Chemical	Units operation			×	
Omar Al-Kubaisi	Chemical	composite materials			×	
Abbas H. Faris	Chemistry Sciences	Polymer Chemistry			×	
Mohammed J. Mohammed	Materials Engineering	Polymer Engineering			×	
Ayad A. Maayoof	Mechanical Engineering	Applied Engineering			×	
Suha A. Mohammed	Chemical Engineering	Transfer phenomena			×	
Khaled A. Mohammed	Civil Engineering	Transportation and Communications			×	
Yasir R. Hussien	Chemical Engineering	Thermal dynamics			×	
Badoor M. Kurji	Chemical Engineering	Transfer phenomena			×	
Suha M. Salih	Chemical Engineering	science of minutes			×	
Khaled J. Hamid	Chemistry Sciences	Physical Chemistry			×	

Osama A. Muhsin	Chemical Engineering	Heat transfer			×	
Omar H. Hussim	Mechanical Engineering	Applied Engineering			×	
Ibrahim K. Alabdaly	Mechanical Engineering	Thermals			×	

Professional Development

Mentoring new faculty members

Mentoring new faculty members is a crucial process in helping them transition smoothly into their roles, develop professionally, and succeed in their academic careers. Effective mentoring provides support in areas such as teaching, research, service, and navigating the institutional culture. Below are strategies and guidelines for mentoring new faculty:

1. Orientation and Institutional Support
2. Teaching Mentorship
3. Research Mentorship
4. Service and Professional Development

Professional development of faculty members

1. **Teaching Enhancement**:
   - Workshops and seminars on innovative teaching methods, curriculum design, and classroom technology.
   - Peer observation and feedback to refine teaching practices and enhance student engagement.
   - Training on inclusive teaching and addressing diverse learning needs.
2. **Research Development**:
   - Support for securing research grants, writing proposals, and publishing in high-impact journals.
   - Collaborative opportunities within the institution or with external partners to advance research agendas.
   - Access to resources such as research tools, labs, and mentoring for improving research productivity.
3. **Leadership and Service Skills**:
   - Training for leadership roles, such as department chairs or committee leads, to help faculty contribute to institutional governance.
   - Professional development in managing service responsibilities and navigating institutional politics.
4. **Workshops and Conferences**:
   - Encouragement to attend academic conferences and workshops for networking and staying updated on field advancements.
   - Presenting research at conferences to build professional credibility and broaden academic influence.
5. **Technology and Pedagogy**:

- Training in new educational technologies, online teaching platforms, and tools for engaging students digitally.
- Continuous learning about evolving pedagogical trends to enhance teaching effectiveness.

6. **Mentorship and Peer Support**:
   - Formal or informal mentorship programs where senior faculty guide newer faculty in career progression and work-life balance.
   - Peer support groups for sharing best practices, research collaboration, and teaching innovations.

Faculty professional development ensures continuous improvement, helping educators excel in their roles while adapting to the dynamic demands of higher education.

7. Acceptance Criterion

Central Admission

8. The most important sources of information about the program

The most important sources of information about an academic program, such as **Chemical and Petrochemical Engineering**, are essential for students, faculty, and stakeholders to understand the program's structure, objectives, and requirements. Below are the key sources of information:

1. Program Handbook or Catalog

- **Comprehensive Guide**: The official program handbook or academic catalog contains detailed information about the curriculum, course descriptions, program objectives, and graduation requirements. It is usually available through the university's website or in print form.
- **Policies and Procedures**: It includes academic policies, grading systems, academic integrity guidelines, and program-specific requirements like internships or research projects.

2. Departmental Website

- **Central Hub**: The department's website serves as the primary source for up-to-date information on the program. It typically provides details about faculty members, courses offered, research areas, facilities (such as labs), and application processes.
- **News and Updates**: It often features announcements about new courses, events, seminars, and changes in program structure or requirements.

3. Course Syllabi

- **Course-Level Information**: Each course syllabus provides specific information about course content, learning outcomes, assessment methods,

and required materials. It serves as a guide for students to understand what is expected of them in each class.

9. Program Development Plan

A **Program Development Plan** for a **Chemical and Petrochemical Engineering** program outlines the strategy for continuous improvement, addressing academic, research, industry, and societal needs. The plan typically aligns with institutional goals, accreditation standards, and evolving industry requirements. Below are key elements of a Program Development Plan:

1. Curriculum Enhancement

- **Regular Curriculum Review**: we did a review to ensure that the curriculum remains current by integrating the latest advancements in chemical and petrochemical engineering technologies. This involves periodic reviews and updates to course content, textbooks, and learning resources.
- **Interdisciplinary Integration**: we put a plan to encourage the inclusion of interdisciplinary courses that blend chemical engineering with fields like materials science, environmental engineering, and data analytics.

2. Faculty Development

- **Professional Development**: we plan for faculty professional development through workshops, conferences, and sabbaticals to help them stay updated with the latest trends in engineering education and research.
- **Mentorship Programs**: Establish formal mentorship programs for new faculty to support their teaching and research activities, ensuring a smooth transition and career progression.

3. Research and Innovation

- **Research Focus Areas**: we put a plan to promote research in areas critical to the chemical and petrochemical industries, such as process optimization, catalysis, energy storage, and carbon capture technologies.
- **Industry Collaboration**: we put a plan to enhance collaboration with industry for joint research projects, funding opportunities, and technology transfer initiatives. This could involve setting up research centers or establishing industry advisory boards.

4. Infrastructure and Laboratory Upgrades

- **State-of-the-Art Laboratories**: we will upgrade laboratories with modern equipment and technologies that reflect current industry practices, such as process control systems, simulation software, and high-tech analytical instruments.

- **Virtual and Remote Labs**: we will develop virtual lab platforms and simulations to enhance learning, especially in areas where physical lab work might be limited or expensive.
- **Sustainable Practices**: we put a guide to ensure that labs and facilities adopt sustainable and environmentally friendly practices, such as waste reduction and energy-efficient technologies.

5. Accreditation and Quality Assurance

By implementing these strategies, the **Chemical and Petrochemical Engineering Program** will remain relevant, responsive to industry trends, and aligned with both academic excellence and societal needs.

Program Skills Outline

Year/Level	Course Code	Course Name	Basic or optional	Required program Learning outcomes											
				Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
1st/1	UOA 001	Arabic language I	Basic					x			x	x	x	x	x
	UOA 005	Human rights and Democracy	Basic									x	x	x	x
	ENG 002	Chemistry	Basic		x				x						
	ENG 003	Calculus I	Basic		x										
	ENG 005	Fundamental of Electrical Engineering	Basic		x										
	CHE 001	Principles of Chemical Engineering I	Basic	x	x										
1st/2	UOA 003	English Language I	Basic					x				x	x	x	x
	UOA 007	Computer Science I	Basic		x			x				x	x	x	x
	ENG 004	Calculus II	Basic		x										
	ENG 007	Engineering Drawing	Basic		x										
	CHE 002	Physical Chemistry I	Basic	x	x				x						

	CHE 003	Principles of Chemical engineering II	Basic	x	x				x	x			x		
2nd/1	UOA 006	The Crimes of Baath Regime in Iraq	Basic									x	x		
	ENG 001	Physics	Basic		x										
	ENG 008	Calculus III	Basic		x										
	CHE 004	Physical Chemistry II	Basic	x	x										
	CHE 005	Fluid Mechanics I	Basic	x											
	CHE 006	Thermodynamic I	Basic	x											
	CHE 007	Mass Transfer I	Basic	x											
2nd/2	ENG 006	Engineering Mechanics (Static)	Basic		x										
	ENG 009	Calculus IV	Basic		x										
	CHE 008	Organic Chemistry	Basic		x										
	CHE 009	Fluid Mechanics II	Basic	x	x										
	CHE 010	Thermodynamic II	Basic	x	x										

	CHE 011	Mass Transfer II	Basic	x	x											
3rd/1	ENG 010	Engineering Statics	Basic		x											
	CHE 012	Engineering Analysis	Basic		x											
	CHE 013	Reactor Design I	Basic	x												
	CHE 014	Unit Operation I	Basic	x												
	CHE 015	Heat Transfer I	Basic	x												
	CHE 016	Engineering Material	Basic	x												
3rd/2	ENG 011	Engineering Numerical Methods	Basic		x											
	CHE 017	Reactor Design II	Basic	x												
	CHE 018	Unit Operation I	Basic	x												
	CHE 019	Heat Transfer II	Basic	x												
	CHE 020	Environment Engineering	Basic	x						x		x	x	x	x	
	CHE 021	Chemical & Petrochemical Industry	Basic	x												

	ENG 012	Ethics and Leadership Skills	Basic								x	x	x	x	x
	CHE 022	Petroleum and Natural Gas Engineering	Basic	x											
4th/1	CHE 023	Transport Phenomena	Basic	x											
	CHE 024	Equipment Design	Basic	x											
	CHE 025	Control Processes I	Basic	x											
	CHE 026	Project I	Basic	x	x				x	x			x	x	
	CHE 027	Technology of Catalyst	Basic	x											
	CHE 028	Petroleum Refinery	Basic	x											
4th/2	CHE 029	Engineering Economy	Basic		x										
	CHE 030	Corrosion Engineering	Basic	x	x										
	CHE 031	Control Processes II	Basic	x											
	CHE 032	Project II	Basic	x	x					x	x	x	x	x	x

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Description Form

1. Course Name:
Calculus I
2. Course Code:
Eng 003
3. Semester / Year:
1st /2024
4. Description Preparation Date:
19/9/2024
5. Available Attendance Forms:
Personal Attendance to give lecture
6. Number of Credit Hours (Total) / Number of Units (Total)
6 ECTS
7. Course administrator's name (mention all, if more than one name)
Name: Ayad Aied Mahuof Email: ayadaied@uoanbar.edu.iq
8. Course Objectives

Course Objectives	1. Students should be able to work with functions represented in a variety of ways: graphical, numerical, analytical, or verbal. They should understand the connections among these representations. 2. Students should understand the meaning of the derivative in terms of a rate of change and local linear approximation and should be able to use derivatives to solve a variety of problems. 3. Students should understand the meaning of the definite integral both as a limit of Riemann sums and as the net accumulation of a rate of change and should be able to use integrals to solve a variety of problems. 4. Students should understand the relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus.

9. Teaching and Learning Strategies

Strategy	1. develop mathematical skill so that students are able to sketch the graph of various functions and evalu Limits by using different techniques including L'Hospital's rule 2. apply mathematical methods and principals in solving various derivative problems from Engineering fie involving applications of derivatives 3. demonstrate algebraic facility with algebraic topics including exponential, logarithmic,and trigonome functions and compute derivative and antiderivative of algebraic, trigonometric, in trigonometric, exponen logarithmic, and apply them to solve problems in a range of engineering applications

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	1	Functions	Lectures and tutorial	Quiz
2	4	1	Functions	Lectures and tutorial	Quiz
3	4	1	Limits:	Lectures and tutorial	Assignment &Quiz
4	4	1	Limits:	Lectures and tutorial	Assignment &Quiz
5	4	1	Differentiation rules	Lectures and tutorial	Assignment &Quiz
6	4	1	Differentiation rules	Lectures and tutorial	Assignment &Quiz
7	4	1	The Chain Rule, Implicit Differentiation	Lectures and tutorial	Assignment &Quiz
8	4	1	Mid exam	Lectures and tutorial	Assignment &Quiz
9	4	1	Applications of differentiation	Lectures and tutorial	Assignment &Quiz
10	4	1	Applications of differentiation	Lectures and tutorial	Assignment &Quiz
11	4	1	Integrals	Lectures and tutorial	Assignment &Quiz
12	4	1	Applications of integrals:	Lectures and tutorial	Assignment &Quiz
13	4	1	Applications of integrals	Lectures and tutorial	Assignment &Quiz
14	4	1	Exponential and logarithmic functions.	Lectures and tutorial	Assignment &Quiz
15	4	1	Derivative and integrals involving inverse trig functions. Hyperbolic functions.	Lectures and tutorial	Assignment &Quiz
11.Course Evaluation					

Monthly Exam: 20 Mark Quizzes: 10 Mark Assignment and Other Activities:10 Mark Mid Term Exam: 10 Final Exam: 50 Mark	
12.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Thomas, G. 8., Haas, J., Heil, C., & Weir, M. (2018). Thomas' Calculus. Pearson Education Limited.
Main references (sources)	Stewart, J., Clegg, D. K., & Watson, S. (2020). Calculus: early transcendental. Cengage Learning.
Recommended books and references (scientific journals, reports...)	Stroud, K. A., & Booth, D. J. (2020). Engineering mathema Bloomsbury Publishing
Electronic References, Websites	

Course Description Form

1. Course Name:
Calculus II
2. Course Code:
Eng 004
3. Semester / Year:
2nd /2024
4. Description Preparation Date:
19/9/2024
5. Available Attendance Forms:
Personal Attendance to give lecture
6. Number of Credit Hours (Total) / Number of Units (Total)
6 ECTS
7. Course administrator's name (mention all, if more than one name)
Name: Ayad Aied Mahuof Email: ayadaied@uoanbar.edu.iq
8. Course Objectives

Course Objectives	To introduce the concept of integration, study various techniques of integration and illustrate some applications of integration.

9. Teaching and Learning Strategies

Strategy	1. Evaluate of definite, indefinite and improper integrals by using different integration techniques. 2. Determine arc length, surface area and volume by using the applications of integration techniques. 3. Define polar coordinate graphs and solve related problems including area, arc length and volume.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	1	Integral	Lectures and tutorial	Quiz
2	4	1	Integral	Lectures and tutorial	Quiz
3	4	1	Integration Techniques - Integration by Parts.	Lectures and tutorial	Assignment &Quiz
4	4	1	Integration Techniques- Trigonometric Integrals.	Lectures and tutorial	Assignment &Quiz
5	4	1	Integration Techniques- Partial Fractions	Lectures and tutorial	Assignment &Quiz
6	4	1	Progress Exam	Lectures and tutorial	Assignment &Quiz
7	4	1	Applications of Integrals-Infinite Integral, Areas	Lectures and tutorial	Assignment &Quiz
8	4	1	Applications of Integrals- Arc Length, Surface area	Lectures and tutorial	Assignment &Quiz

9	4	1	Applications of Integrals- Volumes (Disk, Washer, Shell)	Lectures and tutorial	Assignment &Quiz
10	4	1	Polar Coordinates - Common Polar Coordinate Graphs	Lectures and tutorial	Assignment &Quiz
11	4	1	Polar Coordinates - Common Polar Coordinate Graphs	Lectures and tutorial	Assignment &Quiz
12	4	1	Polar Coordinates - Tangents with Polar Coordinates, Curves defined by parametric equations.	Lectures and tutorial	Assignment &Quiz
13	4	1	Polar Coordinates - Tangents with Polar Coordinates, Curves defined by parametric equations.	Lectures and tutorial	Assignment &Quiz
14	4	1	Polar Coordinates - Tangents with Polar Coordinates, Curves defined by parametric equations.	Lectures and tutorial	Assignment &Quiz
15	4	1	Progress Exam	Lectures and tutorial	Assignment &Quiz

11.Course Evaluation

Monthly Exam: 20 Mark
Quizzes: 10 Mark
Assignment and Other Activities:10 Mark
Mid Term Exam: 10
Final Exam: 50 Mark

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	Thomas, G. 8., Haas, J., Heil, C., & Weir, M. (2018). Thomas' Calculus. Pearson Education Limited.
Main references (sources)	Stewart, J., Clegg, D. K., & Watson, S. (2020). Calculus: early transcendental. Cengage Learning.
Recommended books and references (scientific journals, reports...)	Stroud, K. A., & Booth, D. J. (2020). Engineering mathema Bloomsbury Publishing
Electronic References, Websites	

Course Description Form

1. Course Name:

Chemical reactor design

2. Course Code:

CHE 3318

3. Semester / Year:

1st /2024

4. Description Preparation Date:

19/9/2024

5. Available Attendance Forms:

Personal Attendance to give lecture

6. Number of Credit Hours (Total) / Number of Units (Total)

3

7. Course administrator's name (mention all, if more than one name)

Name: Suha Akram, PhD
Email: suha-elzein@uoanbar.edu.iq

8. Course Objectives

Course Objectives	The goals of this course are to enable students to: To provide the student with principles and kinetic tools useful in analyzing the rates of chemical reactions for homogeneous reactions. And to increase the student's ability to do chemical reactor design by providing the knowledge and tools required to obtain, evaluate, and improve rate equations for use in design, operation and optimization of chemical reactors.

9. Teaching and Learning Strategies

Strategy	By the end of successful completion of this course, the student will be able to: 1. Define process variables and parameters of chemical reactors 2. Implement the kinetic models based on the physical picture of the process or conducted kinetic experiment 3. Vary the reaction kinetics in homogeneous systems and apply mathematical numerical and / or analytical methods in estimation of the kinetic model parameters 4. Set up the mathematical models of the processes with chemical reaction in various types of reactors (kinetic and reactor model) and apply the methodology of chemical engineering when choosing a reactor for the implementation of certain types of reactions 5. Apply the acquired knowledge in modeling and design of chemical reactors and apply mathematical methods, models and techniques in solving case studies

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Understand the different types of reactors such as batch	**define the chemical reactor as the basic unit of chemical processes, define the process space, system boundaries, and input and**	1,2	Quiz

			output variables of the process , define the basic division and classification of chemical reactors		
2	4	Understand the different types of reactors continuous stirred-tank (CSTR)	**Types of reaction, single and multiple reaction , in parallel, series, reversible, and catalytic reactions**	1,2	Quiz
3	4	continuous stirred-tank (CSTR) plug flow reactors (PFR).	**define the dependence of reaction rate on temperature**	1,2	Assignment &Quiz
4	4	Gain knowledge of reaction rate laws and mechanisms	**define the dependence of reaction rate on temperature**	1,2	Assignment &Quiz
5	4	how to use them to predict reactor behavior.	**Define the integral method of the kinetic model parameters estimation**	1,2	Assignment &Quiz
6	4	**Material and Energy Balances:** Learn to apply material and energy balance equations to reactor design.	**Progress Exam 1**	1,2	Assignment &Quiz
7	4	**Reactor Sizing:** Understand how to size reactors for desired conversion and yield, considering both ideal and non-ideal conditions.	**define the reactor model for batch reactor**	1,2	Assignment &Quiz
8	4	**Residence Time Distribution (RTD):** Study the importance of RTD and its impact on reactor performance.	**define the reactor model for CSTR reactor - define the reactor model for plug-flow reactor**	1,2	Assignment &Quiz
9	4	**Deviations from Ideal Behavior:** Learn about the factors that cause deviations from ideal reactor behavior and how to model them.	**Single reactor design batch , plug, and mixed flow reactor**	1,2	Assignment &Quiz
10	4	**Models for Non-Ideal Reactors:** Understand models such as the tanks-in-series model and the dispersion model.	**Select the best reactor that give best conversion**	1,2	Assignment &Quiz
11	4	**Catalyst Characteristics:** Learn about the properties of catalysts and how they influence reaction rates.	**Multiple-Reactor Systems in series and in parallel, choosing same type of reactors**	1,2	Assignment &Quiz
12	4	**Design of Catalytic Reactors:** Understand the design principles for reactors involving solid	**Progress Exam 2**	1,2	Assignment &Quiz

		catalysts, including packed bed reactors.			
13	4	Study the role of heat transfer in reactor design, including concepts like heat exchangers and temperature control.	**Multiple-Reactor Systems in series and in parallel, choosing different type of reactors, Recycle Reactor**	1,2	Assignment &Quiz
14	4	Understand the principles of mass transfer and their application in reactor design.	**Multiple-Reactor Systems in series and in parallel, choosing shape type of reactors Autocatalytic Reactions**	1,2	Assignment &Quiz
15	4	Study reactors involving multiple phases, such as gas-liquid and liquid-solid systems.	**Size Comparison of Single Reactors and multiple reactors**	1,2	

11.Course Evaluation

Monthly Exam: 20 Mark
Quizzes: 10 Mark
Assignment and Other Activities:10 Mark
Final Exam: 40 Mark

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

1. Course Name:

Composite Materials

2. Course Code:

CHE 3403

3. Semester / Year:

2nd /2024

4. Description Preparation Date:

19/9/2024

5. Available Attendance Forms:

Personal Attendance to give lecture

6. Number of Credit Hours (Total) / Number of Units (Total)

2 ECTS

7. Course administrator's name (mention all, if more than one name)

Name: Ayad Aied Mahuof
Email: ayadaied@uoanbar.edu.iq

8. Course Objectives

Course Objectives	The main objective of this course is not only to enlarge the students' knowledge in composite materials but also in their macro/micro mechanical properties to empower the students with the skills needed for the design, manufacture and analysis of composite materials from a material scientist's viewpoint.

9. Teaching and Learning Strategies

Strategy	1. Identify, describe and evaluate the properties of fibre reinforcements, polymer matrix materials and commercial composites. 2. Develop competency in one or more common composite manufacturing techniques, and be able to select the appropriate technique for manufacture of fibre-reinforced composite products. 3. Analyse the mechanical performance of composite laminates; and understand and predict the failure behaviour of fibre-reinforced composites.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	1,2	Introduction to composite materials	Lectures and tutorial	Quiz
2	4	1,2	Specific resistance properties of composite materials	Lectures and tutorial	Quiz
3	4	1, 2	Classification of compounds, methods of manufacturing, and applications	Lectures and tutorial	Assignment &Quiz
4	4	1, 2	Classification of compounds, methods of manufacturing, and applications	Lectures and tutorial	Assignment &Quiz
5	4	1, 2	Recycling of fiber reinforced composite	Lectures and tutorial	Assignment &Quiz

6	4	1, 2,3	Micromechanical analysis of a unidirectional compound	Lectures and tutorial	Assignment &Quiz
7	4	1, 2,3	Fractional size of bubbles, longitudinal and transverse modulus of elasticity	Lectures and tutorial	Assignment &Quiz
8	4	1, 2,3	Shear modulus, Poisson's ratio, and longitudinal tensile stress	Lectures and tutorial	Assignment &Quiz
9	4	1, 2,3	Transverse tensile stress and shear stress	Lectures and tutorial	Assignment &Quiz
10	4	1, 2,3	Transverse and longitudinal compressive stress	Lectures and tutorial	Assignment &Quiz
11	4	1, 2,3	Maximum tensile and compressive stress in a single component	Lectures and tutorial	Assignment &Quiz
12	4	1, 2,3	Coefficient of thermal expansion and humidity coefficient	Lectures and tutorial	Assignment &Quiz
13	4	1,3	Macromechanical analysis of composite layer	Lectures and tutorial	Assignment &Quiz
14	4	1,3	Strain and stress	Lectures and tutorial	Assignment &Quiz
15	4	1,2,3	Strain energy	Lectures and tutorial	Assignment &Quiz

11.Course Evaluation

Monthly Exam: 20 Mark
Quizzes: 10 Mark
Assignment and Other Activities:10 Mark
Final Exam: 60 Mark

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	Mechanics of Composite Materials, Second Edition, Autar K. K
Main references (sources)	FIBERREINFORCED COMPOSITES Materials, Manufacturing,and Design, By: P.K. Mallick 3rd edition
Recommended books and references (scientific journals, reports...)	

Electronic References, Websites	

Course Description Form

13.Course Name:	
Corrosion Engineering	
14.Course Code:	
CHE 030	
15.Semester / Year:	
1st /2024	
16.Description Preparation Date:	
19/9/2024	
17.Available Attendance Forms:	
Personal Attendance to give lecture	
18.Number of Credit Hours (Total) / Number of Units (Total)	
3	
19.Course administrator's name (mention all, if more than one name)	
Name: Suha Akram, PhD Email: suha-elzein@uoanbar.edu.iq	
20.Course Objectives	
Course Objectives	The goals of this course are to enable students to: By the end of this course, the successful student will be knowledgeable about the role corrosion plays in material failures be knowledgeable about electrochemical corrosion mechanisms be knowledgeable about environment assisted cracking be able to calculate from first principles determine a materials corrosion performance understand the factors controlling galvanic corrosion and be able to assess the tendency of a metal to suffer galvanic corrosion in a mixed material system be aware of the different forms of corrosion and details of corrosion phenomenology knowledgeable about corrosion and environment assisted cracking mitigation strategies be able to perform electrochemical experiments to characterize corrosion performance
21.Teaching and Learning Strategies	
Strategy	By the end of successful completion of this course, the student will be able to: 1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics 2. an ability to apply engineering design to produce solutions that meet specified needs with

	consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors 3. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts 4. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions 5. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

22. Course Structure

Week	Hours	Unit or subject name	Learning method	Evaluation method
1	4	**Concept and Overview and introduction to corrosion**	1,2	Quiz
2	4	**Basic concepts: electrode potentials, corrosion cells and thermodynamics**	1,2	Quiz
3	4	half cell reactions, anode, cathode, Faraday's law, units, 8 forms of corrosion	1,2	Assignment &Quiz
4	4	electrolytes, interfaces, double layer, electrode potential, reference electrodes. Measurements	1,2	Assignment &Quiz
5	4	thermodynamics review, free energy, Gibbs' energy, chemical potential, Nernst equation	1,2	Assignment &Quiz
6	4	Pourbaix diagram calculations, water, metals with water, alloy examples, limitations with corrosion	1,2	Assignment &Quiz
7	4	**Progress Exam 1**	1,2	Assignment &Quiz
8	4	kinetics, weight change, measurement methods, polarization, anodic / cathodic protection	1,2	Assignment &Quiz
9	4	passivity, theories, surface analysis, effects of alloying elements	1,2	Assignment &Quiz
10	4	thermodynamics of corrosion, electrochemical cells, galvanic corrosion, (fuel cells and batteries)	1,2	Assignment &Quiz
11	4	inhibitors, acids, neutral solutions	1,2	Assignment &Quiz
12	4	crevices, pitting, occluded cells and mechanical aspects, stress corrosion cracking forms,	1,2	Assignment &Quiz

13	4	forms of corrosion (carburization, nitridation, HTHA, oxidation, sulfidation, molten salts, molten phases, halogens, mixed mode)	1,2	Assignment &Quiz
14	4	**Progress Exam 2**	1,2	Assignment &Quiz
15	4	**Case Study**	1,2	

23.Course Evaluation
Monthly Exam: 20 Mark Quizzes: 10 Mark Assignment and Other Activities:10 Mark Final Exam: 40 Mark

24.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

1. Course Name:	
Calculus III	
2. Course Code:	
CHE 2209	
3. Semester / Year:	
2nd /2024	
4. Description Preparation Date:	
20/9/2024	
5. Available Attendance Forms:	
Personal Attendance to give lecture	
6. Number of Credit Hours (Total) / Number of Units (Total)	
6 ECTS	
7. Course administrator's name (mention all, if more than one name)	
Name: Ahmed Mouthanna Abdulghafoor Email: ahmed.mouthana@uoanbar.edu.iq	
8. Course Objectives	
Course Objectives	The Objectives of this course are to enable students to: 1- To understand these concepts of applications and how to evaluate volumes, surface area, and to understand analytic geometry. 2-To provide practice at developing critical thinking skills, solving open ended problems and to work in teams 3-To develop a deep understanding of issues related to the basic principles of polar Coordinates, vector analysis,

	determinants, Matrices and how to solve problems in chemical engineering.

9. Teaching and Learning Strategies

Strategy	By the end of successful completion of this course, the student will be able to: 1. Perform calculus operations on vector-valued functions, including derivatives, integrals curvature, displacement, velocity, acceleration, and torsion. 2. Perform calculus operations on functions of several variables, including partial derivatives, directional derivatives, and multiple integrals. 3. Find extrema and tangent planes. 4. Solve problems using the Fundamental Theorem of Line Integrals, Green's Theorem, The Divergence Theorem and Stokes' Theorem. 5. Apply the computational and conceptual principles to the solutions of real-wo problems Type something like: The main strategy that will be adopted in delivering this mod is to encourage students' participation in the exercises, while at the same time refin and expanding their critical thinking skills. This will be achieved through class interactive tutorials and by considering types of simple experiments involving so sampling activities that are interesting to the students.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Vectors and Properties of Vectors	Introduction to Vectors	1,2,3	Quiz
2	3	Geometry of Spaces	Geometry of Spaces	1,2,3	Quiz
3	3	Vector-Valued Functions	Equation of vector	1,2,3	Assignment &Quiz
4	3	Tangent and Normal Vectors and, Arch Length and Curvature	Equation of vector	1,2,3	Assignment &Quiz
5	3	Function of Several Variables	Partial Derivatives	1,2,3	Assignment &Quiz
6	3	Triple integrals and Applications	Partial Derivatives	1,2,3	Assignment &Quiz
7	3	Partial Derivatives and Chain Rules for Functions of Several Variables	Partial Derivatives	1,2,3	Assignment &Quiz
8	3	Tangent Planes and Normal Lines and, Extrema of	Partial Derivatives	1,2,3	Assignment &Quiz

		Functions of Two Variables			
9	3	Iterated Integrals and Area in Plane	Multiple Integrals	1,2,3	Assignment &Quiz
10	3	Double Integrals and Volume	Multiple Integrals	1,2,3	Assignment &Quiz
11	3	Triple integrals and Applications		1,2,3	Assignment &Quiz
12	3	Vector Field and Line Integrals	Multiple Integrals	1,2,3	Assignment &Quiz
13	3	Conservative Vector Field, Independent of Path and, and complex number	complex number	1,2,3	Assignment &Quiz
14	3	matrix	matrix	1,2,3	Assignment &Quiz
15	3	Final exam		1,2,3	Assignment &Quiz

11.Course Evaluation	
Formative Assignment: 40 Mark Midterm exam: 10 Mark Final Exam: 50 Mark	
12.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Calculus III
Main references (sources) Thomas' Calculus Early Transcendentals 1 Edition.by George B. Thomas Jr. (Author),	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

25.Course Name:
Fluid Mechanics I
26.Course Code:
CHE 005
27.Semester / Year:
1st /2024
28.Description Preparation Date:
23/9/2024
29.Available Attendance Forms:
Personal Attendance to give lecture

30.Number of Credit Hours (Total) / Number of Units (Total)
4 ECTS
31.Course administrator's name (mention all, if more than one name)
Name: Ibrshim Khudhur Abduljabbar Email: ibrahin.khadir@uoanbar.edu.iq
32.Course Objectives

Course Objectives:	• Provide a thorough understanding and practical applications fluid mechanics problems analysis for determinate the solution. • Testing and examine fluid mechanics under different load conditions to find the solution behavior. • Understanding and applying mathematical model for the solution of indeterminate fluid flow problems.

33.Teaching and Learning Strategies	
Strategy	1. Interactive Lectures • Begin with clear explanations of fundamental concepts in fluid mechanics, such as f properties, fluid statics, and fluid dynamics. Use diagrams, animations, and video illustrate key principles like Bernoulli's equation, continuity, and viscosity. Analo can help clarify complex ideas—for example, comparing fluid flow to the movemer traffic can make concepts more relatable. • Pose questions throughout your lectures to keep students engaged and assess their understanding. Utilize tools like clickers, quizzes, or polling software to encourage participation. For instance, ask students to predict the outcome of a fluid flow scenario before revealing the answer, fostering critical thinking. • Relate theoretical concepts to real-world applications in fields like chemical engineering. Discuss how fluid mechanics principles are applied in oil refineries, chemical plants, and wastewater treatment facilities. Highlight specific examples, such as the role of pumps in transport systems or the importance of fluid dynamics in reactor design, to make the content more relatable and practical. 2. Problem-Based Learning (PBL) • Introduce industry-based case studies where students apply fluid mechanics concepts to solve practical engineering problems. For example, analyze a case study on fluid flow in a pipeline system or the behavior of fluids in a mixing process. This approach encourages critical thinking and collaboration as students work together to develop solutions based on real-world scenarios. • Use in-class examples to demonstrate how to break down complex fluid mechanics problems systematically. Start by identifying relevant principles, such as the conservation of mass or Bernoulli’s principle. Then, guide students through the

application of mathematical formulas step by step, showing them how to approach and solve problems methodically.

3. Use of Visual Aids and Simulations

- Utilize visual aids such as flow diagrams and piping and instrumentation diagrams (P&ID) to help students visualize fluid flow systems and equipment connections. These diagrams can illustrate the layout of pipes, valves, and other components, enhancing students' understanding of how different parts interact within a fluid system.
- Integrate simulation software like ANSYS Fluent, OpenFOAM, or MATLAB into lectures and assignments. These tools allow students to simulate fluid mechanics concepts, such as flow through various geometries or pressure drop calculations in pipes. This hands-on experience helps bridge the gap between theory and practice.
- Use multimedia resources, such as animations and videos, to explain complex fluid mechanics processes, such as turbulent versus laminar flow, or the dynamics of fluid interaction in different scenarios. These visual tools can make abstract concepts more concrete, aiding comprehension and retention.

34. Course Structure

Week	Hours	Required Learning Outcomes	Learning method	Evaluation method
1	3	Definitions of Stress on Fluid and Continuum	1,2,3	Quiz
2	3	Fluid Properties Distinction between Newtonian and NonNewtonian Fluid	1,2,3	Quiz
3	3	Compressibility, Surface tension of Liquids, Units and Dimensions	1,2,3	Assignment &Quiz
4	3	Forces on Fluid element, Normal Stress in Stationary Fluid	1,2,3	Assignment &Quiz
5	3	Fundamental equation of fluid static and Applications	1,2,3	Assignment &Quiz
6	3	Hydrostatic Thrust on Submerged Surfaces and Applications	1,2,3	Assignment &Quiz
7	3	Stability of Unconstrained bodies, Applications	1,2,3	Assignment &Quiz

8	3	Applications, 1st Semester Exam	1,2,3	Assignment &Quiz
9	3	Scalar &Vector fields flow field description of fluid motion	1,2,3	Assignment &Quiz
10	3	Variation of flow parameters in time and space material & acceleration, Applications	1,2,3	Assignment &Quiz
11	3	Stream line, path lines, one, two and three dimensional flow	1,2,3	Assignment &Quiz
12	3	System, Conservation of mass, Conservation of momentum	1,2,3	Assignment &Quiz
13	3	Applications, 2nd Semester Exam	1,2,3	Assignment &Quiz
14	3	Conservation of energy, Bernoulli's equation, Applications	1,2,3	Assignment &Quiz
15	3	Measurements of flow rate, Applications of equation of motion	1,2,3	Assignment &Quiz

35.Course Evaluation

Monthly Exam: 20 Mark

Quizzes: 10 Mark

Assignment and Other Activities:10 Mark

Final Exam: 60 Mark

36.Learning and Teaching Resources

Required textbooks (curricular books, if any)	• Fluid Mechanics" by Frank M. White. • Engineering Fluid Mechanics" by Clayton T. Crowe, Donald F. Elger, and John A. Roberson. • Fluid Mechanics: Fundamentals and Applications" by Yunus Çengel and John Cimbala. • Introduction to Fluid Mechanics" by Robert W. Fox, Alan T. McDonald, and Philip J. Pritchard

Main references (sources)	• Computational Fluid Dynamics: The Basics with Applications" by John D. Anderson • Fundamentals of Fluid Mechanics" by Bruce A. R. and Richard H. Pletcher
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

37.Course Name:
Fluid Mechanics II
38.Course Code:
CHE 009
39.Semester / Year:
2nd /2024
40.Description Preparation Date:
23/9/2024
41.Available Attendance Forms:
Personal Attendance to give lecture
42.Number of Credit Hours (Total) / Number of Units (Total)
4 ECTS
43.Course administrator's name (mention all, if more than one name)
Name: Ibrshim Khudhur Abduljabbar Email: ibrahin.khadir@uoanbar.edu.iq

44.Course Objectives	
Course Objectives:	• Provide a thorough understanding and practical applications fluid mechanics problems analysis for determinate the solution. • Testing and examine fluid mechanics under different load conditions to find the solution behavior. • Understanding and applying mathematical model for the solution of indeterminate fluid flow problems.
45.Teaching and Learning Strategies	
Strategy	1. Interactive Lectures

- Begin with clear explanations of fundamental concepts in fluid mechanics, such as f properties, fluid statics, and fluid dynamics. Use diagrams, animations, and video illustrate key principles like Bernoulli's equation, continuity, and viscosity. Analo can help clarify complex ideas—for example, comparing fluid flow to the movemer traffic can make concepts more relatable.
- Pose questions throughout your lectures to keep students engaged and assess their understanding. Utilize tools like clickers, quizzes, or polling software to encourage participation. For instance, ask students to predict the outcome of a fluid flow scenario before revealing the answer, fostering critical thinking.
- Relate theoretical concepts to real-world applications in fields like chemical engineering. Discuss how fluid mechanics principles are applied in oil refineries, chemical plants, and wastewater treatment facilities. Highlight specific examples, such as the role of pumps in transport systems or the importance of fluid dynamics in reactor design, to make the content more relatable and practical.

2. Problem-Based Learning (PBL)

- Introduce industry-based case studies where students apply fluid mechanics concepts to solve practical engineering problems. For example, analyze a case study on fluid flow in a pipeline system or the behavior of fluids in a mixing process. This approach encourages critical thinking and collaboration as students work together to develop solutions based on real-world scenarios.
- Use in-class examples to demonstrate how to break down complex fluid mechanics problems systematically. Start by identifying relevant principles, such as the conservation of mass or Bernoulli’s principle. Then, guide students through the application of mathematical formulas step by step, showing them how to approach and solve problems methodically.

3. Use of Visual Aids and Simulations

- Utilize visual aids such as flow diagrams and piping and instrumentation diagrams (P&ID) to help students visualize fluid flow systems and equipment connections. These diagrams can illustrate the layout of pipes, valves, and other components, enhancing students' understanding of how different parts interact within a fluid system.
- Integrate simulation software like ANSYS Fluent, OpenFOAM, or MATLAB into lectures and assignments. These tools allow students to simulate fluid mechanics concepts, such as flow through various geometries or pressure drop calculations in pipes. This hands-on experience helps bridge the gap between theory and practice.
- Use multimedia resources, such as animations and videos, to explain complex fluid mechanics processes, such as turbulent versus laminar flow, or the dynamics of fluid interaction in different scenarios. These visual tools can make abstract concepts more concrete, aiding comprehension and retention.

46. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Principle of physical Similarity	Introduction to Fluid Mechanics	1,2,3	Quiz
2	3	Magnitude of different Forces acting on fluid element	Fluid Properties and Behavior	1,2,3	Quiz
3	3	Dynamics similarity of flow, Applications	Fluid Statics	1,2,3	Assignment &Quiz
4	3	Dimensional Analysis Pi-theorem	Fluid Kinematics	1,2,3	Assignment &Quiz
5	3	Applications and quiz.	Fluid Dynamics	1,2,3	Assignment &Quiz
6	3	Applications, 1st Examination	Viscous Flows and Turbulence	1,2,3	Assignment &Quiz
7	3	Viscous Incompressible flow, Flow between parallel plate, Couette flow.	Compressible Flows and Shock Waves	1,2,3	Assignment &Quiz
8	3	Flow in pipes shear stress, applications.	Multiphase Flows and Transport Phenomena	1,2,3	Assignment &Quiz
9	3	Friction calculation in conduit applications.	Fluid Instability and Transition	1,2,3	Assignment &Quiz
10	3	Applications, 2nd Examination.	Computational Fluid Dynamics (CFD)	1,2,3	Assignment &Quiz
11	3	Pipes network analysis, Pipes in series and in parallel, Applications and quiz.	Hydraulics and Hydrology	1,2,3	Assignment &Quiz

12	3	Applications, Boundary layer concept.	Aerodynamics and Aerospace Engineering	1,2,3	Assignment &Quiz
13	3	Applications,	Chemical Engineering Fluid Mechanics	1,2,3	Assignment &Quiz
14	3	Centrifugal Pump classifications, theory of centrifugal pump, Pump Performance Curves and Net Positive-Suction Head (NPSH).	Biomedical Fluid Mechanics	1,2,3	Assignment &Quiz
15	3	Applications of Centrifugal Pump.	Environmental Fluid Mechanic	1,2,3	Assignment &Quiz

47.Course Evaluation

Monthly Exam: 20 Mark

Quizzes: 10 Mark

Assignment and Other Activities:10 Mark

Final Exam: 60 Mark

48.Learning and Teaching Resources

Required textbooks (curricular books, if any)	• Fluid Mechanics" by Frank M. White. • Engineering Fluid Mechanics" by Clayton T. Crowe, Donald F. Elger, and John A. Roberson. • Fluid Mechanics: Fundamentals and Applications" by Yunus Çengel and John Cimbala. • Introduction to Fluid Mechanics" by Robert W. Fox, Alan T. McDonald, and Philip J. Pritchard
Main references (sources)	• Computational Fluid Dynamics: The Basics with Applications" by John D. Anderson

	• Fundamentals of Fluid Mechanics" by Bruce A. R. and Richard H. Pletcher
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

49.Course Name:
Engineering Materials
50.Course Code:
CHE 1309
51.Semester / Year:
2nd /2024
52.Description Preparation Date:
21/9/2024
53.Available Attendance Forms:
Personal Attendance to give lecture
54.Number of Credit Hours (Total) / Number of Units (Total)
6 ECTS
55.Course administrator's name (mention all, if more than one name)
Name: Omar Mustafa Hussein Email: Moh.jasim @uoanbar.edu.iq
56.Course Objectives

Course Objectives	1. explore the scope of strength of materials and its importance to engineering education. 2. develop a fundamental understanding of the basic principles of strength of materials. 3. develop problem-solving ability based on relevant laws, mathematical equations and graphical relationships.
57.Teaching and Learning Strategies	
Strategy	**1.** Conceptual Understanding through Visual Aids

Diagrams and Animations: Use diagrams, videos, and animations to explain concepts like stress-strain relationships, deformation, and material behavior under different loads.

Real-World Examples: Relate abstract concepts to real-world engineering problems such as bridges, buildings, and aircraft materials.

2. Active Learning Techniques

Problem-Based Learning (PBL): Present students with engineering challenges and encourage them to solve these problems by applying the principles of strength of materials and material properties.

Case Studies: Analyze real engineering failures (e.g., bridge collapses or material failures) to explore the practical importance of these concepts.

3. Hands-On Laboratory Work

Material Testing: Provide opportunities for students to perform tensile tests, compression tests, and hardness tests in the lab to observe material behavior first-hand.

Stress-Strain Experiments: Allow students to measure and plot stress-strain curves for different materials to understand elastic and plastic deformation.

4. Simulation and Software Tools

Finite Element Analysis (FEA): Teach students to use FEA software to simulate material behavior under different loading conditions.

CAD Integration: Use computer-aided design (CAD) software to visualize how materials are used in structures and machines, enhancing their understanding of both the materials and their applications.

5. Collaborative Learning

Group Projects: Assign group projects where students design structures or components, selecting appropriate materials and justifying their choices based on strength and durability.

- Peer Teaching: Encourage students to explain concepts to their peers, fostering collaborative learning and reinforcing their own understanding.

58. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Understand the concepts of stress and strain at a point as well as the stress-strain relationships for homogenous, isotropic materials.	Strength of materials definitions	1,2,3	Quiz

2	3	Understand the concepts of stress and strain at a point as well as the stress-strain relationships for homogenous, isotropic materials.	Simple stress	1,2,3	Quiz
3	3	Understand the concepts of stress and strain at a point as well as the stress-strain relationships for homogenous, isotropic materials.	Shear stress	1,2,3	Assignment &Quiz
4	3	1. Determine the stresses and strains in members subjected to combined loading and apply the theories of failure for static loading.	Stress in cylinders	1,2,3	Assignment &Quiz
5	3	Determine the stresses and strains in members subjected to combined loading and apply the theories of failure for static loading.	Simple strain	1,2,3	Assignment &Quiz
6	3	Determine the stresses and strains in members subjected to combined loading and apply the theories of failure for static loading.	Thermal stress	1,2,3	Assignment &Quiz
7	3	Analyze slender, long columns subjected to axial loads.	Thermal stress	1,2,3	Assignment &Quiz
8	3	Equipment Design and Analysis	deformation in beams	1,2,3	Assignment &Quiz
9	3	Analyze slender, long columns subjected to axial loads.	Equations of stress and momentum in beams	1,2,3	Assignment &Quiz

10	3	Analyze slender, long columns subjected to axial loads.	Equations of stress and momentum in beams	1,2,3	Assignment &Quiz
11	3	Equipment Design and Analysis	Torsion	1,2,3	Assignment &Quiz
12	3	Analyze slender, long columns subjected to axial loads.	Crystalline structure,	1,2,3	Assignment &Quiz
13	3	Analyze slender, long columns subjected to axial loads.	Phase diagram, Alloys of copper, aluminium and iron	1,2,3	Assignment &Quiz
14	3	Analyze slender, long columns subjected to axial loads.	Practical: tests of the resistance of materials to friction, crystalline structure of metals.	1,2,3	Assignment &Quiz
15	3	Final exam		1,2,3	Assignment &Quiz

59.Course Evaluation

Monthly Exam: 20 Mark

Quizzes: 10 Mark

Assignment and Other Activities:10 Mark

Labrotary:10 Mark

Final Exam: 50 Mark

60.Learning and Teaching Resources

Required textbooks (curricular books, if any)	- Mechanics of Materials (Seventh Edition) R.C. Hibbeler.2009
Main references (sources)	- William D. Callister. “Materials Science and Engineering an introduction” John Wiley & Sons, sixth ed.2008
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

61.Course Name:
Reactor Design I
62.Course Code:
CHE
63.Semester / Year:
1st /2024
64.Description Preparation Date:
25/9/2024
65.Available Attendance Forms:
Personal Attendance to give lecture
66.Number of Credit Hours (Total) / Number of Units (Total)
6 ECTS
67.Course administrator's name (mention all, if more than one name)
Name: Badoor Muhsen Kurji Email: bdoorm.kurji@uoanbar.edu.iq
68.Course Objectives

Course Objectives	• Provide the student with principles and kinetic tools useful in analyzing the rates of chemical reactions for homogeneous reactions. • Increase the student's ability to do chemical reactor design by providing the knowledge and tools required to obtain, evaluate, and improve rate equations for use in design, operation and optimization of chemical reactors.

69.Teaching and Learning Strategies	
Strategy	1. Interactive Lectures • Conceptual Explanation: Begin with clear explanations of fundamental concepts using diagrams, videos, and analogies. • Incorporating Questions: Pose questions during lectures to keep students engaged and assess their understanding. Use tools like clicker questions, quizzes. 2. Problem-Based Learning (PBL)

	• Case Studies: Introduce to the type of reactors and knowledge the advantage and disadvantage for each one to solve practical engineering problems. • Step-by-Step Problem Solving: Use in-class examples to demonstrate how to break dov complex reactions.

70. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Define process variables and parameters of chemical reactors	define the chemical reactor as the basic unit of chemical processes, define the process space, system boundaries, and input and output variables of the process , define the basic division and classification of chemical reactors	1, 2	Quiz
2	4	Define process variables and parameters of chemical reactors	Types of reaction, single and multiple reaction , in parallel, series, reversible, and catalytic reactions	1, 2, 3	Quiz
3	4	implement the kinetic models based on the physical picture of the process or conducted kinetic experiment	define the dependence of reaction rate on temperature	1, 2, 3	Assignment &Quiz
4	4	implement the kinetic models based on the physical picture of the process or conducted kinetic experiment	define the dependence of reaction rate on temperature	3, 4, 5	Assignment &Quiz

5	4	implement the kinetic models based on the physical picture of the process or conducted kinetic experiment	Define the integral method of the kinetic model parameters estimation	3, 4, 5	Assignment &Quiz
6	4	. Vary the reaction kinetics in homogeneous systems and apply mathematical numerical and / or analytical methods in estimation of the kinetic model parameters	define the reactor model for batch reactor	3, 4, 5	Assignment &Quiz
7	4	. Vary the reaction kinetics in homogeneous systems and apply mathematical numerical and / or analytical methods in estimation of the kinetic model parameters	define the reactor model for CSTR reactor - define the reactor model for plug-flow reactor	1, 2, 3	Assignment &Quiz
8	4	Set up the mathematical models of the processes with chemical reaction in various types of reactors (kinetic and reactor model) and apply the methodology of chemical engineering when choosing a reactor for the implementation	Single reactor design batch , plug, and mixed flow reactor	1, 2, 3	Assignment &Quiz

		of certain types of reactions			
9	4	Set up the mathematical models of the processes with chemical reaction in various types of reactors (kinetic and reactor model) and apply the methodology of chemical engineering when choosing a reactor for the implementation of certain types of reactions	Select the best reactor that give best conversion	1, 2, 3	Assignment &Quiz
10	4	Set up the mathematical models of the processes with chemical reaction in various types of reactors (kinetic and reactor model) and apply the methodology of chemical engineering when choosing a reactor for the implementation of certain types of reactions	Multiple-Reactor Systems in series and in parallel, choosing same type of reactors	2, 3, 4	Assignment &Quiz
11	4	Apply the acquired knowledge in modeling and design of chemical reactors and apply mathematical	Multiple-Reactor Systems in series and in parallel, choosing different type of reactors, Recycle Reactor	2, 3, 4	Assignment &Quiz

12	4	Apply the acquired knowledge in modeling and design of chemical reactors and apply mathematical	Multiple-Reactor Systems in series and in parallel, choosing different type of reactors, Recycle Reactor	1, 2, 3	Assignment &Quiz
13	4	Apply the acquired knowledge in modeling and design of chemical reactors and apply mathematical	Multiple-Reactor Systems in series and in parallel, choosing shape type of reactors Autocatalytic Reactions	1, 2, 3	Assignment &Quiz
14	4	Apply the acquired knowledge in modeling and design of chemical reactors and apply mathematical	Size Comparison of Single Reactors and multiple reactors	1, 2, 3	Assignment &Quiz
15	4	Final exam		1, 2, 3	Assignment &Quiz

71.Course Evaluation

Monthly Exam: 20 Mark

Quizzes: 10 Mark

Assignment and Other Activities:10 Mark

Final Exam: 60 Mark

72.Learning and Teaching Resources

Required textbooks (curricular books, if any)	Chemical Reaction Engineering
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

73.Course Name:
Technology of catalysis
74.Course Code:
CHE 426
75.Semester / Year:
2nd/2025
76.Description Preparation Date:
19/9/2024
77.Available Attendance Forms:
Personal Attendance to give lecture
78.Number of Credit Hours (Total) / Number of Units (Total)
6 ECTS
79.Course administrator's name (mention all, if more than one name)
Name: Sufyan Fadhil Email:sufyanfadhil@uoanbar.edu.iq
80.Course Objectives

Course Objectives	• To achieve fundamental understanding of the subject of catalysis. • Reactor design with catalyst. • Mass transport limitation due to solid catalyst.

81.Teaching and Learning Strategies	
Strategy	1. Interactive Lectures • Conceptual Explanation: Begin with clear explanations of fundamental concepts (e.g., fluid dynamics, heat transfer, etc.) using diagrams, videos, and analogies. • Incorporating Questions: Pose questions during lectures to keep students engaged and assess their understanding. Use tools like clicker questions, quizzes, or polling software to encourage participation. • Real-Life Examples: Relate theoretical concepts to real-world chemical engineering applications such as oil refineries, chemical plants, and wastewater treatment to make the content more relatable.

	2. Problem-Based Learning (PBL) • Case Studies: Introduce industry-based case studies where students apply unit operation concepts to solve practical engineering problems, encouraging critical thinking and collaboration. • Step-by-Step Problem Solving: Use in-class examples to demonstrate how to break down complex unit operation problems, from identifying relevant principles to applying mathematical formulas. 3. Use of Visual Aids and Simulations • Process Flow Diagrams (PFD): Utilize visual aids such as flow diagrams, piping, and instrumentation diagrams (P&ID) to help students visualize process layouts and equipment connections. • Simulation Software: Integrate software like Aspen Plus, MATLAB, or COMSOL into lectures and assignments to simulate unit operations (e.g., heat exchangers, evaporators), providing hands-on learning experiences. • Animations and Videos: Use multimedia resources to explain complex processes such as heat transfer in exchangers or fluid flow through pipes, which can make abstract concepts more concrete.

82. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	equations in adsorption phenomena.	Introduction to Catalysis,	1,2,3	Quiz
2	3	equations in adsorption phenomena.	Catalyst materials	1,2,3	Quiz
3	3	equations in adsorption phenomena.	Structures of catalytic pellets	1,2,3	Assignment &Quiz
4	3	reaction rate equation in	Kinetics models for	1,2,3	Assignment &Quiz

		heterogeneous systems	heterogeneous reactions		
5	3	equations in adsorption phenomena	Chemical and pysical adsorption	1,2,3	Assignment &Quiz
6	3	equations in adsorption phenomena,	Catalyst characterization	1,2,3	Assignment &Quiz
7	3	reaction rate equation in heterogeneous systems	Rate equation for solid-liquid catalytic reactions	1,2,3	Assignment &Quiz
8	3	reaction rate equation in heterogeneous systems	Rate equation in terns of fluid phase concentration at the catalyst surfac	1,2,3	Assignment &Quiz
9	3	reaction rate equation in heterogeneous systems	Adsorption of inerts	1,2,3	Assignment &Quiz
10	3	reaction rate equation in heterogeneous systems	Problems in catalyst rate equation derivation	1,2,3	Assignment &Quiz
11	3	the significance of the catalysis in reactor	Design equation of reactors for gas-solid reactions	1,2,3	Assignment &Quiz

12	3	the significance of the catalysis in reactor	Packed-bed reactors and fluidized bed reactors	1,2,3	Assignment &Quiz
13	3	the significance of the catalysis in reactor	Catalyst deactivation	1,2,3	Assignment &Quiz
14	3	the significance of the catalysis in reactor	Catalyst preparation	1,2,3	Assignment &Quiz
15	3	Mass transport limitations	**Effectiveness factor and mass transfer limitation**	1,2,3	Assignment &Quiz

83.Course Evaluation
Monthly Exam: 20 Mark Quizzes: 10 Mark Assignment and Other Activities:10 Mark Final Exam: 60 Mark

84.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Elements of chemical reaction engineering By: H. Scott Fogler
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

85.Course Name:
Transport phenomena

86.Course Code:
CHE 423
87.Semester / Year:
1st /2024
88.Description Preparation Date:
19/9/2024
89.Available Attendance Forms:
Personal Attendance to give lecture
90.Number of Credit Hours (Total) / Number of Units (Total)
6 ECTS
91.Course administrator's name (mention all, if more than one name)
Name: Sufyan Fadhil Email:sufyanfadhil@uoanbar.edu.iq

92.Course Objectives

Course Objectives	• To achieve fundamental understanding of the subject of transport phenomena. • Problem Solving using principles of momentum transport, energy transport and mass transport.

93.Teaching and Learning Strategies

Strategy	1. Interactive Lectures • Conceptual Explanation: Begin with clear explanations of fundamental concepts (e.g., fluid dynamics, heat transfer, etc.) using diagrams, videos, and analogies. • Incorporating Questions: Pose questions during lectures to keep students engaged and assess their understanding. Use tools like clicker questions, quizzes, or polling software to encourage participation. • Real-Life Examples: Relate theoretical concepts to real-world chemical engineering applications such as oil refineries, chemical plants, and wastewater treatment to make the content more relatable.

	2. Problem-Based Learning (PBL) • Case Studies: Introduce industry-based case studies where students apply unit operation concepts to solve practical engineering problems, encouraging critical thinking and collaboration. • Step-by-Step Problem Solving: Use in-class examples to demonstrate how to break down complex unit operation problems, from identifying relevant principles to applying mathematical formulas. 3. Use of Visual Aids and Simulations • Process Flow Diagrams (PFD): Utilize visual aids such as flow diagrams, piping, and instrumentation diagrams (P&ID) to help students visualize process layouts and equipment connections. • Simulation Software: Integrate software like Aspen Plus, MATLAB, or COMSOL into lectures and assignments to simulate unit operations (e.g., heat exchangers, evaporators), providing hands-on learning experiences. • Animations and Videos: Use multimedia resources to explain complex processes such as heat transfer in exchangers or fluid flow through pipes, which can make abstract concepts more concrete.

94. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Understanding of Core Concepts	**Introduction of transport phenomena, Newton's law of viscosity, Molecular Theory**	1,2,3	Quiz
2	3	Application of Transport Phenomena	**Shell momentum Balance and boundary conditions**	1,2,3	Quiz
3	3	formulate and solve problems in fluid,	**Flow through an annulus**	1,2,3	Assignment &Quiz
4	3	can formulate and solve problems in fluid,	**Equation of continuity , equation of motion**	1,2,3	Assignment &Quiz
5	3	can formulate and solve	**Use of the equation of**	1,2,3	Assignment &Quiz

		problems in fluid,	**change to solve flow problems**		
6	3	can formulate and solve problems in fluid,	**flow through two adjacent immiscible fluids**	1,2,3	Assignment &Quiz
7	3	can formulate and solve problems in energy	**Fourier's law of heat conduction, shell energy balance**	1,2,3	Assignment &Quiz
8	3	can formulate and solve problems in energy	**Heat conduction with electrical source, heat conduction with a nuclear heat source,**	1,2,3	Assignment &Quiz
9	3	can formulate and solve problems in energy	**Energy equation , special forms of the equations of change**	1,2,3	Assignment &Quiz
10	3	can formulate and solve problems in mass	**Fick's law of binary diffusion**	1,2,3	Assignment &Quiz
11	3	formulate and solve problems in mass	**Shell mass balance, boundary conditions**	1,2,3	Assignment &Quiz
12	3	formulate and solve problems in mass	**diffusion through a stagnant gas film**	1,2,3	Assignment &Quiz
13	3	formulate and solve problems in mass	**Diffusion into a falling liquid film**	1,2,3	Assignment &Quiz
14	3	formulate and solve problems in mass	**Equation of continuity for multicomponent mixture**	1,2,3	Assignment &Quiz
15	3	Final exam		1,2,3	Assignment &Quiz

95.Course Evaluation

Monthly Exam: 20 Mark

Quizzes: 10 Mark

Assignment and Other Activities:10 Mark Final Exam: 60 Mark

96.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	**Transport phenomena R. Byron Bird**
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

97.Course Name:
Unit Operation I
98.Course Code:
CHE 014
99.Semester / Year:
1st /2024
100. Description Preparation Date:
19/9/2024
101. Available Attendance Forms:
Personal Attendance to give lecture
102. Number of Credit Hours (Total) / Number of Units (Total)
6 ECTS
103. Course administrator's name (mention all, if more than one name)
Name: Omar Mustafa Hussein Email: omalkuba@uoanbar.edu.iq

104. Course Objectives	
Course Objectives	• Understanding Fundamental Concept • Design and Operation of Equipment • Problem Solving in Process Engineering:
105. Teaching and Learning Strategies	

Strategy	1. Interactive Lectures • Conceptual Explanation: Begin with clear explanations of fundamental concepts (e.g., fluid dynamics, heat transfer, etc.) using diagrams, videos, and analogies. • Incorporating Questions: Pose questions during lectures to keep students engaged and assess their understanding. Use tools like clicker questions, quizzes, or polling software to encourage participation. • Real-Life Examples: Relate theoretical concepts to real-world chemical engineering applications such as oil refineries, chemical plants, and wastewater treatment to make the content more relatable. 2. Problem-Based Learning (PBL) • Case Studies: Introduce industry-based case studies where students apply unit operation concepts to solve practical engineering problems, encouraging critical thinking and collaboration. • Step-by-Step Problem Solving: Use in-class examples to demonstrate how to break down complex unit operation problems, from identifying relevant principles to applying mathematical formulas. 3. Use of Visual Aids and Simulations • Process Flow Diagrams (PFD): Utilize visual aids such as flow diagrams, piping, and instrumentation diagrams (P&ID) to help students visualize process layouts and equipment connections. • Simulation Software: Integrate software like Aspen Plus, MATLAB, or COMSOL into lectures and assignments to simulate unit operations (e.g., heat exchangers, evaporators), providing hands-on learning experiences. • Animations and Videos: Use multimedia resources to explain complex processes such as heat transfer in exchangers or fluid flow through pipes, which can make abstract concepts more concrete.

106. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Understanding of Core Concepts	Introduction to Unit Operations; Equilibrium stage operations	1,2,3	Quiz
2	3	Application of Transport Phenomena	Thermodynamics of distillation	1,2,3	Quiz

3	3	Equipment Design and Analysis	Binary distillations review	1,2,3	Assignment &Quiz
4	3	Equipment Design and Analysis	Distillation Methods	1,2,3	Assignment &Quiz
5	3	Equipment Design and Analysis	Distillation Methods	1,2,3	Assignment &Quiz
6	3	Equipment Design and Analysis	Distillation Methods	1,2,3	Assignment &Quiz
7	3	Equipment Design and Analysis	Distillation Methods	1,2,3	Assignment &Quiz
8	3	Equipment Design and Analysis	Packed bed columns	1,2,3	Assignment &Quiz
9	3	Equipment Design and Analysis	Principles of humidification	1,2,3	Assignment &Quiz
10	3	Equipment Design and Analysis	Methods of humidification	1,2,3	Assignment &Quiz
11	3	Equipment Design and Analysis	Principles of drying	1,2,3	Assignment &Quiz
12	3	Equipment Design and Analysis	Principles of drying	1,2,3	Assignment &Quiz
13	3	Equipment Design and Analysis	Principles of adsorption	1,2,3	Assignment &Quiz
14	3	Equipment Design and Analysis	Methods of adsorption	1,2,3	Assignment &Quiz
15	3	Final exam		1,2,3	Assignment &Quiz

107. Course Evaluation

Monthly Exam: 20 Mark

Quizzes: 10 Mark

Assignment and Other Activities:10 Mark Final Exam: 60 Mark

108. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Unit Operation for Chemical Engineering
Main references (sources)	Principles of Unit Operation
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

109. Course Name:
Organic Chemistry
110. Course Code:
CHE 008
111. Semester / Year:
1st /2024
112. Description Preparation Date:
19/9/2024
113. Available Attendance Forms:
Personal Attendance to give lecture
114. Number of Credit Hours (Total) / Number of Units (Total)
3 ECTS
115. Course administrator's name (mention all, if more than one name)
Name: Abbas Hasan Faris Email: abbashasan@uoanbar.edu.iq
116. Course Objectives

Course Objectives	- explore the scope of organic chemistry and its importance to chemical engineering education. - Provide a thorough understanding and principles of organic chemistry.

	- Provide a thorough understanding practical applications of chemical and chemical properties

117. Teaching and Learning Strategies

Strategy	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students.

118. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Able to differentiate between different types of organic materials and structures.	Introduction & Classification Organic Chemistry.	1,2,3	Quiz
2	2	Able to differentiate between different types of organic materials and structures.	names of organic compounds.	1,2,3	Quiz
3	2	Able to differentiate between different types of organic materials and structures.	Aliphatic compounds.	1,2,3	Assignment &Quiz
4	2	Able to relate materials properties and performance to the structure.	alkyl halides properties, preparation and reactions.	1,2,3	Assignment &Quiz

5	2	Able to demonstrate knowledge about Bonding and isomerism. Alkanes and cycloalkanes. Alkenes and alkynes.	Alkanes and cycloalkanes	1,2,3	Assignment &Quiz
6	2	Able to demonstrate knowledge about Bonding and isomerism. Alkanes and cycloalkanes. Alkenes and alkynes.	Alkanes and cycloalkanes	1,2,3	Assignment &Quiz
7	2	Able to demonstrate knowledge about Bonding and isomerism. Alkanes and cycloalkanes. Alkenes and alkynes.	Alkenes	1,2,3	Assignment &Quiz
8	2	Able to demonstrate knowledge about Bonding and isomerism. Alkanes and cycloalkanes. Alkenes and alkynes.	Alkynes	1,2,3	Assignment &Quiz
9	2	Able to relate materials properties and performance to the structure.	Aromatic compounds	1,2,3	Assignment &Quiz

10	2	Able to relate materials properties and performance to the structure.	Alcohols	1,2,3	Assignment &Quiz
11	2	Able to relate materials properties and performance to the structure.	Ethers and epoxies	1,2,3	Assignment &Quiz
12	2	Able to relate materials properties and performance to the structure.	Amines	1,2,3	Assignment &Quiz
13	2	Able to relate materials properties and performance to the structure.	Aldehydes and ketones.	1,2,3	Assignment &Quiz
14	2	Able to relate materials properties and performance to the structure.	Carboxylic acids and their derivatives	1,2,3	Assignment &Quiz
15	2	Final exam		1,2,3	Assignment &Quiz

119. Course Evaluation

Monthly Exam: 20 Mark

Quizzes: 10 Mark

Assignment and Other Activities:10 Mark Final Exam: 60 Mark	
120. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Morrison, R. Thornton; Boyd, R. Neilson "Orga Chemistry" 6th edition, 2001.
Main references (sources)	
Recommended books and references (scientific journals, reports...)	William H. Brown, Introduction to Organic Chemis Second Edition, John Wiley and Sons, INC., U. S 2002.
Electronic References, Websites	Chemistry 3 by Andrew Burrows: 2nd edition

Course Description Form

121. Course Name:
Water Treatment
122. Course Code:
CHE 3321
123. Semester / Year:
1st /2024
124. Description Preparation Date:
19/9/2024
125. Available Attendance Forms:
Personal Attendance to give lecture
126. Number of Credit Hours (Total) / Number of Units (Total)
4 ECTS
127. Course administrator's name (mention all, if more than one name)
Name: Abbas Hasan Faris Email: abbashasan@uoanbar.edu.iq

128. Course Objectives	
Course Objectives	• Scientific reasoning for how to protect water quality • The theory and conceptual design • Physical, chemical, and biological processes:
129. Teaching and Learning Strategies	

Strategy	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students.

130. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	An ability to apply knowledge of mathematics, science, and engineering	Introduction to Water Supply and Wastewater	1,2,3	Quiz
2	2	An ability to apply knowledge of mathematics, science, and engineering	Why Treat Water and Wastewater?	1,2,3	Quiz
3	2	An ability to apply knowledge of mathematics, science, and engineering	Water Quality Parameters.	1,2,3	Assignment &Quiz
4	2	An ability to apply knowledge of mathematics, science, and engineering	Aerobic and Anaerobic Decomposition	1,2,3	Assignment &Quiz
5	2	An ability to design a system component or process	Effect of Pollution on Stream	1,2,3	Assignment &Quiz

6	2	An ability to design a system component or process	Sedimentation-Flocculation; Filtration; Chemical Treatment	1,2,3	Assignment &Quiz
7	2	An ability to design a system component or process	Effect of Pollution on Groundwater	1,2,3	Assignment &Quiz
8	2	An ability to identify, formulate and solve engineering problems	Measurement of Water Quality	1,2,3	Assignment &Quiz
9	2	An ability to design a system component or process	SETTLING	1,2,3	Assignment &Quiz
10	2	An ability to design a system component or process	Primary conditions in filter design	1,2,3	Assignment &Quiz
11	2	An ability to design a system component or process	Solid Analysis	1,2,3	Assignment &Quiz
12	2	An ability to design a system component or process	Properties and Contamination of Water	1,2,3	Assignment &Quiz
13	2	An ability to design a system component or process	Sedimentation Tank	1,2,3	Assignment &Quiz
14	2	An ability to design a system component or process	Reactor Tanks - Mixed Tanks, First-order Kinetics, Plug Flow.	1,2,3	Assignment &Quiz

15	2	Final exam		1,2,3	Assignment &Quiz

131. Course Evaluation
Monthly Exam: 20 Mark Quizzes: 10 Mark Assignment and Other Activities:10 Mark Final Exam: 60 Mark

132. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Water Treatment: Principles and Design, MWH Staff. 2nd ed. New York, NY: Wiley, 2005. ISBN
Main references (sources)	
Recommended books and references (scientific journals, reports...)	Quantitative Chemical Analysis, Daniel C. Harris, W. H. Freeman and Co., 9th edition, ISBN 978-1-4641-3538-5
Electronic References, Websites	

Course Description Form

133. Course Name:
Environment Engineering
134. Course Code:
CHE 020
135. Semester / Year:
1st /2024
136. Description Preparation Date:
19/9/2024
137. Available Attendance Forms:
Personal Attendance to give lecture
138. Number of Credit Hours (Total) / Number of Units (Total)
4 ECTS
139. Course administrator's name (mention all, if more than one name)

Name: Abbas Hasan Faris

Email: abbashasan@uoanbar.edu.iq

140. Course Objectives

Course Objectives	• Scientific reasoning for how to protect water quality • The theory and conceptual design • Physical, chemical, and biological processes:

141. Teaching and Learning Strategies

Strategy	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students.

142. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	An ability to apply knowledge of mathematics, science, and engineering	Introduction to Water Supply and Wastewater	1,2,3	Quiz
2	2	An ability to apply knowledge of mathematics, science, and engineering	Why Treat Water and Wastewater?	1,2,3	Quiz
3	2	An ability to apply knowledge of mathematics, science, and engineering	Water Quality Parameters.	1,2,3	Assignment &Quiz

4	2	An ability to apply knowledge of mathematics, science, and engineering	Aerobic and Anaerobic Decomposition	1,2,3	Assignment &Quiz
5	2	An ability to design a system component or process	Effect of Pollution on Stream	1,2,3	Assignment &Quiz
6	2	An ability to design a system component or process	Sedimentation-Flocculation; Filtration; Chemical Treatment	1,2,3	Assignment &Quiz
7	2	An ability to design a system component or process	Effect of Pollution on Groundwater	1,2,3	Assignment &Quiz
8	2	An ability to identify, formulate and solve engineering problems	Air pollution.	1,2,3	Assignment &Quiz
9	2	An ability to design a system	Soil pollution	1,2,3	Assignment &Quiz
10	2	An ability to design a system component or process	Radioactive Contamination	1,2,3	Assignment &Quiz
11	2	An ability to design a system component or process	Climate change	1,2,3	Assignment &Quiz
12	2	An ability to design a system component or process	Greenhouse gases	1,2,3	Assignment &Quiz

13	2	An ability to design a system component or process	Air Pollution	1,2,3	Assignment &Quiz
14	2	An ability to design a system component or process	Air pollution control equipment	1,2,3	Assignment &Quiz
15	2	Final exam		1,2,3	Assignment &Quiz

143. Course Evaluation

Monthly Exam: 20 Mark

Quizzes: 10 Mark

Assignment and Other Activities:10 Mark

Final Exam: 60 Mark

144. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Environmental Engineering, Ruth F. Weiner a Robin Matthews
Main references (sources)	
Recommended books and references (scientific journals, reports...)	Fundamental of Wastewater Treatment a Engineering, Rumana Riffat
Electronic References, Websites	

Course Description Form

145. Course Name:

Heat Transfer - I

146. Course Code:

CHE

147. Semester / Year:

1st /2024

148. Description Preparation Date:

19/9/2024

149. Available Attendance Forms:

Personal Attendance to give lecture

150. Number of Credit Hours (Total) / Number of Units (Total)

4

151. Course administrator's name (mention all, if more than one name)

Name: Dr. Mustafa B. Al-hadithi

Email: mustafaalhadithi@uoanbar.edu.iq

152. Course Objectives

Course Objectives	• Understanding Fundamental Concept of heat transfer • The concept of overall heat transfer coefficient with the temperature profile is also discussed in detail • Problem Solving and investigation in application the modes of heat transfer problems.

153. Teaching and Learning Strategies

Strategy

1. Interactive Lectures

- Conceptual Explanation: Begin with clear explanations of fundamental concepts (e.g., fluid dynamics, mathematics, etc.) using diagrams, videos, and analogies.
- Incorporating Questions: Pose questions during lectures to keep students engaged and assess their understanding. Use tools like clicker questions, quizzes, or polling software to encourage participation.
- Real-Life Examples: Relate theoretical concepts to real-world chemical engineering applications such as heat exchanger, boilers, and boiling and condensation to make the content more relatable.

2. Problem-Based Learning (PBL)

- Case Studies: Introduce industry-based case studies where students apply a heat transfer concepts to solve practical engineering problems, encouraging critical thinking and collaboration.
- Step-by-Step Problem Solving: Use in-class examples to demonstrate how to break down any heat transfer problems, from identifying relevant principles to applying mathematical formulas (Fourier's law, Newton's law of cooling) .

154. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Understanding of Core Concepts	Rate equations: conduction, convection, and radiation.	1,2	Quiz

2	4	The student should learn to evaluate the heat flow through a 1-D, SS system with no heat sources for rectangular and cylindrical geometries.	Heat diffusion equation, boundary and initial conditions, One dimensional steady state conduction	1,2	Quiz
3	4	The student should learn to evaluate Composite thermal resistances for 1-D, Steady state heat transfer with no heat sources	Heat transfer through composite walls for different shape	1,2	Assignment &Quiz
4	4	Steady state heat transfer with heat sources placed in parallel or in series may be evaluated in a manner similar to electrical resistances placed in parallel or in series.	Critical thickness of insulation for cylinder and sphere	1,2	Assignment &Quiz
5	4	All previous Required LOC be applied in this week	Applications	1,2	Assignment &Quiz
6	4	Students should be able to write boundary conditions for (a) very long fins, (b) insulated tip fins, (c) convective tip fins and (d) fins with a specified tip temperature.	Steady state heat conduction through fins of uniform cross section.	1,2	Assignment &Quiz
7	4	Students should be able to apply the temperature profile to the Fourier Law to obtain a heat flow through the fin.	fin effectiveness and fin efficiency	1,2	Assignment &Quiz
8	4	The student should appreciate the inherent nature of the *discretization process*, and know how to formulate the finite difference equations for the discrete points of a nodal network.	Applications, Two-dimensional steady state conduction, analytical solution	1,2	Assignment &Quiz
9	4	Although one may find it convenient to solve these equations using hand calculations for a coarse mesh, one should be able to treat fine meshes using standard computer algorithms involving direct or iterative techniques	Finite difference method: explicit and implicit formulation, applications.	1,2	Assignment &Quiz
10	4	should be able to known the temperature profile in any solid geometry from using Hesleer chart	Transient conduction in solids with negligible internal temperature gradients, Biot number and Fourier number.	1,2	Assignment &Quiz
11	4	The student must be able to perform engineering calculations that involve an energy balance and appropriate convection correlations	Flow over a body, velocity and thermal boundary layers, drag-co-efficient and heat transfer coefficient	1,2	Assignment &Quiz

12	4	The student must be able to perform the methodology involves determining whether the flow is laminar or turbulent and establishing the length of the entry region.	Flow inside a duct; hydrodynamics and thermal entry lengths;	1,2	Assignment &Quiz
13	4	The student must be able to perform after deciding whether one is interested in local conditions (at a particular axial location) or in average conditions (for the entire tube), the convection correlation may be selected and used with the appropriate form of the energy balance to solve the problem.	fully developed and developing flow with thermal analysis heat transfer.	1,2	Assignment &Quiz
14	4	The student must be able to perform the free convection correlation may be selected and used with the appropriate form of the energy balance to solve the free convection heat transfer problem	Free convection heat transfer from vertical surface and vertical cylinder, horizontal surface and horizontal cylinders.	1,2	Assignment &Quiz
15	4	Final exam		1,2	

155. Course Evaluation

Monthly Exam: 20 Mark

Quizzes: 10 Mark

Assignment and Other Activities:10 Mark

Final Exam: 40 Mark

156. Learning and Teaching Resources

Required textbooks (curricular books, if a	Heat transfer by Holman 10th ed.
Main references (sources)	1- Heat and mass transfer by Rajput 2- Heat and mass transfer Fundamentals a Applications, by Yunus Cegel and J. Ghajar 6th
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

157. Course Name:

Heat Transfer - II

158. Course Code:

CHE

159. Semester / Year:
2nd /2024
160. Description Preparation Date:
24/9/2024
161. Available Attendance Forms:
Personal Attendance to give lecture
162. Number of Credit Hours (Total) / Number of Units (Total)
3
163. Course administrator's name (mention all, if more than one name)
Name: Dr. Mustafa B. Al-hadithi Email: mustafaalhadithi@uoanbar.edu.iq *

164. Course Objectives	
Course Objectives	• The course material on Heat Transfer is designed for the undergraduate students of Chemical and petrochemical Engineering. • The course provides an elementary knowledge of the heat Exchanger design problem. • The course is primarily developed for the students those who need the these knowledge in the heat transfer operations and design the heating equipment.

165. Teaching and Learning Strategies	
Strategy	1. Interactive Lectures • Conceptual Explanation: Begin with clear explanations of fundamental concepts (e.g., fluid dynamics, mathematics, etc.) using diagrams, videos, and analogies. • Incorporating Questions: Pose questions during lectures to keep students engaged and assess their understanding. Use tools like clicker questions, quizzes, or polling software to encourage participation. • Real-Life Examples: Relate theoretical concepts to real-world chemical engineering applications such as heat exchanger, boilers, and boiling and condensation to make the content more relatable. 2. Problem-Based Learning (PBL) • Case Studies: Introduce industry-based case studies where students apply a heat transfer concepts to solve practical engineering problems, encouraging critical thinking and collaboration.

	• Step-by-Step Problem Solving: Use in-class examples to demonstrate how to break down any heat transfer problems, from identifying relevant principles to applying mathematical formulas (Fourier's law, Newton's law of cooling) .

166. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	The student should learn to evaluate the most common applications of heat transfer is to design equipment for exchanging heat from one fluid to another. Such devices are generally called Heat Exchangers.	Heat exchanger types and flow arrangement, Overall heat transfer coefficient,	1,2	Quiz
2	4	The student should learn to evaluate the most common applications of heat transfer is to design equipment for exchanging heat from one fluid to another. Such devices are generally called Heat Exchangers. Because there are many important applications, heat exchanger research and development has had a long history.	fouling factor and LMTD for parallel flow and counter flow.	1,2	Quiz
3	4	The student should learn to evaluate ways of improving deign and performance.	effectiveness-NTU method, parallel and counter flow heat exchanger, Heat exchanger design and multi-pass cross flow.	1,2	Assignment &Quiz
4	4	The focus is on convection processes associated with the change in phase of a fluid, particularly those	Different regimes of boiling and mechanism of condensation. The boiling curve	1,2	Assignment &Quiz

		processes that can occur at a solid-liquid interface, namely, boiling and condensation.			
5	4	The student should learn to evaluate phase change, heat transfer to and from the fluid can occur without influencing the fluid temperature. differences.	Condensation heat transfer phenomena,	1,2	Assignment &Quiz
6	4	Students should be able to write Hence, in boiling and condensation, large heat transfer rates may be achieved with small temperature	Film condensation inside horizontal tube..	1,2	Assignment &Quiz
7	4		Problem solution and quiz	1,2	Assignment &Quiz
8	4	Students should be able to apply the radiation heat transfer, Definitions, concept of a black body, Kirchoff's law, Lambert's Cosine Law	Definitions, concept of a black body, Kirchoff's law,	1,2	Assignment &Quiz
9	4	The student should appreciate Stefan-Boltzman's law, Plank's distribution law, Wein's displacement law and configuration factor	Lambert's Cosine Law, Stefan-Boltzman's law	1,2	Assignment &Quiz
10	4	Students should be able to apply the radiation heat transfer laws in analyses design problems	Radiation heat exchange between two parallel plates..	1,2	Assignment &Quiz
11	4	Students should be able to apply the radiation heat transfer laws in	Shielding, radiation heat exchange in an enclosure.	1,2	Assignment &Quiz

		analyses design problems			
12	4		Problem solution and quiz	1,2	Assignment &Quiz
13	4	The student must be able to perform engineering concept of solar energy	Concept of solar energy.	1,2	Assignment &Quiz
14	4	The student must be able to perform the methodology involves determining conditions of renewable energy regime	Methods used in renewable energy uses.	1,2	Assignment &Quiz
15	4	Final exam		1,2	

167. Course Evaluation
Monthly Exam: 20 Mark Quizzes: 10 Mark Assignment and Other Activities:10 Mark Final Exam: 40 Mark

168. Learning and Teaching Resources	
Required textbooks (curricular books, if a	Heat transfer by Holman 10th ed.
Main references (sources)	3- Heat and mass transfer by Rajput 4- Heat and mass transfer Fundamentals a Applications, by Yunus Cegel and J. Ghajar 6th
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

1. Course Name:
ENGLISH LANGUAGE III
2. Course Code:
CHE3106
3. Semester / Year:
1st /2024
4. Description Preparation Date:

19/9/2024

5. Available Attendance Forms:

Personal Attendance to give lecture

6. Number of Credit Hours (Total) / Number of Units (Total)

3

7. Course administrator's name (mention all, if more than one name)

Name: Dr. Khaled J Hamid

Email: Khaled.j.h@uoanbar.edu.iq

8. Course Objectives

Course Objectives	This course emphasizes the fundamental language skills of reading, writing, speaking, listening, thinking, viewing and presenting. An emphasis on vocabulary and composition skills will be an on-going part of the program. Its main aim is to continue in student´s actual language skills, improve them and extend basic vocabulary so that he or she would be able to understand a simple text and to communicate and study in an English.

9. Teaching and Learning Strategies

Strategy	By the end of successful completion of this course, the student will be able to: 1. Expand targeted vocabulary assigned from intermediate level textbooks. 2. improve vocabulary quiz- and test-taking ability. 3. Identify topic sentences and main ideas; discern major from minor details in intermediate textbooks. 4. Be able to identify the setting, main events, climax and resolution of readers at the intermediate level and summarize the novel in writing. 5. Respond thoughtfully, verbally and in speaking and writing, to intermediate level texts by drawing connections between personal experiences and/or world knowledge to the assigned text.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Understand different spoken English accents and dialects.	It's wonderful, types of auxiliary verb.	1,2	Quiz
2	4	Recognize the main ideas and supporting details in spoken texts.	It's wonderful, types of auxiliary verb.	1,2	Quiz

3	4	Understand and follow instructions and directions given in spoken English.	Get happy, present tense.	1,2	Assignment &Quiz
4	4	Express thoughts, opinions, and ideas clearly and confidently.	Get happy, present tense.	1,2	Assignment &Quiz
5	4	Pronounce words correctly and use appropriate intonation.	Telling tales, past tense.	1,2	Assignment &Quiz
6	4	Participate in conversations, ask questions, and respond to others.	Telling tales, past tense.	1,2	Assignment &Quiz
7	4	Understand different types of written texts, including fiction, non-fiction, and functional texts.	Progressive Exam-1	1,2	Assignment &Quiz
8	4	Recognize the main ideas and supporting details in written texts.	Doing the right thing, modal verbs.	1,2	Assignment &Quiz
9	4	Analyze and interpret written texts, identifying the author's purpose, tone, and point of view.	Doing the right thing, modal verbs.	1,2	Assignment &Quiz
10	4	Produce written texts that are clear, coherent, and well-structured.	Progressive Exam-2	1,2	Assignment &Quiz
11	4	Use correct grammar, vocabulary, and punctuation in written texts.	On the move, future forms.	1,2	Assignment &Quiz
12	4	Write texts for different purposes and audiences, using appropriate tone, style, and language.	On the move, future forms.	1,2	Assignment &Quiz
13	4	Use correct grammar and sentence structure in spoken and written English.	I just love it, questions with like.	1,2	Assignment &Quiz
14	4	Learn and use new vocabulary in context.	The world of work, present perfect.	1,2	Assignment &Quiz
15	4	Understand and use idiomatic expressions and phrasal verbs.	Practical session (speaking)	1,2	

11.Course Evaluation

Monthly Exam: 20 Mark

Quizzes: 10 Mark

Assignment and Other Activities:10 Mark

Final Exam: 40 Mark

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	

Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

169. Course Name:	
Mass Transfer	
170. Course Code:	
171. Semester / Year:	
1st /2024	
172. Description Preparation Date:	
19/9/2024	
173. Available Attendance Forms:	
Personal Attendance to give lecture	
174. Number of Credit Hours (Total) / Number of Units (Total)	
3	
175. Course administrator's name (mention all, if more than one name)	
Name: Bdoor M. Kurji Email: Bdoorm.kurji@uonbar.edu.iq	
176. Course Objectives	
Course Objectives	Upon successful completion of the course, you will be able to: 1. Understanding Fundamental Principles: To provide students with a solid understanding of the fundamental principles governing mass transfer phenomena, including diffusion, convection, and mass transfer with chemical reactions. 2. Application of Mass Transfer Concepts: To enable students to apply mass transfer concepts to solve engineering problems in various fields such as chemical processing, environmental engineering, and biotechnology. 3. Problem-Solving Skills: To enhance students' problem-solving skills by applying mathematical and theoretical concepts to practical mass transfer problems encountered in industry.
177. Teaching and Learning Strategies	
Strategy	By the end of successful completion of this course, the student will be able to: 1. Describe the fundamental principles of mass transfer, including diffusion, convection,

	and mass transfer with chemical reactions. 2. Apply mathematical models to analyze mass transfer phenomena in various engineering applications, such as distillation, absorption, and membrane processes. 3. Calculate mass transfer coefficients using appropriate correlations and dimensionless groups, and interpret their significance in different mass transfer scenarios.

178. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Understand the concept of mass transfer and its importance in various engineering fields.	Introduction to Mass Transfer	1,2	Quiz
2	4	Describe the different mechanisms of mass transfer, including diffusion, convection, and dispersion.	Overview of mass transfer processes Importance and applications of mass transfer in engineering Basic concepts: concentration, diffusion, flux, and driving force	1,2	Quiz
3	4	Recognize the key variables that affect mass transfer, such as concentration, temperature, pressure, and flow rate.	Diffusion Molecular diffusion and Fick's laws	1,2	Assignment &Quiz
4	4	Understand and apply Fick's Law to calculate diffusion rates and concentrations.	Diffusion in gases, liquids, and solids	1,2	Assignment &Quiz
5	4	Explain the concept of convective mass transfer and calculate convective mass transfer coefficients.	Diffusion coefficient and concentration profiles Steady-state and unsteady-state diffusion	1,2	Assignment &Quiz
6	4	Identify and analyze the different resistances to mass transfer, including boundary layer resistance and surface resistance.	Introduction: Convective Mass Transfer	1,2	Assignment &Quiz
7	4	Design and analyze equipment such as absorbers, strippers, and extractors.	Convective mass transfer coefficients	1,2	Assignment &Quiz

8	4	Calculate mass transfer rates and efficiencies for various mass transfer operations.	Boundary layer theory Mass transfer correlations	1,2	Assignment &Quiz
9	4	Optimize mass transfer processes to achieve desired outcomes, such as maximizing separation efficiency or minimizing energy consumption.	Dimensionless groups: Reynolds, Schmidt, Sherwood	1,2	Assignment &Quiz
10	4	Apply mass transfer principles to solve real-world problems in fields such as chemical engineering, environmental engineering, and biomedical engineering.	Mass Transfer with Chemical Reaction	1,2	Assignment &Quiz
11	4	Analyze case studies of mass transfer applications and identify key factors that affect mass transfer rates and efficiencies.	Absorption and adsorption	1,2	Assignment &Quiz
12	4	Design and propose mass transfer solutions for specific industrial or environmental problems.	Mass transfer coupled with chemical reactions	1,2	Assignment &Quiz
13	4	Critically evaluate mass transfer data and identify potential sources of error or uncertainty.	Rate equations for mass transfer with reaction	1,2	Assignment &Quiz
14	4	Develop and solve mass transfer models to predict mass transfer rates and efficiencies.	Mass Transfer Equipment Design	1,2	Assignment &Quiz
15	4	Troubleshoot mass transfer problems and identify potential solutions.	Design principles for mass transfer equipment	1,2	

179. Course Evaluation

Monthly Exam: 20 Mark

Quizzes: 10 Mark

Assignment and Other Activities:10 Mark

Final Exam: 40 Mark	
180. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

181. Course Name:	
Modeling and Simulation	
182. Course Code:	
183. Semester / Year:	
1st /2024	
184. Description Preparation Date:	
19/9/2024	
185. Available Attendance Forms:	
Personal Attendance to give lecture	
186. Number of Credit Hours (Total) / Number of Units (Total)	
3	
187. Course administrator's name (mention all, if more than one name)	
Name: Bdoor M. Kurji Email: Bdoorm.kurji@uonbar.edu.iq	
188. Course Objectives	
Course Objectives	1. Understand the practical concepts of soil behavior and their interaction with water and structures. 2. Apply the knowledge of soil properties and basic mechanics to analyze and design foundations and earth structures that are related to Dams and Water Resources Engineering program.
189. Teaching and Learning Strategies	
Strategy	Upon completion of this course students will be able to 1. learn basic definitions and fundamental principles related to process modelling and simulation and understand different types of models and their hierarchy as well as the

	general steps followed in developing a process model. 2. Develop appropriate mathematical models of varying complexities for different chemical engineering systems. and learn about the commonly available mathematical tools and techniques as used in the simulation of developed models. 3. Simulate a process using process simulators (ASPEN Plus/ ASPEN Hysys)

190. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Understand the concepts of modeling and simulation, and their importance in various fields.	**Concept and Overview and introduction to corrosion**	1,2	Quiz
2	4	Describe the steps involved in the modeling process, including problem definition, model formulation, and model validation.	**Basic concepts: electrode potentials, corrosion cells and thermodynamics**	1,2	Quiz
3	4	Recognize different types of models, such as mathematical, statistical, and computational models.	half cell reactions, anode, cathode, Faraday's law, units, 8 forms of corrosion	1,2	Assignment &Quiz
4	4	Use mathematical techniques, such as differential equations and linear algebra, to model real-world systems.	electrolytes, interfaces, double layer, electrode potential, reference electrodes. Measurements	1,2	Assignment &Quiz
5	4	Apply statistical techniques, such as regression and time series analysis, to model data and make predictions.	thermodynamics review, free energy, Gibbs' energy, chemical potential, Nernst equation	1,2	Assignment &Quiz
6	4	Use computational tools, such as simulation software and programming	Pourbaix diagram calculations, water, metals with water, alloy examples, limitations with corrosion	1,2	Assignment &Quiz

		languages, to model complex systems.			
7	4	Design and conduct simulation experiments to analyze and optimize system performance.	**Progress Exam 1**	1,2	Assignment &Quiz
8	4	Apply simulation software, such as Simulink or Arena, to model and analyze complex systems.	kinetics, weight change, measurement methods, polarization, anodic / cathodic protection	1,2	Assignment &Quiz
9	4	Analyze and interpret simulation results, including data visualization and statistical analysis.	passivity, theories, surface analysis, effects of alloying elements	1,2	Assignment &Quiz
10	4	Use modeling and simulation to solve real-world problems in fields such as engineering, economics, and healthcare.	thermodynamics of corrosion, electrochemical cells, galvanic corrosion, (fuel cells and batteries)	1,2	Assignment &Quiz
11	4	Assess the effectiveness of models and simulations in predicting system behavior and making decisions.	inhibitors, acids, neutral solutions	1,2	Assignment &Quiz
12	4	Assess the effectiveness of models and simulations in predicting system behavior and making decisions.	crevices, pitting, occluded cells and mechanical aspects, stress corrosion cracking forms,	1,2	Assignment &Quiz
13	4	Critically evaluate models and simulations, including their assumptions, limitations, and uncertainties.	forms of corrosion (carburization, nitridation, HTHA, oxidation, sulfidation, molten salts, molten phases, halogens, mixed mode)	1,2	Assignment &Quiz
14	4	Develop and solve complex modeling and simulation problems,	**Progress Exam 2**	1,2	Assignment &Quiz

		including those with multiple variables and uncertainties.			
15	4	Troubleshoot modeling and simulation issues, including errors, inconsistencies, and inaccuracies.	**Case Study**	1,2	

191. Course Evaluation
Monthly Exam: 20 Mark Quizzes: 10 Mark Assignment and Other Activities:10 Mark Final Exam: 40 Mark

192. Learning and Teaching Resources	
Required textbooks (curricular books, if a	
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

1. Course Name:
Physical Chemistry II
2. Course Code:
CHE 004
3. Semester / Year:
1st /2024
4. Description Preparation Date:
19/9/2024
5. Available Attendance Forms:
Personal Attendance to give lecture
6. Number of Credit Hours (Total) / Number of Units (Total)
3
7. Course administrator's name (mention all, if more than one name)

Name: Dr. Khaled J Hamid

Email: Khaled.j.h@uoanbar.edu.iq

8. Course Objectives

Course Objectives	The goals of this course are to enable students to: 1. explore the scope of physical chemistry and its importance to chemical engineering education. 2. develop a fundamental understanding of the basic principles of physical chemistry. 3. develop problem-solving ability based on relevant laws, mathematical equations and graphical relationships.

9. Teaching and Learning Strategies

Strategy	By the end of successful completion of this course, the student will be: 1. able to demonstrate an understanding of gas behavior using different equations of state and kinetic molecular model. 2. able to demonstrate an understanding of thermodynamics laws and their applications. 3. able to demonstrate knowledge about kinetics laws, define the rate of reaction and the rate constant. 4. skilled in problem solving and analytical reasoning as applied to scientific problems.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Apply the laws of thermodynamics to predict the behavior of physical systems.	Introduction to Physical Chemistry	1,2	Quiz
2	4	Describe the factors that influence reaction rates and apply kinetic principles to predict reaction outcomes.	Gases: Properties, behavior and gases laws	1,2	Quiz
3	4	Apply quantum mechanical principles to explain the behavior of atoms and molecules.	Thermodynamics: definitions, the First law of Thermodynamics	1,2	Assignment &Quiz
4	4	Calculate thermodynamic	Enthalpy and Thermochemistry	1,2	Assignment &Quiz

		properties such as internal energy, enthalpy, and entropy.			
5	4	Use thermodynamic principles to analyze and predict the behavior of real-world systems.	The Second law of thermodynamics: Spontaneity& Entropy	1,2	Assignment &Quiz
6	4	Describe the principles of phase equilibria and phase transitions.	The Third law of thermodynamics & Gibbs Free Energy	1,2	Assignment &Quiz
7	4	Use quantum mechanical principles to explain the behavior of atoms and molecules.	Chemical Reaction	1,2	Assignment &Quiz
8	4	Describe the principles of spectroscopy and apply them to analyze the behavior of atoms and molecules.	Kinetics: Rate of Reaction equation	1,2	Assignment &Quiz
9	4	Interpret spectroscopic data to determine molecular structure and properties.	Kinetics: The Order of the reactions	1,2	Assignment &Quiz
10	4	Describe the factors that influence reaction rates and apply kinetic principles to predict reaction outcomes.	Chemical Equilibrium	1,2	Assignment &Quiz
11	4	Use kinetic models to analyze and predict the behavior of real-world systems.	Catalysis	1,2	Assignment &Quiz
12	4	Describe the principles of reaction dynamics and apply them to analyze the behavior of reacting systems.	Viscosity of liquid	1,2	Assignment &Quiz
13	4	Describe the principles of statistical mechanics and apply them to analyze the behavior of systems.	Introduction to Nanotechnology	1,2	Assignment &Quiz

14	4	Use statistical mechanical models to analyze and predict the behavior of real-world systems.	Electrical conductance	1,2	Assignment &Quiz
15	4	Describe the principles of phase transitions and critical phenomena.	Electrolyte	1,2	

11.Course Evaluation
Monthly Exam: 20 Mark Quizzes: 10 Mark Assignment and Other Activities:10 Mark Final Exam: 40 Mark

12.Learning and Teaching Resources	
Required textbooks (curricular books, if a	
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

1. Course Name:
Process Control
2. Course Code:
CHE 4328
3. Semester / Year:
1st /2024
4. Description Preparation Date:
19/9/2024
5. Available Attendance Forms:
Personal Attendance to give lecture
6. Number of Credit Hours (Total) / Number of Units (Total)

5 ECTS

7. Course administrator's name (mention all, if more than one name)

Name: Ayad Aied Mahuof

Email: ayadaied@uoanbar.edu.iq

8. Course Objectives

Course Objectives	1. To apply the models of physical techniques with equations to derive and analyze the transfer functions of open and closed loop control systems. 2. To able the student is responsible for designing, developing, and implementing solutions that control dynamic systems. Dynamic systems are systems that constantly change. The main aim of a control systems engineer is to bring stability to these constantly changing systems to produce the desired outcome. 3.To construct a system that has a desirable response to standard inputs. A desirable transient response is one that is sufficiently fast without excessive oscillations. A desirable steady-state response is one that follows the desired output with sufficient accuracy.

9. Teaching and Learning Strategies

Strategy	1. Identify open and closed loop control system and formulate mathematical model for physical systems. 2. Interpret and apply block diagram representations of control systems and design PID controllers based on empirical tuning rules 3. Compute stability of linear systems using the Routh array test and use this to generate control design constraints 4. Use Evans root locus techniques in control design for real world systems

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method

1	4	1,2	Introduction to automatic control	Lectures and tutorial	Quiz	
2	4	1,2	Representation of control components	Lectures and tutorial	Quiz	
3	4	1, 2	Representation of control systems: Mass, spring damper system.	Lectures and tutorial	Assignment &Quiz	
4	4	1, 2	Representation of control systems: Hydraulic system	Lectures and tutorial	Assignment &Quiz	
5	4	1, 2	Representation of control systems: Pneumatic system	Lectures and tutorial	Assignment &Quiz	
6	4	1, 2	Representation of control systems: Electrical system	Lectures and tutorial	Assignment &Quiz	
7	4	1, 2	Representation of control systems: Thermal system	Lectures and tutorial	Assignment &Quiz	
8	4	1,3	Steady-state operation	Lectures and tutorial	Assignment &Quiz	
9	4	1	Laplace transformer	Lectures and tutorial	Assignment &Quiz	
10	4	1,3	Transient and steady-state responses	Lectures and tutorial	Assignment &Quiz	
11	4	2,3	Steady-state errors in control systems	Lectures and tutorial	Assignment &Quiz	

12	4	1,2,3,4	Stability of control systems	Lectures and tutorial	Assignment &Quiz	
13	4	1,3,4	The rout locus method	Lectures and tutorial	Assignment &Quiz	
14	4	1,3,4	The rout locus method	Lectures and tutorial	Assignment &Quiz	
15	4	1,2,3,4	Progress Exam	Lectures and tutorial	Assignment &Quiz	

11.Course Evaluation	
Monthly Exam: 20 Mark Quizzes: 10 Mark Assignment and Other Activities:10 Mark Final Exam: 60 Mark	

12.Learning and Teaching Resources		
Required textbooks (curricular books, if any)	1Modern Control Engineering, Fifth Edition 2010, Katsuhiko Ogata	
Main references (sources)	Modern Control Systems, Twelfth Edition 2011, by Richard C. Dorf and Robert H. Bishop, Prentice Hall.	
Recommended books and references (scientific journals, reports...)		
Electronic References, Websites		

Course Description Form

193. Course Name:
Thermodynamics -I
194. Course Code:
CHE2311
195. Semester / Year:
1st /2024
196. Description Preparation Date:

19/9/2024

197. Available Attendance Forms:

Personal Attendance to give lecture

198. Number of Credit Hours (Total) / Number of Units (Total)

3

199. Course administrator's name (mention all, if more than one name)

Name: Prof Dr. Hamed Abdullah Fayyadh Al-Falahi

Email: h.alfalahi@uoanbar.edu.iq

200. Course Objectives

Course Objectives	Course objectives will guide the participant to develop key concepts and techniques to design equipment in development process plant. These key concepts can be utilized to make design and operating decisions, training, and. Course such as these should be almost a requirement for engineers and can utilized as refresher for engineers with experience. 1. To introduce students to the principles concepts of thermal systems engineering using several contemporary applications. 2. Enable students to gain access to the science of thermodynamics by understanding how engineering analysis is done How to deal with laws, equations, illustrations, and other data, and link the data to reach the outputs and enable the student to be able to analyze, elicit and draw conclusions 3. Enable students to gain access to the science of thermodynamics by understanding how engineering analysis is done.

201. Teaching and Learning Strategies

Strategy	1. The student will be able to distinguish between Engineering thermal systems, their connection mechanisms, and their uses in the field of applied work through a group of contemporary applications. 2. The student should have the ability to distinguish between the laws of Engineering thermodynamics and apply them mathematically and physically, and then design devices that fall into the field of practical applications based on the laws of conservation of energy and mass. 3. The student distinguishes the relationship between heat and other forms of energy, and the transformation of thermal energy into different types of energy and vice versa, that is, how different types of energy are transformed into thermal energy, and how they affect matter. 4. That the student understands how heat is converted into mechanical work, and since chemical energy is a form of energy that is related to other forms, especially heat, applying the rules of thermodynamics to chemical reactions as specific systems is very useful for understanding chemical reactions.

	5. The student will employ the laws of thermodynamics in studying, designing, and developing a range of Engineering devices necessary for the chemical process of open and closed systems, such as; nozzles and diffusers, turbines, compressors and pumps, throttling devices, heat exchangers, evaporator, condenser, and boiler.

202. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Understand the definition and scope of thermodynamics.	**WHAT IS THERMAL SYSTEMS ENGINEERING?**	1,2	Quiz
2	4	Describe the different types of thermodynamic systems, including open, closed, and isolated systems.	**GETTING STARTED IN THERMODYNAMICS: INTRODUCTORY CONCEPTS AND DEFINITIONS**	1,2	Quiz
3	4	Recognize the different thermodynamic properties, including temperature, pressure, volume, and energy.	**CONCEPTS OF UNIT AND DIMENTION AND FUNDEMENTAL VARIABLES**	1,2	Assignment &Quiz
4	4	Understand the concept of thermal equilibrium and the Zeroth Law.	**USING ENERGY AND THE FIRST LAW OF THERMODYNAMICS**/Mechanical Concepts of Energy	1,2	Assignment &Quiz
5	4	Use the First Law to analyze energy transformations and conservation.	**ENERGY AND THE FIRST LAW OF THERMODYNAMICS**/Broadening Our Understanding of Mechanical Work	1,2	Assignment &Quiz
6	4	Understand the concept of entropy and the Second Law.	**EVALUATING PROPERTIES OF PURE SUBSTANCE**	1,2	Assignment &Quiz
7	4	Analyze and calculate the work and heat transfer	**THE FIRST LAW OF THERMODYNAMIC**	1,2	Assignment &Quiz

		during isothermal processes.	**S FOR <u>CLOSED</u> SYSTEMS**		
8	4	Understand and calculate the work and heat transfer during adiabatic processes.	**THE FIRST LAW OF THERMODYNAMICS FOR <u>OPEN</u> SYSTEMS (**(Introduction, Conservation of Mass for a Control Volume Open Systems)	1,2	Assignment &Quiz
9	4	Calculate the efficiency and work output of cyclic processes.	**THE FIRST LAW OF THERMODYNAMICS FOR <u>OPEN</u> SYSTEMS** Conservation of Energy for a Control Volume Open Systems**)**	1,2	Assignment &Quiz
10	4	Use the First Law to calculate the internal energy of a system.	**GENERAL APPLICATIONS of THE FIRST LAW OF THERMODYNAMICS FOR <u>OPEN</u> SYSTEMS**(nozzles and diffusers, turbines, compressors and pumps)	1,2	Assignment &Quiz
11	4	Calculate the enthalpy of a system and understand its relationship to internal energy.	**GENERAL APPLICATIONS of THE FIRST LAW OF THERMODYNAMICS FOR <u>OPEN</u> SYSTEMS** (throttling devices, heat exchangers Evaporator, Condenser, and Boiler)	1,2	Assignment &Quiz
12	4	Calculate the entropy of a system and understand its relationship to the Second Law.	**THE IDEAL GASE LAWS AND IDEAL GAS MIXTURES** (The Ideal Gas Laws	1,2	Assignment &Quiz
13	4	Calculate the efficiency and work output of heat engines.	**THE REAL GASE LAWS AND REAL GAS MIXTURES** (Compressibility)	1,2	Assignment &Quiz

14	4	Understand and analyze the refrigeration cycle.	**THE REAL GASE LAWS AND REAL GAS MIXTURES** (Equation of State)	1,2	Assignment &Quiz
15	4	Use thermodynamic principles to analyze and solve real-world problems.	**THE REAL GASE LAWS AND REAL GAS MIXTURES** (Equation of State)	1,2	

203. Course Evaluation

Monthly Exam: 20 Mark

Quizzes: 10 Mark

Assignment and Other Activities:10 Mark

Final Exam: 40 Mark

204. Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

205.	Course Name:
	Thermodynamics -II
206.	Course Code:
	CHE2311
207.	Semester / Year:
	1st /2024
208.	Description Preparation Date:
	19/9/2024
209.	Available Attendance Forms:
	Personal Attendance to give lecture
210.	Number of Credit Hours (Total) / Number of Units (Total)
	3
211.	Course administrator's name (mention all, if more than one name)
	Name: Prof Dr. Hamed Abdullah Fayyadh Al-Falahi

Email: h.alfalahi@uoanbar.edu.iq

212. Course Objectives

Course Objectives	Course objectives will guide the participant to develop key concepts and techniques to design equipment in development process plant. These key concepts can be utilized to make design and operating decisions, training, and. Course such as these should be almost a requirement for engineers and can utilized as refresher for engineers with experience. 4. To introduce students to the principles concepts of thermal systems engineering using several contemporary applications. 5. Enable students to gain access to the science of thermodynamics by understanding how engineering analysis is done How to deal with laws, equations, illustrations, and other data, and link the data to reach the outputs and enable the student to be able to analyze, elicit and draw conclusions 6. Enable students to gain access to the science of thermodynamics by understanding how engineering analysis is done

213. Teaching and Learning Strategies

Strategy	At the end of the first course of applied thermodynamics, the student achieves the following: 1. The student will be able to employ the laws of thermodynamics in simulating the thermal power cycle. 2. To enable the student to employ the second law of thermodynamics and its relationship to entropy in the mathematical analysis of steam and gas power plants, refrigeration and liquefaction. 3. That the student distinguishes the relationship between heat and other forms of energy, and the conversion of thermal energy into different types of energy and vice versa, that is, how different types of energy are transformed into thermal energy, in the thermal power cycle.

214. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Understand the relationship between Gibbs free energy, enthalpy, and entropy.	THE SECOND LAW OF THERMODYNAMICS AND ENTROPY (Introducing the Second Law:, Identifying Irreversibility's:, Applying the Second Law to Thermodynamic Cycles, Analysis of Carnot heat	1,2	Quiz

			engines, Analysis of Carnot refrigerators and heat pumps)		
2	4	Use chemical potential to analyze and predict the behavior of systems.	USING ENTROPY (Introducing Entropy, Entropy Change in Internally Reversible Processes, Entropy Balance for Closed Systems, Entropy Rate Balance for Control Volumes, Isentropic Processes, Isentropic Efficiencies of Turbines, Nozzles, Compressors, and Pumps)	**1,2**	**Quiz**
3	4	Explain the concept of fugacity and its relationship to chemical potential.	ANALYSIS OF ENGINEERING SYSTEMS BASED ON THE SECOND LAW OF THERMODYNAMICS (Analysis of Closed System According to 2nd Law of Thermodynamics, Analysis of Open System According to 2nd Law of Thermodynamics)	**1,2**	**Assignment &Quiz**
4	4	Use the Maxwell relations to derive thermodynamic properties.	APPLICATIONS OF SECOND LAW IN VAPOR POWER CYCLES (Production of Power from Heat, Kind of Power Cycles, Modeling Vapor Power Systems, Analyzing Vapor Power Systems-Carnot and Rankine Cycle)	**1,2**	**Assignment &Quiz**
5	4	Understand the relationship between thermodynamic potentials and the properties of a system.	DEVIATION OF ACTUAL VAPOR POWER CYCLES FROM IDEAL RANKINE CYCLES (Introduction, Mathematical Analysis Deviation of Actual Vapor Power Cycles from Ideal Rankine Cycles)	**1,2**	**Assignment &Quiz**
6	4	Use Jacobians to derive thermodynamic relations.	MODIFICATION METHODS OF THE STEAM RANKINE CYCLES(Using Economizer, Increase Pressure in the Boiler, Decrease Pressure in the Condenser, Increase Temperature of Superheated	**1,2**	**Assignment &Quiz**

			Steam in the Boiler, Reheated Cycle, The Regenerative Cycle)		
7	4	Understand the conditions for phase equilibria and the phase rule.	NUCLEAR POWER SYSTEM CYCLES (Kind of Nuclear Power System Cycle, Analysis of nuclear system cycles based on 2nd Law of Thermodynamics)	1,2	Assignment &Quiz
8	4	Interpret and analyze phase diagrams to predict the behavior of systems.	APPLICATIONS OF SECOND LAW IN GAS POWER CYCLES (Reciprocating Combustion Engines)	1,2	Assignment &Quiz
9	4	Understand the concept of azeotropy and its implications for phase equilibria.	APPLICATIONS OF SECOND LAW IN GAS POWER CYCLES (Gas Turbine Brayton Engine Cycle)	1,2	Assignment &Quiz
10	4	Understand the concept of partial molar properties and their relationship to the properties of a mixture.	APPLICATIONS OF SECOND LAW IN REFRIGRATION AND LIQUEFACTION CYCLES (Air Refrigeration system)	1,2	Assignment &Quiz
11	4	Use excess properties to analyze and predict the behavior of mixtures.	APPLICATIONS OF SECOND LAW IN REFRIGRATION AND LIQUEFACTION CYCLES (Vapor Compression system)	1,2	Assignment &Quiz
12	4	Understand the thermodynamics of solutions, including the concept of solubility	APPLICATIONS OF SECOND LAW IN REFRIGRATION AND LIQUEFACTION CYCLES (Vapor Absorption system)	1,2	Assignment &Quiz
13	4	Use thermodynamic principles to analyze and predict the behavior of chemical reactions.	APPLICATIONS OF SECOND LAW IN REFRIGRATION AND LIQUEFACTION CYCLES (Refrigerants)	1,2	Assignment &Quiz
14	4	Understand the concept of	VAPOR LIQUID EQUILIBRIUM (Duhem's theorem, phase behavior for	1,2	Assignment &Quiz

		thermodynamic optimization and its applications.	vapor –liquid system, VLE qualitative behavior, VLE by modified Raoults Law)		
15	4	Use thermodynamic principles to analyze and solve real-world problems.	GENERAL REVIEW	**1,2**	

215. Course Evaluation

Monthly Exam: 20 Mark

Quizzes: 10 Mark

Assignment and Other Activities:10 Mark

Final Exam: 40 Mark

216. Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

1. Course Name:

Characterization of Petroleum and Natural Gas

2. Course Code:

CHE 3316

3. Semester / Year:

1st /2024

4. Description Preparation Date:

19/9/2024

5. Available Attendance Forms:

Personal Attendance to give lecture

6. Number of Credit Hours (Total) / Number of Units (Total)

7. Course administrator's name (mention all, if more than one name)

Name: Osama Ali Mohsen

Email: Osama.a.m@uoanbar.edu.iq

8. Course Objectives

Course Objectives	The main objective of oil and gas properties module is to familiarize the students with the theories of genesis of petroleum origin and to find out the main formation of oil and gas. The chemical and physical composition of crude oil consider as a main goal of this course. By the end of this course the student should also know how to classify crude oil according to API. The Course Syllabus practical part of this course aims to give an experimental knowledge about physical properties of crude oil such as flash point, fire point, and water content.

9. Teaching and Learning Strategies

Strategy	Our modern technological society relies very heavily on fossil fuels as an important source of energy. Crude oil is produced from the deep underground reservoir and must undergo a series of refining processes which converts it into a variety of products - petrol for cars, fuel oil for heating, diesel fuels for transportation means, bitumen for roads. The goal of this course is familiarizing the petroleum students with these technologies It is designed to provide them with an understanding of the crude oil and its origins and how it can be classified to its original bases (paraffinic base, naphthenic base or aromatic base) and some related topics such as classification of crude oil and studying its physical properties on laboratorial base (e.g. water content, flash point and fire point, smoke point & … etc.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Introduction to History of Petroleum	Introduction to History of Petroleum	1,2,3	Quiz
2	2	Definition of Petroleum and its classification, Physical and chemical properties of Crude oil and natural gas,	Definition of Petroleum and its classification, Physical and chemical properties of Crude oil and natural gas,	1,2,3	Quiz

3	2	Definition of Crude oil, and its Classification according to API degree	Definition of Crude oil, and its Classification according to API degree	1,2,3	Assignment &Quiz
4	2	Organic and Inorganic theories of formation of crude oil and natural gas , Rock Types (Igneous , Sedimentary and Metamorphic)	Organic and Inorganic theories of formation of crude oil and natural gas , Rock Types (Igneous , Sedimentary and Metamorphic)	1,2,3	Assignment &Quiz
5	2	General chemical hydrocarbon composition in petroleum. Hydrocarbons (Paraffins, Olefins, and Naphthenes)	General chemical hydrocarbon composition in petroleum. Hydrocarbons (Paraffins, Olefins, and Naphthenes)	1,2,3	Assignment &Quiz
6	2	Progress Exam 1	Progress Exam 1	1,2,3	Assignment &Quiz
7	2	Classification of Laboratory test and physical properties (Slat Content, The weight percentage of sulfur content, Pour point and Cloud point, Ash Content.)	Classification of Laboratory test and physical properties (Slat Content, The weight percentage of sulfur content, Pour point and Cloud point, Ash Content.)	1,2,3	Assignment &Quiz

Course Description Form

217. Course Name:
Unit Operation I
218. Course Code:

CHE 014	
219. Semester / Year:	
1st /2024	
220. Description Preparation Date:	
19/9/2024	
221. Available Attendance Forms:	
Personal Attendance to give lecture	
222. Number of Credit Hours (Total) / Number of Units (Total)	
6 ECTS	
223. Course administrator's name (mention all, if more than one name)	
Name: Omar Mustafa Hussein Email: omalkuba@uoanbar.edu.iq	
224. Course Objectives	
Course Objectives	• Understanding Fundamental Concept • Design and Operation of Equipment • Problem Solving in Process Engineering:
225. Teaching and Learning Strategies	
Strategy	1. Interactive Lectures • Conceptual Explanation: Begin with clear explanations of fundamental conce (e.g., fluid dynamics, heat transfer, etc.) using diagrams, videos, and analogies • Incorporating Questions: Pose questions during lectures to keep students enga and assess their understanding. Use tools like clicker questions, quizzes, or poll software to encourage participation. • Real-Life Examples: Relate theoretical concepts to real-world chem engineering applications such as oil refineries, chemical plants, and wastew treatment to make the content more relatable. 2. Problem-Based Learning (PBL) • Case Studies: Introduce industry-based case studies where students apply u operation concepts to solve practical engineering problems, encouraging criti thinking and collaboration.

	• Step-by-Step Problem Solving: Use in-class examples to demonstrate how break down complex unit operation problems, from identifying relevant princip to applying mathematical formulas. 3. Use of Visual Aids and Simulations • Process Flow Diagrams (PFD): Utilize visual aids such as flow diagrams, pipi and instrumentation diagrams (P&ID) to help students visualize process layo and equipment connections. • Simulation Software: Integrate software like Aspen Plus, MATLAB, or COMS into lectures and assignments to simulate unit operations (e.g., heat exchang evaporators), providing hands-on learning experiences. • Animations and Videos: Use multimedia resources to explain complex proces such as heat transfer in exchangers or fluid flow through pipes, which can m abstract concepts more concrete.

226. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Understanding of Core Concepts	Introduction to Unit Operations; Equilibrium stage operations	1,2,3	Quiz
2	3	Application of Transport Phenomena	Thermodynamics of distillation	1,2,3	Quiz
3	3	Equipment Design and Analysis	Binary distillations review	1,2,3	Assignment &Quiz
4	3	Equipment Design and Analysis	Distillation Methods	1,2,3	Assignment &Quiz
5	3	Equipment Design and Analysis	Distillation Methods	1,2,3	Assignment &Quiz
6	3	Equipment Design and Analysis	Distillation Methods	1,2,3	Assignment &Quiz
7	3	Equipment Design and Analysis	Distillation Methods	1,2,3	Assignment &Quiz

8	3	Equipment Design and Analysis	Packed bed columns	1,2,3	Assignment &Quiz
9	3	Equipment Design and Analysis	Principles of humidification	1,2,3	Assignment &Quiz
10	3	Equipment Design and Analysis	Methods of humidification	1,2,3	Assignment &Quiz
11	3	Equipment Design and Analysis	Principles of drying	1,2,3	Assignment &Quiz
12	3	Equipment Design and Analysis	Principles of drying	1,2,3	Assignment &Quiz
13	3	Equipment Design and Analysis	Principles of adsorption	1,2,3	Assignment &Quiz
14	3	Equipment Design and Analysis	Methods of adsorption	1,2,3	Assignment &Quiz
15	3	Final exam		1,2,3	Assignment &Quiz

227. Course Evaluation

Monthly Exam: 20 Mark

Quizzes: 10 Mark

Assignment and Other Activities:10 Mark

Final Exam: 60 Mark

228. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Unit Operation for Chemical Engineeri
Main references (sources)	Principles of Unit Operation
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

229. Course Name:
Unit Operation I
230. Course Code:
CHE 014
231. Semester / Year:
1st /2024
232. Description Preparation Date:
19/9/2024
233. Available Attendance Forms:
Personal Attendance to give lecture
234. Number of Credit Hours (Total) / Number of Units (Total)
6 ECTS
235. Course administrator's name (mention all, if more than one name)
Name: Omar Mustafa Hussein Email: omalkuba@uoanbar.edu.iq

236. Course Objectives	
Course Objectives	• Understanding Fundamental Concept • Design and Operation of Equipment • Problem Solving in Process Engineering:

237. Teaching and Learning Strategies	
Strategy	1. Interactive Lectures • Conceptual Explanation: Begin with clear explanations of fundamental concepts (e.g., fluid dynamics, heat transfer, etc.) using diagrams, videos, and analogies. • Incorporating Questions: Pose questions during lectures to keep students engaged and assess their understanding. Use tools like clicker questions, quizzes, or polling software to encourage participation. • Real-Life Examples: Relate theoretical concepts to real-world chemical engineering applications such as oil refineries, chemical plants, and wastewater treatment to make the content more relatable. 2. Problem-Based Learning (PBL) • Case Studies: Introduce industry-based case studies where students apply unit operation concepts to solve practical engineering problems, encouraging critical thinking and collaboration.

	• Step-by-Step Problem Solving: Use in-class examples to demonstrate how to break down complex unit operation problems, from identifying relevant principles to applying mathematical formulas. 3. Use of Visual Aids and Simulations • Process Flow Diagrams (PFD): Utilize visual aids such as flow diagrams, piping, and instrumentation diagrams (P&ID) to help students visualize process layouts and equipment connections. • Simulation Software: Integrate software like Aspen Plus, MATLAB, or COMSOL into lectures and assignments to simulate unit operations (e.g., heat exchangers, evaporators), providing hands-on learning experiences. • Animations and Videos: Use multimedia resources to explain complex processes such as heat transfer in exchangers or fluid flow through pipes, which can make abstract concepts more concrete.

238. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Understanding of Core Concepts	Introduction to Unit Operations; Equilibrium stage operations	1,2,3	Quiz
2	3	Application of Transport Phenomena	Thermodynamics of distillation	1,2,3	Quiz
3	3	Equipment Design and Analysis	Binary distillations review	1,2,3	Assignment &Quiz
4	3	Equipment Design and Analysis	Distillation Methods	1,2,3	Assignment &Quiz
5	3	Equipment Design and Analysis	Distillation Methods	1,2,3	Assignment &Quiz
6	3	Equipment Design and Analysis	Distillation Methods	1,2,3	Assignment &Quiz
7	3	Equipment Design and Analysis	Distillation Methods	1,2,3	Assignment &Quiz
8	3	Equipment Design and Analysis	Packed bed columns	1,2,3	Assignment &Quiz
9	3	Equipment Design and Analysis	Principles of humidification	1,2,3	Assignment &Quiz

10	3	Equipment Design and Analysis	Methods of humidification	1,2,3	Assignment &Quiz
11	3	Equipment Design and Analysis	Principles of drying	1,2,3	Assignment &Quiz
12	3	Equipment Design and Analysis	Principles of drying	1,2,3	Assignment &Quiz
13	3	Equipment Design and Analysis	Principles of adsorption	1,2,3	Assignment &Quiz
14	3	Equipment Design and Analysis	Methods of adsorption	1,2,3	Assignment &Quiz
15	3	Final exam		1,2,3	Assignment &Quiz

239. Course Evaluation

Monthly Exam: 20 Mark

Quizzes: 10 Mark

Assignment and Other Activities:10 Mark

Final Exam: 60 Mark

240. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Unit Operation for Chemical Engineering
Main references (sources)	Principles of Unit Operation
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

241. Course Name:

Unit Operation I

242. Course Code:

CHE 014

243. Semester / Year:

1st /2024

244. Description Preparation Date:

19/9/2024

245. Available Attendance Forms:

Personal Attendance to give lecture

246. Number of Credit Hours (Total) / Number of Units (Total)

6 ECTS

247. Course administrator's name (mention all, if more than one name)

Name: Omar Mustafa Hussein

Email: omalkuba@uoanbar.edu.iq

248. Course Objectives

Course Objectives	• Understanding Fundamental Concept • Design and Operation of Equipment • Problem Solving in Process Engineering:

249. Teaching and Learning Strategies

Strategy

1. Interactive Lectures

- Conceptual Explanation: Begin with clear explanations of fundamental concepts (e.g., fluid dynamics, heat transfer, etc.) using diagrams, videos, and analogies.
- Incorporating Questions: Pose questions during lectures to keep students engaged and assess their understanding. Use tools like clicker questions, quizzes, or polling software to encourage participation.
- Real-Life Examples: Relate theoretical concepts to real-world chemical engineering applications such as oil refineries, chemical plants, and wastewater treatment to make the content more relatable.

2. Problem-Based Learning (PBL)

- Case Studies: Introduce industry-based case studies where students apply unit operation concepts to solve practical engineering problems, encouraging critical thinking and collaboration.
- Step-by-Step Problem Solving: Use in-class examples to demonstrate how to break down complex unit operation problems, from identifying relevant principles to applying mathematical formulas.

3. Use of Visual Aids and Simulations

- Process Flow Diagrams (PFD): Utilize visual aids such as flow diagrams, piping, and instrumentation diagrams (P&ID) to help students visualize process layouts and equipment connections.

	• Simulation Software: Integrate software like Aspen Plus, MATLAB, or COMSOL into lectures and assignments to simulate unit operations (e.g., heat exchangers, evaporators), providing hands-on learning experiences. • Animations and Videos: Use multimedia resources to explain complex processes such as heat transfer in exchangers or fluid flow through pipes, which can make abstract concepts more concrete.

250. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Understanding of Core Concepts	Introduction to Unit Operations; Equilibrium stage operations	1,2,3	Quiz
2	3	Application of Transport Phenomena	Thermodynamics of distillation	1,2,3	Quiz
3	3	Equipment Design and Analysis	Binary distillations review	1,2,3	Assignment &Quiz
4	3	Equipment Design and Analysis	Distillation Methods	1,2,3	Assignment &Quiz
5	3	Equipment Design and Analysis	Distillation Methods	1,2,3	Assignment &Quiz
6	3	Equipment Design and Analysis	Distillation Methods	1,2,3	Assignment &Quiz
7	3	Equipment Design and Analysis	Distillation Methods	1,2,3	Assignment &Quiz
8	3	Equipment Design and Analysis	Packed bed columns	1,2,3	Assignment &Quiz
9	3	Equipment Design and Analysis	Principles of humidification	1,2,3	Assignment &Quiz
10	3	Equipment Design and Analysis	Methods of humidification	1,2,3	Assignment &Quiz
11	3	Equipment Design and Analysis	Principles of drying	1,2,3	Assignment &Quiz

12	3	Equipment Design and Analysis	Principles of drying	1,2,3	Assignment &Quiz
13	3	Equipment Design and Analysis	Principles of adsorption	1,2,3	Assignment &Quiz
14	3	Equipment Design and Analysis	Methods of adsorption	1,2,3	Assignment &Quiz
15	3	Final exam		1,2,3	Assignment &Quiz

251. Course Evaluation

Monthly Exam: 20 Mark

Quizzes: 10 Mark

Assignment and Other Activities:10 Mark

Final Exam: 60 Mark

252. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Unit Operation for Chemical Engineering
Main references (sources)	Principles of Unit Operation
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

253.	Course Name:
	Petroleum refinery II
254.	Course Code:
	CHE 022
255.	Semester / Year:
	1st /2024
256.	Description Preparation Date:
	19/9/2024
257.	Available Attendance Forms:
	Personal Attendance to give lecture

258.	Number of Credit Hours (Total) / Number of Units (Total)
	6 ECTS
259.	Course administrator's name (mention all, if more than one name)
	Name: Omar Mustafa Hussein Email: omalkuba@uoanbar.edu.iq
260.	Course Objectives
Course Objectives	• Introduce the Fundamentals of Crude Oil Processing • Equip Students with the Knowledge of Refining Unit Operations • Develop Problem-Solving Skills in Refinery Process Engineering • Promote Awareness of Environmental and Safety Challenges • Prepare Students for Professional Responsibilities in the Industry
261.	Teaching and Learning Strategies
Strategy	1. Interactive Lectures • Conceptual Explanation: Begin with clear explanations of fundamental concepts (e.g., fluid dynamics, heat transfer, etc.) using diagrams, videos, and analogies. • Incorporating Questions: Pose questions during lectures to keep students engaged and assess their understanding. Use tools like clicker questions, quizzes, or polling software to encourage participation. • Real-Life Examples: Relate theoretical concepts to real-world chemical engineering applications such as oil refineries, chemical plants, and wastewater treatment to make the content more relatable. 2. Problem-Based Learning (PBL) • Case Studies: Introduce industry-based case studies where students apply unit operation concepts to solve practical engineering problems, encouraging critical thinking and collaboration. • Step-by-Step Problem Solving: Use in-class examples to demonstrate how to break down complex unit operation problems, from identifying relevant principles to applying mathematical formulas. 3. Use of Visual Aids and Simulations • Process Flow Diagrams (PFD): Utilize visual aids such as flow diagrams, piping, and instrumentation diagrams (P&ID) to help students visualize process layouts and equipment connections. • Simulation Software: Integrate software like Aspen Plus, MATLAB, or COMSOL into lectures and assignments to simulate unit operations (e.g., heat exchangers, evaporators), providing hands-on learning experiences.

	• Animations and Videos: Use multimedia resources to explain complex processes such as heat transfer in exchangers or fluid flow through pipes, which can make abstract concepts more concrete.

262. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Understanding of Core Concepts	An introduction to crude oil and its processing	1,2,3	Quiz
2	3	Application of Transport Phenomena	The composition and characteristics of crude oil	1,2,3	Quiz
3	3	Equipment Design and Analysis	The crude oil assay	1,2,3	Assignment &Quiz
4	3	Equipment Design and Analysis	Basic processes in oil refineries	1,2,3	Assignment &Quiz
5	3	Equipment Design and Analysis	Process Description of refinery process	1,2,3	Assignment &Quiz
6	3	Equipment Design and Analysis	Distillation Unit in refinery process	1,2,3	Assignment &Quiz
7	3	Equipment Design and Analysis	Crude oil desalting	1,2,3	Assignment &Quiz
8	3	Equipment Design and Analysis	Reflux arrangement in distillation column	1,2,3	Assignment &Quiz
9	3	Equipment Design and Analysis	Thermal cracking processes: Vacume Distillation Column	1,2,3	Assignment &Quiz

10	3	Equipment Design and Analysis	Types of vacume distillation column	1,2,3	Assignment &Quiz
11	3	Equipment Design and Analysis	Thermal Cracking processes: Steam Jet Ejectors	1,2,3	Assignment &Quiz
12	3	Equipment Design and Analysis	Thermal Cracking Processes: Cocking drums	1,2,3	Assignment &Quiz
13	3	Equipment Design and Analysis	Types of coking	1,2,3	Assignment &Quiz
14	3	Equipment Design and Analysis	Yield correlation for flexi-coking	1,2,3	Assignment &Quiz
15	3	Final exam		1,2,3	Assignment &Quiz

263. Course Evaluation

Monthly Exam: 20 Mark

Quizzes: 10 Mark

Assignment and Other Activities:10 Mark

Final Exam: 60 Mark

264. Learning and Teaching Resources

quired textbooks (curricular books, if any)	Nelson, W. L. (1958). Petroleum refinery engineering.
in references (sources)	ker, A. K. (2018). Petroleum Refining Design and blications Handbook, Volume 1. John Wiley & s.
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

265. Course Name:
Principles of Chemical Eng. I
266. Course Code:
CHE1301
267. Semester / Year:
1st /2024
268. Description Preparation Date:
19/9/2024
269. Available Attendance Forms:
Personal Attendance to give lecture
270. Number of Credit Hours (Total) / Number of Units (Total)
4
271. Course administrator's name (mention all, if more than one name)
Name: Prof Dr. Hamed Abdullah Fayyadh Al-Falahi Email: h.alfalahi@uoanbar.edu.iq

272. Course Objectives	
Course Objectives	Course objectives will guide the participant to develop key concepts and techniques to design equipment in process plant. These key concepts can be utilized to make design and operating decisions, training, and development. Course such as these should be almost a requirement for engineers and can utilized as refresher for engineers with experience. 1. To introduce students, you to the principles concepts of thermal systems engineering using several contemporary applications. 2. To acquaint students with what material and energy balances are, and how to formulate and solve them. 3. To develop a fundamental understanding of chemical engineering processes. This objective is accomplished in three directions; ○ Conventional problems that reinforced students understanding of the basic concepts and principals (included in each lecture). ○ Most problems requiring significant numerical computations can be solved with a personal computer using either POLYMATH or MATHLAB. ○ To develop creative skill. A number of homework problems have been included that are designed to enhance critical thinking skills.
273. Teaching and Learning Strategies	

Strategy	1. Interactive Lectures • Conceptual Explanation: Begin with clear explanations of fundamental concepts (e.g., fluid dynamics, mathematics, etc.) using diagrams, videos, and analogies. • Incorporating Questions: Pose questions during lectures to keep students engaged and assess their understanding. Use tools like clicker questions, quizzes, or polling software to encourage participation. • Real-Life Examples: Relate theoretical concepts to real-world chemical engineering applications such as heat exchanger, boilers, and boiling and condensation to make the content more relatable. 2. Problem-Based Learning (PBL) • Case Studies: Introduce industry-based case studies where students apply a heat transfer concepts to solve practical engineering problems, encouraging critical thinking and collaboration. • Step-by-Step Problem Solving: Use in-class examples to demonstrate how to break down any heat transfer problems, from identifying relevant principles to applying mathematical formulas (Fourier's law, Newton's law of cooling) .

274. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	Understand the definition and scope of chemical engineering.	INTRODUCTION TO CHEMICAL ENGINEERING PROCESSES	1,2	Quiz
2	4	Apply material balance principles to solve problems.	DIMENSIONS, UNITS, AND THEIR CONVERSION	1,2	Quiz
3	4	Apply energy balance principles to solve problems.	MOLES, DENSITY, AND CONCENTRATION	1,2	Assignment &Quiz
4	4	Understand the principles of fluid flow, including laminar and turbulent flow.	CHOOSING A BASIS, TEPERATURE, PRESSURE AND ITS CONVERSION	1,2	Assignment &Quiz
5	4	Understand the principles of heat	INTRODUCTION TO MATERIAL BALANCES/ Terminologies	1,2	Assignment &Quiz

		transfer, including conduction, convection, and radiation.			
6	4	Understand the principles of mass transfer, including diffusion and convection.	GENERAL STRATEGY FOR SOLVING MATERIAL BALANCES	1,2	Assignment &Quiz
7	4	Use the laws of thermodynamics to analyze and solve problems.	SOLVING MATERIAL BALANCE PROBLEMS FOR SINGLE UNITS WITHOUT REACTION	1,2	Assignment &Quiz
8	4	Understand the concept of thermodynamic properties, including temperature, pressure, and entropy.	THE CHEMICAL REACTION EQUATION AND STOICHIOMETRY	1,2	Assignment &Quiz
9	4	Apply material balance principles to solve problems.	THE CHEMICAL REACTION EQUATION AND STOICHIOMETRY/ Other Terminologies	1,2	Assignment &Quiz
10	4	Apply energy balance principles to solve problems.	MATERIAL BALANCES FOR PROCESSES INVOLVING REACTION by SPECIES MATERIAL BALANCES	1,2	Assignment &Quiz
11	4	Apply principles of unit operations to solve problems.	MATERIAL BALANCES FOR PROCESSES INVOLVING REACTION by ELEMENT MATERIAL BALANCES	1,2	Assignment &Quiz
12	4	Use mathematical and analytical skills to solve chemical engineering problems.	MATERIAL BALANCES FOR SINGLE UNITS PROCESSES INVOLVING COMBUSTION	1,2	Assignment &Quiz
13	4	Use critical thinking to analyze and solve complex problems.	MATERIAL BALANCES FOR PROCESSES INVOLVING RECYCLE WITH OUT CHEMICAL REACTION	1,2	Assignment &Quiz

14	4	Communicate solutions to problems clearly and effectively.	MATERIAL BALANCES FOR PROCESSES INVOLVING RECYCLE WITH CHEMICAL REACTION	1,2	Assignment &Quiz
15	4	Final exam	MATERIAL BALANCES FOR PROCESSES INVOLVING BYPASS AND PURGE WITH OUT CHEMICAL REACTION AND WITH CHEMICAL REACTION	1,2	

275. Course Evaluation

Monthly Exam: 20 Mark

Quizzes: 10 Mark

Assignment and Other Activities:10 Mark

Final Exam: 40 Mark

276. Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

277. Course Name:

Principles of Chemical Eng. II

278. Course Code:

CHE1301

279. Semester / Year:

1st /2024

280. Description Preparation Date:

19/9/2024

281. Available Attendance Forms:

Personal Attendance to give lecture

282. Number of Credit Hours (Total) / Number of Units (Total)

4

283. Course administrator's name (mention all, if more than one name)

Name: Prof Dr. Hamed Abdullah Fayyadh Al-Falahi

Email: h.alfalahi@uoanbar.edu.iq

284. Course Objectives

Course Objectives	Course objectives will guide the participant to develop key concepts and techniques to design equipment in process plant. These key concepts can be utilized to make design and operating decisions, training, and development. Course such as these should be almost a requirement for engineers and can utilized as refresher for engineers with experience. • To introduce students, you to the principles concepts of thermal systems engineering using several contemporary applications. • To acquaint students with what energy balances are, and how to formulate and solve them. • To develop a fundamental understanding of chemical engineering processes. This objective is accomplished in three directions; ○ Conventional problems that reinforced students understanding of the basic concepts and principals (included in each lecture). ○ Most problems requiring significant numerical computations can be solved with a personal computer using either POLYMATH or MATHLAB. ○ To develop creative skill. A number of homework problems have been included that are designed to enhance critical thinking skills.

285. Teaching and Learning Strategies

Strategy	At the end of the course, the student will be able to: 1. The ability to conduct mathematical analysis to balance the energies entering and leaving chemical industrial process units to benefit from them in designing the equipment's necessary to complete them. 2. The engineer should be able to distinguish between ideal and real gases and benefit from them in calculating the capacity of the devices involved in the chemical process. 3. The engineer must be a pioneer in green engineering by choosing a controlled, economical chemical process that leaves no impact on the environment. 4. The engineer will be able to distinguish between closed and open systems in stable and unstable states and how to deal with the energy balance in order to control the performance of the chemical process.

286. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method

1	4	Understand the principles of distillation, including vapor-liquid equilibrium and separation.	**IDEAL GASES (**Important Terminologies, Pure Substance, Some questions about the Ideal Gas, Correlation Equations for the Ideal Gas)	1,2	Quiz
2	4	Understand the principles of absorption and stripping, including mass transfer and separation.	**IDEAL GASE MIXTURE (**Ideal Gas Mixtures and Partial Pressure, Material Balances Involving Ideal Gases**)**	1,2	Quiz
3	4	Understand the principles of crystallization, including nucleation and growth.	**REAL GASES / COMPRESSIBILITY (**Critical States and Critical Constant, Reduced Variables, Compressibility, Compressibility Charts, Calculating the Compressibility Factor Using the Pitzer Factors Z^O an d Z^1, Real Gas Mixtures**)**	1,2	Assignment &Quiz
4	4	Understand the principles of chemical kinetics, including reaction rates and mechanisms.	**REAL GASES / EQUATIONS OF STATE (**Main Concepts about Equation of State, How can accurate the equations of state?**)**	1,2	Assignment &Quiz
5	4	Understand the principles of reactor design, including batch, continuous, and semi-batch reactors.	**INTRODUCTION TO ENERGY BALANCES (**Introduction, The Terminologies Associated with Energy Balances, what is Thermodynamic? Thermodynamics Laws**)**	1,2	Assignment &Quiz
6	4	Understand the principles of catalysis, including	**TYPES OF ENERGY AND FIRST LAW OF THERMODYNAMIC S** (Mechanical Concepts of Energy, Work in	1,2	Assignment &Quiz

		catalyst types and mechanisms.	Mechanics, Internal Energy, Energy transfer by heat**)**		
7	4	Understand the principles of process control, including feedback control and stability.	**BASIC ENERGY BALANCES FOR <u>CLOSED</u> PROCESSES WITH OUT CHEMICAL REACTION /Closed steady and un steady state system** (The Concept of the Conservation of Mass and Conservation of Energy, Mass Balance for Closed Systems in Unsteady-State and steady State Process, Energy Balance for Closed Systems in Unsteady-State and steady State Process**)**	1,2	Assignment &Quiz
8	4	Understand the principles of instrumentation, including sensors, transmitters, and controllers.	**GENERAL APPLICATION OF ENERGY BALANCES FOR CLOSED SYSTEM IN THE ABSENCE OF CHEMICAL REACTION**	1,2	Assignment &Quiz
9	4	Understand the principles of control systems, including PID control and tuning.	**BASIC ENERGY BALANCES FOR <u>OPEN</u> PROCESSES WITH OUT CHEMICAL REACTION (**Open steady and un steady state system**,** Conservation of Energy for a Control Volume Open Systems)	1,2	Assignment &Quiz
10	4	Understand the principles of plant design, including layout, materials, and energy efficiency.	**GENERAL APPLICATION OF ENERGY BALANCES FOR OPEN SYSTEM IN THE ABSENCE OF CHEMICAL REACTION**	1,2	Assignment &Quiz

			(Introduction about Modeling Control Volumes at Steady State, Nozzles and Diffusers, Turbines, Compressors and Pumps**)**		
11	4	Understand the principles of economic evaluation, including cost estimation, profitability analysis, and sensitivity analysis.	**GENERAL CALCULATION OF ENTHALPY CHANGES (**Thermochemical Data for Q, U , H , C_p, and C_v , Enthalpy Change Including Phase Transitions, Tables and Charts to Retrieve Enthalpy Values**)**	1,2	Assignment &Quiz
12	4	Understand the principles of project management, including planning, scheduling, and risk management.	**HOW TO ACCOUNT ENERGY BALANCES FOR CHEMICAL REACTION (**The Objective, The Standard Heat (Enthalpy) of Formation, The Heat (Enthalpy) of Reaction, Merging the Heat of Formation with the Sensible of a Compound in Making an Energy Balance, The Heat of Combustion**)**	1,2	Assignment &Quiz
13	4	Use mathematical and analytical skills to solve complex chemical engineering problems.	**IDEAL PROCESSES**	1,2	Assignment &Quiz
14	4	Use critical thinking to analyze and solve complex problems.	**HUMIDITY CHARTS AND THEIR USE**	1,2	Assignment &Quiz
15	4	Final exam	**COMPUTER AIDED BALANCE CALCULATIONS**	1,2	
287. Course Evaluation					

Monthly Exam: 20 Mark Quizzes: 10 Mark Assignment and Other Activities:10 Mark Final Exam: 40 Mark

288. Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	