Ministry of Higher Education and Scientific Research
Scientific Supervision and Scientific Evaluation
Quality Assurance and Performance Evaluation Division

Academic Programand Course Description Chemical Engineering Department

2025 - 2026

Introduction:

The educational program is a well-planned set of courses that include procedures and experiences arranged in the form of an academic syllabus. Its main goal is to improve and build graduates' skills so they are ready for the job market. The program is reviewed and evaluated every year through internal or external audit procedures and programs like the External Examiner Program. The academic program description is a short summary of the main features of the program and its courses. It shows what skills students are working to develop based on the program's goals. This description is very important because it is the main part of getting the program accredited, and it is written by the teaching staff together under the supervision of scientific committees in the scientific departments. This guide, in its second version, includes a description of the academic program after updating the subjects and paragraphs of the previous guide in light of the updates and developments of the educational system in Iraq, which included the description of the academic program in its traditional form (annual, quarterly), as well as the adoption of the academic program description circulated according to the letter of the Department of Studies T 3/2906 on 3/5/2023 regarding the programs that adopt the Bologna Process as the basis for their work. In this regard, we can only emphasize the importance of writing an academic programs and course description to ensure the proper functioning of the educational process.

Concepts and terminology:

Academic Program Description: The academic program description provides a brief summary of its vision, mission and objectives, including an accurate description of the targeted learning outcomes according to specific learning strategies.

Course Description: Provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the students to achieve, proving whether they have made the most of the available learning opportunities. It is derived from the program description.

Program Vision: An ambitious picture for the future of the academic program to be sophisticated, inspiring, stimulating, realistic and applicable.

Program Mission: Briefly outlines the objectives and activities necessary to achieve them and defines the program's development paths and directions. **Program Objectives:** They are statements that describe what the academic program intends to achieve within a specific period of time and are measurable and observable.

Curriculum Structure: All courses / subjects included in the academic program according to the approved learning system (quarterly, annual, Bologna Process) whether it is a requirement (ministry, university, college and scientific department) with the number of credit hours. Learning Outcomes: A compatible set of knowledge, skills and values acquired by students after the successful completion of the academic program and must determine the learning outcomes of each course in a way that achieves the objectives of the program.

Teaching and learning strategies: They are the strategies used by the faculty members to develop students' teaching and learning, and they are plans that are

followed to reach the learning goals. They describe all classroom and extracurricular activities to achieve the learning outcomes of the program.

Academic Program Description Form

University Name: University of Diyala

Faculty/Institute: College of Engineering

Scientific Department: Chemical Engineering Department

Academic or Professional Program Name: Bachelor

Final Certificate Name: Bachelor of Science in Chemical Engineering

Academic System: Course

Description Preparation Date: 2026

File Completion Date: 30 / 6 /2026

Signature:

Head of Department Name:

Lect. Dr. Muwafaq Mahdi Abd

Date: 30/6/2026

Signature:

Scientific Associate Name:

Prof. Dr. Jabar Qasim Jabar

Date: 30/6/2026

The file is checked by: Assist. Prof. Dr. Salah N. Farhan

Department of Quality Assurance and University Performance

Director of the Quality Assurance and University Performance Department: Date:

Signature: 30/6/2026

Approval of the Dean

Prof. Dr. Anees Abdullah Khadom

Scanned with CamScanner

Academic Program Description Form

1. Program Vision

The vision of the Chemical Engineering Department is to be recognized as one of the distinguished departments in its education, research and outreach programs.

• Hopping to be a world-renowned department, advancing the contributions of chemical engineering through innovation, research, education, and social responsibility.

• Making every effort to provide the student with the foundations of modern knowledge and scientific research methods in the fields of chemical engineering.

• Working to develop the students' personality to make them capable of innovation, leadership, self-learning, and teamwork.

• Developing curricula periodically and according to local and international standards.

• Opening horizons of cooperation between the Department of Chemical Engineering and the departments of faculties of the University of Diyala and the corresponding departments in Iraqi universities.

2. Program Mission

• Preparing engineers with competence and scientific knowledge in the of chemical engineering and its technological developments.

• Enabling the graduate student to possess the skills in designing production units, oil, petrochemical, food and pharmaceutical industries.

• Preparing engineers capable for operate and manage factories related to chemical engineering specializations by focusing on the theoretical aspects and linking them to the practical aspect.

• Preparing the graduates to continue postgraduate studies in various fields of chemical engineering.

• Study the market needs for new and necessary branches of chemical engineering and implement it.

•Make contact with the community's needs for chemical engineering specializations by preparing highly qualified graduates.

• Working to develop teaching and learning methods and adopting modern methods in addition to traditional one.

• Contributing to providing academic and scientific consultations and developing services in Diyala Governorate in particular and Iraq in general.

3. Program Objectives

- Graduating effective scientific cadres who are distinguished scientifically and practically and are characterized by sound professional ethics and honesty.
- Promoting scientific research and encouraging creativity and innovators in the fields and applications of chemical technology.
- Providing an environment for stimulating the scientific thoughts.
- acquiring the local and international academic accreditation.

4. Program Accreditation

The department submitted an application to obtain program accreditation from the Iraqi Council for Engineering Accreditation

5. Other external influences

All relevant ministries in dealing with this program, such as the Ministry of Oil, Industry, Environment, and others

6. Program Structure

Program Structure	Number of Courses	Credit Hours	Percentage	Reviews
Institution Requirements	**0**	**0**	**0%**	
College Requirements	**4**	**10**	**9.1%**	
Department Requirements	**44**	**110**	**90.1%**	
Summer Training	**1 month**	**Without credit**	**-**	**Compulsory training**
Others				

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

7. Program Description

Year	Course code	Course Name	Credit Hours	
			Theoretical	**Practical**
Year 1/ Semester 1	E 101	Mathematics I	4	0
	CHE 101	Organic Chemistry	2	2
	CHE 102	Principles of Chemical Engineering	4	0
	CHE 103	Engineering Mechanics	3	0
	U 101	Democracy and Human Rights	2	0
	U 103	Computer skills	1	2
Year 1/ Semester 2	E 102	Mathematics II	4	0
	CHE 104	Analytical Chemistry	2	2
	CHE 105	Material Balance	4	0
	CHE 106	Engineering Drawing	1	3
	U 104	English Language	2	0
	CHE 107	Workshop Engineering	0	3
	UD02	Arabic Language	2	0
Year 2/ Semester 1	E201	Engineering Mathematics I	4	
	Ch. E202	Fluid Flow I	4	
	Ch. E203	Physical Chemistry I	3	
	Ch. E204	Petroleum and Gas Technology	3	2
	Ch. E205	Visual Basic programming	2	2
	Ch. E206	Principles of Chemical Engineering III	3	
	Ch. E207	Environmental Pollution	2	
	Ch. E208	Statistic and probability	1	
Year 2/ Semester 2	E202	Engineering Mathematics II	4	
	Ch. E210	Fluid Flow II	4	2
	Ch. E211	Green Chemical Technology	2	
	Ch. E212	Physical Chemistry II	3	2
	Ch. E213	Instrumentation and Chemical Analysis	2	
	Ch. E214	MATLAB for Engineers	2	2
	Ch. E215	Industrial Safety	2	

Year 3/ Semester 1	Ch. E301	Applied Mathematics	3	
	Ch. E302	Mass transfer I	4	
	Ch. E303	Biochemical Engineering	2	
	Ch. E304	Food Engineering	2	
	Ch. E305	Heat transfer I	4	2
	Ch. E306	Thermodynamics I	3	
	Ch. E307	Materials Science and Technology	2	2
	Ch. E308	Industrial Managements	2	
Year 3/ Semester 2	Ch. E309	Numerical and Optimization methods	3	
	Ch. E310	Mass transfer II	4	2
	Ch. E311	Economics of Chemical Engineering	2	
	Ch. E312	Combustion engineering	2	
	Ch. E313	Heat transfer II	4	
	Ch. E314	Thermodynamics II	3	
	Ch. E315	Chemical and petrochemical Industries	3	2
	Ch. E316	Polymer technology	2	
Year 4/ Semester 1	E402	Graduation Project	1	2
	Ch. E402	Units Operation I	4	2
	Ch. E403	Processes Control I	3	
	Ch. E404	Reactor Design I	3	
	Ch. E405	Petroleum Refinery I	3	
	Ch. E406	Equipment Design	3	
	Ch. E407	Corrosion Engineering	2	
Year 4/ Semester 2	E402	Graduation Project	1	2
	Ch. E409	Units Operation II	4	
	Ch. E410	Processes Control II	3	2
	Ch. E411	Reactor Design II	4	
	Ch. E412	Petroleum Refinery II	3	
	Ch. E413	Natural gas processing	2	
	E401	Engineering Profession Ethics	1	

8. Extended learning outcomes of the program

A- Knowledge	
1- Knowledge and understanding	➢ Knowing the facts, concepts, principles and theories of chemical engineering, and understanding the determinants and constraints facing the engineer's work for the purpose of making the right decision. ➢ Understanding basic mathematical derivations and linking various phenomena with equations and laws to determine the variables that govern the industrial unit. ➢ The ability to know the optimal conditions for industrial work and manage it correctly.
2- Awareness and understanding	➢ Awareness of industrial problems that may be specific to known or unknown circumstances. ➢ Analyze and discuss available data or conduct specific experiments to obtain more data.
3- Ability to apply	➢ Design units and processes and make the necessary improvements. ➢ The ability to apply new technologies within the general jurisdiction. ➢ Having a comprehensive view of industrial engineering problems, taking into account cost, safety and quality
Skills	
1- The ability to use a variety of sources of understanding 2- Conduct successful laboratory experiments or design a safe experiment and extract important data 3- Work ethically and have the ability to identify and identify risks	➢ Using multiple techniques and devices related to the specialty. ➢ Using laboratory equipment to find data. ➢ Develop and provide a safe work environment by selecting the most appropriate devices and equipment.
Ethics	
1- Professional work, taking into account costs and occupational safety 2- Working in the spirit of one team and ensuring human victory 3- Anticipating problems and finding appropriate solutions to them	➢ Ethics and professionalism of the profession. ➢ The impact of industrial activities on society, both negatively and positively. ➢ Compatibility with environmental issues and environmental preservation

9. Teaching and Learning Strategies

1. Theoretical lectures with the use of illustrations.
2. Practical laboratory application of concepts taught theoretically
3. Assigning students to perform seminars by assigning them a topic to be discussed with their colleagues
4. Solve problems, discuss them, and assign students some homework and reports through the e-learning platform.

10. Evaluation methods

• Sudden exams (5) marks
• Monthly exams (25) marks

- Reports assigned to them (5) degrees
- Homework assignments (5) marks
- A final examination of the curriculum (60 marks).

11. Facility

Facility Members

Academic Rank	Specialization		Special Requirements / Skills		Number of Teaching	
	General	Special			Staf	lecture
Prof. Dr. Anees A. Khadom	Chemical Engineering	Corrosion			staff	
Prof. Dr. Ahmed Daham Wiheeb	Chemical Engineering	Mass transfer			staff	
Ass. Prof. Dr. Salah N. Farhan	Chemical Engineering	Biochemical Engineering			staff	
Ass. Prof. Dr. Adiba Alnuaimi	Chemical Engineering	Electrochemistry			staff	
Lec. Dr. Ali Z. Alhassan	Chemical Engineering	Unit operation			staff	
Lec. Dr. Muwafaq Mahdi Abd	Chemical Engineering	Fluid Flow			staff	
Lec. Dr. Muhammed Faiq	Chemical Engineering	Mass transfer			staff	
Lec. Dr. Mohammed H. Msaed	Chemical Engineering	Reactor Design			staff	
Assistant Lecturer Nabaa B. Ali	Science of Chemistry	Physical Chemistry			staff	
Ass. Prof. Mohammad A. Hameed	college of Literature	Hebrew language			staff	
Lec. Dr. Ahmed Abbas	Chemical Engineering	Corrosion			staff	
Assistant Lecturer Ali I. Abdalla	Electrical Engineering	Power Converters			staff	
Ass. Prof. Sura Fahmy Yousif	Communication engineering	Image processing			staff	
Assistant Lecturer Whalaa A. Alkhaisi	Petroleum Engineering	Drilling wells			staff	
Ass. Prof. Yaser I. Jasem	Civil Engineering	Environmental Engineering			staff	
Ass. Prof. Mustafa S Mahdi	Mechanical Engineering	Thermal engineering			staff	
Lec. Khalid Al Dolaimy	Mechanical Engineering	Mechanical Design			staff	
Lec. Mohammed k. Mohammed	Nuclear engineering	Environmental Engineering			staff	
Lec. Mohanad A. Sultan	Science of Chemistry	Organic Chemistry			staff	
Ilaf W. Ibrahim	General Law	Human Rights			staff	
Lec. Mutaz H. Ismael	Chemical engineering	Oil Refinery			staff	

Professional Development
Orienting new faculty members
New teaching staff are developed by putting them in central development courses organized by the university, as well as by interacting with senior staff during periodic meetings in the department for the purpose of introducing them to the work contexts and informing them of directives and instructions, along with giving advice, daily guidance and continuous follow-up.
Professional Development of faculty members
Professional development for faculty members takes place through the Divisions of Continuing Education and Academic Affairs in the Deanship of the College and its corresponding departments in the University, which constantly work to hold discussion circles and specialized scientific seminars, while reviewing what is published on the Internet sites of books and periodicals in various scientific specializations.

12- Acceptance criterion

Admission is centralized by the Ministry of Higher Education and Scientific Research according to the grade point average of the students obtained in the sixth scientific stage.

13- The most important sources of information about the program

- Diyala University website / College of Engineering / Department of Chemical Engineering

Website of the Ministry of Higher Education and Scientific Research

11- Program development plan

- Development is carried out by focusing on the advanced scientific staff in the department and through the committees formed annually, especially the Scientific Committee and the Quality Assurance and Academic Accreditation Committee.
- By preparing evaluation studies to prepare and develop senior leadership cadres in all aspects of the educational institution.
- Equipping scientific laboratories with modern equipment and qualifying their cadres in order to improve the most efficient performance.
- Develop future plans and work to implement them
- Creating a kind of competition among researchers, honoring the distinguished ones and motivating them to give more.
- Working to create a kind of financial income for the department to sustain and develop the work
- Supporting the department's first-in-class admission program annually and enrolling them in postgraduate studies.
- Conducting a twinning process with advanced universities and providing training opportunities for teaching staff in those universities

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Program Skills Outline															
				program Learning outcomes											
Year/ Level	CourseCode	CourseName	Basic or optional	Required Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
Fourth Year / First Course	E402	Graduation Project	Basic	√			√			√			√		√
	Ch. E402	Units Operation I	Basic			√			√		√				√
	Ch. E403	Processes Control I	Basic	√			√				√		√		
	Ch. E404	Reactor Design I	Basic			√			√			√		√	√
	Ch. E405	Petroleum Refinery I	Basic		√			√		√				√	
	Ch. E406	Equipment Design	Basic	√			√				√		√		
	Ch. E407	Corrosion Engineering	Optional			√			√			√		√	√
	E402	Graduation Project	Basic		√			√		√				√	
Fourth Year / Second Course	Ch. E409	Units Operation II	Basic	√			√				√		√		
	Ch. E410	Processes Control II	Basic			√			√			√		√	√
	Ch. E411	Reactor Design II	Basic		√			√		√				√	
	Ch. E412	Petroleum Refinery II	Basic	√			√				√		√		
	Ch. E413	Natural gas processing	Optional			√			√			√		√	√
	E401	Engineering Profession Ethics	Basic	√		√	√	√		√				√	√

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

FIRST YEAR

POLONGA PROSSE

SECOND YEAR

POLONGA PROSSE

THIRD YEAR

POLONGA PROSSE

FOURTH YEAR

Course Description Form

1. CourseName:
Control process I
2. Course Code:
Ch.E410
3. Semester/Year:
Course I 2025-2026
4. Description Preparation Date:
4-7-2025
5.AvailableAttendanceForms:
6.Number of Credit Hours (Total)/Number of Units (Total)
60/ 3
7.Courseadministrator's name (mention all, if more than one name)
Name:
8. Course Objectives

Course Objectives	1. To enhancement the ability of students for the analysis of closed-loop system and response of controlled system under different operating conditions. 2. Construction of transfer function of the closed system for different schemes. 3. Provide practice of tuning of controller parameters and limiting of stable operating conditions. 4. Motivation and encourage the students for solving open ended problems

9. Teaching and Learning Strategies	
Strategy	Course divide to attendance lectures, tutorials, Exam, Assignments , and reports.

10. Course Structure

Week	Hours	The output requirements	Unit or subject name	Learning Method	Evaluation method
1	3	Transient Response of complex Control Systems		• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.
2,3	6	• Transient Response of complex Control Systems		• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.
4	3	Stability		• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.
5	3	Introduction to Frequency Response, Bode Diagrams		• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.
6		System Design by Frequency Response .		• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.

7	3	Ziegler-Nichols Controller Settings.		• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.
8	3	• Pneumatic Controller Mechanisms		• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.
9,10	6	Industrial Pneumatic Controller		• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.
11	3	Control of Complex Processes		• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.
12	3	Control of Distillation Column		• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.

13	3	Control of Heat Exchanger		• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.
14	3	• Control of Chemical Reactor		• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.
15	3	Feed-forward Control, Ratio Control		• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.
16	3	• Computer Control Loops		• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.

11.Cours Evaluation

1. Quizzes: - There will be (4) closed books and notes quizzes during the semester. - The quizzes will count 7% of the total module grade.
2. Mid-Term Test, 1 Nos. and will count 10% of the total module grade.
3. Homework and assignments, and will count 7% of the total module grade.
4. Seminars and oral & ppt. presentations, and will count 6% of the total module grade.
5. Extracurricular Activities, this is optional and will count extra marks (1–5%) for the student, depending on the type of activity.
6. Final Exam: - The final exam will be comprehensive, closed books and notes, and will take place on (Saturday-6 th - January / 20) from 9:00 AM - 12:00 PM in rooms () - The final exam will count 70% of the total module grade

12.Learning and Teaching Resources

1. D.R. Coughanowr and S. LeBlanc, Process Systems Analysis and Control, McGraw-Hill, 3nd edition, 2008.
2. Stephanopoulos G., "Chemical Process Control-An Introduction to Theory and Practice, "Prentice -Hall, New Jersey, 1984.

Other support books :-

1. Luyben W. L., "Process Modeling, Simulation and Control for Chemical Engineers," McGraw-Hill, New York, 2nd Ed., 1990 .
2. *Process Dynamics: Modeling, Analysis and Simulation, by Wayne Bequette.*

Course Description Form

1. Course Name:
Unit Operation I
2. Course Code:
Ch. E402
3. Semester / Year:
Course I 2025-2026
4. Description Preparation Date:
21/7/2025
5. Available Attendance Forms:
Available forms of attendance: direct attendance (in the hall) or indirect (e-learning)
6. Number of Credit Hours (Total) / Number of Units (Total)
60 hrs/ (4 Units)
7. Course administrator's name (mention all, if more than one name)
Name: Lec. Dr. Muwafaq Mahdi Abd Email: muwafaq8@uodiyala.edu.iq

8. Course Objectives

Course Objectives	(1) Accomplishing the university's goals within the field of chemical engineering; (2) gives a sound education in the basics of chemical engineering; (3) develop the skills and confidence necessary to solve, based on engineering and scientific principles, problems in the biochemical, chemical and other industries; (4) continue to find graduates of high caliber; (5) Providing education compatible with the needs of the labor market linked to the Syndicate of Chemical Engineers.

9. Teaching and Learning Strategies

Strategies	➢ Theoretical lectures with the use of illustrations. ➢ Practical laboratory application of concepts taught theoretically ➢ Assigning students to perform seminars by assigning them a topic to be discussed by their colleagues ➢ Solve problems, discuss them, and assign students some homework and reports through the e-learning platform

10. Course Structure

Week	Hours	The output requirements	Unit or subject name	Learning Method	Evaluation method
1	4	1. Units Operation (physical). 2. Units Operation (chemical). 3. Raw materials, processes and products. 4. Basic principles of units operation. The type of operations, the forces responsible for them, and the resistance for each type.	Introduction to the unit operation	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
2-4	8	1. Types of fluid flow Molecular diffusion, Eddy motions.	Momentum, mass and heat transfer	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
5-6	8	1- Reynolds' theory momentum, and heat transfer Reynolds' developed theory of heat and mass.	Reynolds Analogy	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
7-9	12	1. How the boundary layer develops. 2. The boundary layer in the stratigraphic and turbulent flow. 3. Coefficient of friction in turbulent flow. 4. Application of the boundary layer theory in tube flow The boundary layer in heat transfer.	Boundary layer	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
10-11	8	1. Free and aggregated sedimentation 2. The theory of the motion of molecules in a fluid 3. Equations of falling velocity Sedimentation devices	Solid particles movement through fluids	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
12-13	8	1. Darcy's equation and transmittance 2. Kozeny–Carman equation and its hypotheses. Retained fluid	The flow through the backed bed	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
14-15	8	1. Using Fluidization advantages and disadvantages 2. Types of Fluidization 3. Calculate the initial liquefaction speed Arkin equation	Fluidization	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture

11.Cours Evaluation

• Sudden exams (5 Marks).
• Monthly exams (25) marks
• Seminars + homework (5 marks).
• Reports (5) degrees
• A final examination of the curriculum (60 Marks).

12. Learning and Teaching Resources

1- Required prescribed books	1. Martin R., Introduction to Particle Technology, Second edition, John Wiley & Sons, Ltd. 2008. 2. McCabe W.L., Smith J.C. & Harriott P., Unit Operations of Chemical Engineering, Fifth edition, McGraw Hill. 1993.
2- Main references (sources)	1. Coulson J.M. & Richardson J.F., Chemical Engineering, Volume 1, six edition, ELBS, Pergamum Press. 2002. 2. Coulson J.M. & Richardson J.F., Chemical Engineering, Volume 2, Fifth edition, ELBS, Pergamon Press. 2002.
Mainstream recommended books and references (scientific journals, Reports.....)	• Chemical Engineering Journal • Chemical Engineering Science
Electronic references and websites	• The ChemEng Student Blog • The Chemical Engineer. • AIChE | All Conferences & Events

Course Description Form

1. Course Name:
Unit Operation II
2. Course Code:
Ch. E409
3. Semester / Year:
Course II 2025-2026
4. Description Preparation Date:
21/7/2025
5. Available Attendance Forms:
Available forms of attendance: direct attendance (in the hall) or indirect (e-learning)
6. Number of Credit Hours (Total) / Number of Units (Total)
60 hrs/ (4 Units)
7. Course administrator's name (mention all, if more than one name)
Name: Lec. Dr. Muwafaq Mahdi Abd Email: muwafaq8@uodiyala.edu.iq

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Strategies	➢ Theoretical lectures with the use of illustrations. ➢ Practical laboratory application of concepts taught theoretically ➢ Assigning students to perform seminars by assigning them a topic to be discussed by their colleagues ➢ Solve problems, discuss them, and assign students some homework and reports through the e-learning platform

10. Course Structure

Week	Hours	The output requirements	Unit or subject name	Learning Method	Evaluation method
1-4	16	5. Type of Filters, Filtration theory 6. Plate and frame filter press, leaf filter. 7. Basic principles of unit operation. 8. filtration at Constant ΔP 9. Filtration at Constant rate Washing Time.	Filtration	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
5-6	8	1. Membrane Separation Process. 2. Molecular diffusion, Eddy motions.	Mechanical Separation	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
7-10	16	5. Introduction and general Principle in drying. 6. Rate of drying, the mechanism of moisture movement. 7. Calculation of rate of drying, moisture transport in Solids at Constant in Continuous dryers. 8. Types of Dryers and falling rate Period Capillary movement	Drying	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
11-13	10	1. Temperature humidity Chart for air – water system 2. Enthalpy – humidity – temperature chart 3. Addition of Vapor or liquid Stream to a gas stream.	Humidification	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
13-15	10	1. Evaluation of heat and Mass transfer Coefficient 2. Cooling tower, height of Packing in Cooling towers 3. Minimum gas Condition	Mechanism of dehumidification	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture

11.Cours Evaluation

• Sudden exams (5 Marks).
• Monthly exams (25) marks
• Seminars + homework (5 marks).
• Reports (5) degrees
• A final examination of the curriculum (60 Marks).

12. Learning and Teaching Resources

1- Required prescribed books	3. Martin R., Introduction to Particle Technology, Second edition, John Wiley & Sons, Ltd. 2008. 4. McCabe W.L., Smith J.C. & Harriott P., Unit Operations of Chemical Engineering, Fifth edition, McGraw Hill. 1993.
2- Main references (sources)	3. Coulson J.M. & Richardson J.F., Chemical Engineering, Volume 1, six edition, ELBS, Pergamum Press. 2002. 4. Coulson J.M. & Richardson J.F., Chemical Engineering, Volume 2, Fifth edition, ELBS, Pergamon Press. 2002.
Mainstream recommended books and references (scientific journals, Reports.....)	• Chemical Engineering Journal • Chemical Engineering Science
Electronic references and websites	• The ChemEng Student Blog • The Chemical Engineer. • AIChE | All Conferences & Events

Course Description Form

1. Course Name:	
Petroleum Refinery I	
2. Course Code:	
Ch.E412	
3. Semester / Year:	
Course I / 2025 - 2026	
4. Description Preparation Date:	
22/7/2025	
5. Available Attendance Forms:	
Mandatory attendance	
6. Number of Credit Hours (Total) / Number of Units (Total)	
3 hrs/ 2 units	
7. Course administrator's name (mention all, if more than one name)	
Name: Dr. Alyaa Mohammed Awad **Email: dr.Alyaa8934@gmail.com**	
8. Course Objectives	
Course Objectives	1. Basic understanding of refining processes: Provide students with basic knowledge about the various processes used in petroleum refining, such as distillation, chemical separation, and hydrotreatment. 2. Practical applications: Teaching students how to apply theoretical knowledge in practical contexts, such as operating and maintaining refining equipment and using modern technology in industry. 3. Problem analysis and solution: Develop students' critical and analytical thinking skills so they can analyze problems related to oil refining and find appropriate solutions. 4. Occupational safety and health: Emphasizing the importance of occupational safety and health procedures in the refining environment, and teaching students how to recognize and deal with hazards. 5. Environmental Impact: Educating students about the environmental impacts of refining processes and how to reduce harmful emissions and waste. 6. Technological developments: Introducing students to the latest technological developments in the field of oil refining and how to benefit from them to improve the efficiency of operations. 7. Economic aspects: Understanding the economic dimensions of refining operations, including costs, returns, and financial challenges associated with the industry
9. Teaching and Learning Strategies	

Strategy	• Explaining basic concepts: Providing theoretical lectures that explain the basic processes of oil refining. • Use teaching aids: Make use of presentations, diagrams, and videos to explain processes and concepts clearly. • Group Discussions: Organizing group discussions to stimulate critical thinking and exchange of ideas among students. • Organizing field visits to oil refineries to familiarize students with the practical environment. • Providing constructive feedback to improve performance. • Providing digital study materials to provide easy access to information. • Promoting awareness of the importance of safety in the work environment.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	At the end of this learning unit, the student is able to : **1.** Explain the different processes of oil refining such as distillation, chemical separation, and hydrotreatment. **2.** Identify the different stages in the refining process and the devices used in it. **3.** Using modern technologies in refining operations and analyzing their results. **4.** Analyze problems related to oil refining using critical thinking skills. **5.** Proposing effective solutions to operational and technical problems in refineries. **6.** Apply	Petroleum Processing Overview. History of Petroleum Production	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
2	3		What is Petroleum, History of Petroleum Processing,	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
3	3		Modern Petroleum Processing.	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
4	3		Refinery Feed-stocks and Products	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
5	3		Thermo-physical Properties of Petroleum Fractions and Crude Oils	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams

6	3	occupational safety and health procedures in the refining environment. **7.** Identify potential risks and how to deal with them to reduce accidents. **8.** Keeping up with the latest technological developments in the field of oil refining. **9.** Applying modern technology to improve process efficiency and reduce costs. **10.** Contributing to research and development to develop new technologies and methods in oil refining. **11.** Providing new ideas to improve operations and increase their efficiency. **12.** Analysis of costs and returns associated with refining operations. Understand the financial challenges facing the refining industry and how to overcome them. 13.Understand the	Specific Gravity, Boiling Point Curves, Breakup of TBP Curve into Pseudo-components, Thermo-physical Properties Calculation	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
7	3		Crude Distillation Desalting Crude Oils	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
8	3		First exam - first semester	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
9	3		Crude Distillation Desalting Crude Oils	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
10	3		Atmospheric Distillation Unit	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
11	3		Material and Energy Balances	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams

12	3	financial challenges facing the refining industry and how to overcome them.	Reflux, Over flash, Overhead Temperature.	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
13	3		Side Draw Temperature	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
14	3		Bottom Temperature, Tower Diameter	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
15	3		Vacuum Distillation Unit.	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams

11.Cours Evaluation

Distribution of the grade out of 100 according to the tasks assigned to the student, such as daily preparation, daily, oral, monthly, written exams, reports, etc.

12. Learning and Teaching Resources

- **W.L. Nelson, Petroleum Refinery Engineering, 1991, MacGraw Hill.**
- **S. Parkash, Refining Processes Handbook, 2003, Elsevier / GPP.**
- **Fahim, Mohamed A., Taher A. Al-Sahhaf, and AmalElkilani. Fundamentals of petroleum refining. Elsevier, 2009.**
- **G.D. Hobson:, Modern Petroleum technology, 1991, Applied Sc. Publisher**
- **J.H. Cary and G.E Handwork,Petroleum Refinery Technology & Economics , ,2001Dekker**
- **Oil and Gas Journal**

Course Description Form

1. Course Name:	
Petroleum Refinery II	
2. Course Code:	
Ch.E412	
3. Semester / Year:	
Course II / 2025 - 2026	
4. Description Preparation Date:	
22/7/2025	
5. Available Attendance Forms:	
Mandatory attendance	
6. Number of Credit Hours (Total) / Number of Units (Total)	
3 hrs/ 2 units	
7. Course administrator's name (mention all, if more than one name)	
Name: Dr. Alyaa Mohammed Awad **Email: dr.Alyaa8934@gmail.com**	
8. Course Objectives	
Course Objectives	1. Basic understanding of refining processes: Provide students with basic knowledge about the various processes used in petroleum refining, such as distillation, chemical separation, and hydrotreatment. 2. Practical applications: Teaching students how to apply theoretical knowledge in practical contexts, such as operating and maintaining refining equipment and using modern technology in industry. 3. Problem analysis and solution: Develop students' critical and analytical thinking skills so they can analyze problems related to oil refining and find appropriate solutions. 4. Occupational safety and health: Emphasizing the importance of occupational safety and health procedures in the refining environment, and teaching students how to recognize and deal with hazards. 5. Environmental Impact: Educating students about the environmental impacts of refining processes and how to reduce harmful emissions and waste. 6. Technological developments: Introducing students to the latest technological developments in the field of oil refining and how to benefit from them to improve the efficiency of operations. 7. Economic aspects: Understanding the economic dimensions of refining operations, including costs, returns, and financial challenges associated with the industry
9. Teaching and Learning Strategies	

Strategy	• Explaining basic concepts: Providing theoretical lectures that explain the basic processes of oil refining. • Use teaching aids: Make use of presentations, diagrams, and videos to explain processes and concepts clearly. • Group Discussions: Organizing group discussions to stimulate critical thinking and exchange of ideas among students. • Organizing field visits to oil refineries to familiarize students with the practical environment. • Providing constructive feedback to improve performance. • Providing digital study materials to provide easy access to information. • Promoting awareness of the importance of safety in the work environment.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	At the end of this learning unit, the student is able to : **13.** Explain the different processes of oil refining such as distillation, chemical separation, and hydrotreatment. **14.** Identify the different stages in the refining process and the devices used in it. **15.** Using modern technologies in refining operations and analyzing their results. **16.** Analyze problems related to oil refining using critical thinking skills. **17.** Proposing effective solutions to operational and technical problems in refineries. **18.** Apply	Conversion Processes Visbreaking	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
2	3		Coking, Fluid Catalytic Cracking	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
3	3		Hydrotreating and Hydrocracking	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
4	3		Upgrading Naphtha Catalytic Reforming	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
5	3		Isomerization	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams

6	3	occupational safety and health procedures in the refining environment. **19.** Identify potential risks and how to deal with them to reduce accidents. **20.** Keeping up with the latest technological developments in the field of oil refining. **21.** Applying modern technology to improve process efficiency and reduce costs. **22.** Contributing to research and development to develop new technologies and methods in oil refining. **23.** Providing new ideas to improve operations and increase their efficiency. **24.** Analysis of costs and returns associated with refining operations. Understand the financial challenges facing the refining industry and how to overcome them. 13.Understand the	Product Blending	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
7	3		Reid Vapor Pressure, Octane Blending. Supporting Processes Hydrogen Production	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
8	3		Mid Examination	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
9	3		Gas Processing Unit	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
10	3		Acid Gas Removal	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
11	3		Sulfur Recovery Processes	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams

12	3	financial challenges facing the refining industry and how to overcome them.	Chemical Treatment of Petroleum Products	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
13	3		Oil Products	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
14	3		Lubricating Oils	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
15	3		Safety and Environmental Aspects in Refining	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams

11.Cours Evaluation

Distribution of the grade out of 100 according to the tasks assigned to the student, such as daily preparation, daily, oral, monthly, written exams, reports, etc.

12. Learning and Teaching Resources

- **W.L. Nelson, Petroleum Refinery Engineering, 1991, MacGraw Hill.**
- **S. Parkash, Refining Processes Handbook, 2003, Elsevier / GPP.**
- **Fahim, Mohamed A., Taher A. Al-Sahhaf, and AmalElkilani. Fundamentals of petroleum refining. Elsevier, 2009.**
- **G.D. Hobson:, Modern Petroleum technology, 1991, Applied Sc. Publisher**
- **J.H. Cary and G.E Handwork,Petroleum Refinery Technology & Economics , ,2001Dekker**
- **Oil and Gas Journal**

Course Description Form

1. Course Name:
Reactor Design I
2. Course Code:
ChE202
3. Semester / Year:
Course I 2025 -2026
4. Description Preparation Date:
25-7-2025
5. Available Attendance Forms:
6. Number of Credit Hours (Total) / Number of Units (Total)
3 hrs
7. Course administrator's name (mention all, if more than one name)
Name: Assist Prof Salah N. Farhan **Email: drsalahchem@uodiyala.edu.iq**
8. Course Objectives

Course Objectives	a) Establish reaction mechanism b) Collect rate data free of transport limitations. c) Correlate rate data by mathematical equation or otherwise. d) Formulate suitable models for reactor design and select reactor type (i.e. ideal flow pattern). e) Account for nonideality of real reactors and for the effect of physical transport processes. f) Select reactor size and operating conditions. g) Specify key reactor elements. h) Specify auxiliary equipment. i) Specify methods of control. j) Specify start-up and shut-down procedures

9. Teaching and Learning Strategies	
Strategy	Course divide to attendance lectures , tutorials, Exam, Assignments , and reports.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	• Define the rate of chemical reactions • Apply the mole balance equations to batch reactors, CSTRs, PFRs, and PBRs • Describe two industrial reaction engineering systems • Describe photos of real reactors.	**Mole Balances**	• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.
2,3	6	• Calculate the equilibrium conversion for both gas and liquid phase reactions • Write the combined mole balance and rate law in measures other than conversion • Set up a stoichiometric table for reactions with phase change	**Conversion and Reactor Sizing,** Stoichiometry of Gas Phase Reactions Stoichiometry - Gas Phase Batch CSTR	• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.

4	3	• Apply CRE algorithm to gas phase • Account for the effects of pressure drop conversion in packed bed tubular reactors and in packed bed spherical reactors Answer what if... questions	Gas Phase Reactions with Pressure Drop Objectives	• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.
5	3	• Write balance equations in measure other than conversion and apply these balance evaluations to membrane reactors and semibatch reactors	Measures Other Than Conversion, Membrane Reactors and Semibatch Reactors Objectives	• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.
6		• Determine the reaction order and specific reaction rate from experimental data obtained for either batch or flow reactors • Describe how to use equal-area differentiatio	Analysis of Data	• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.

		n, polynomial fitting, numerical difference formulas and regression to analyze experimental data to determine the rate law			
7	3	• Define different types of selectivity and yield • Choose a reaction system that would maximize the selectivity of the desired product given the rate laws for all reactions occurring in the system	Selectivity and Relative Rates of Reaction	• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.
8	3	• Write net rates of reaction for each species present • Write the combined mole balance, rate law and stoichiometry for multiple	Algorithms for Multiple Reactions	• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.

		reactions		students are made to participate in the lecture.	
9,10	6	• Discuss each term in the energy balance • Describe the algorithm for CSTRs that are not operated isothermally Size adiabatic and nonadiabatic CSTRs	Energy Balance and Adiabatic Operation	• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.
11	3	• Discuss reactor staging for adiabatic reaction Discuss optimum impact temperatures	Energy Balance and Its Application to the CSTR	• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.
12	3	• Describe the algorithm for PFRs and PBRs with heat exchange Size adiabatic and nonadiabatic PFRs and PBRs	Derivation Energy Balance and Its Application to a PFR	• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.

				• Oral and power point presentations by the students are made to participate in the lecture.	
13	3	• Carry out an analysis to determine the Multiple Steady States (MSS) in a CSTR along with the ignition and extinction temperatures	Multiple Steady States	• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.
14	3	• Analyze multiple reactions carried out in CSTRs, PFRs and PBRs which are not operated isothermally in order to determine the concentrations and temperature as a function of position (PFR/PBR) and operating variables.	Multiple Reactions with Heat Effects	• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.

15	3	• Analyze batch reactors and semibatch not operated isothermally • Analyze the startup of nonisothermal CSTRs • Analyze multiple reactions in batch and semibatch reactors not operated isothermally	Unsteady State Nonisothermal Reactor Design	• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.
16	3	• Define a catalyst, a catalytic mechanism and a rate limiting step • Describe the steps in a catalytic mechanism and how one goes about deriving a rate law and a mechanism and rate limiting step consistent with the experimental data	Catalysis	• Lecture plan and in-class activities. • Each class will commence with a summary of the previous lecture. • Questions will be asked and the responses will be used to evaluate the students' understanding of the topics covered. • Oral and power point presentations by the students are made to participate in the lecture.	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.

11.Cours Evaluation

1. Quizzes: - There will be (4) closed books and notes quizzes during the semester. - The quizzes will count 7% of the total module grade.
2. Mid-Term Test, 1 Nos. and will count 10% of the total module grade.
3. Homework and assignments, and will count 7% of the total module grade.
4. Seminars and oral & ppt. presentations, and will count 6% of the total module grade.
5. Extracurricular Activities, this is optional and will count extra marks (1–5%) for the student, depending on the type of activity.
6. Final Exam: - The final exam will be comprehensive, closed books and notes, and will take place on (Saturday-6 th - January / 20) from 9:00 AM - 12:00 PM in rooms ( ) - The final exam will count 70% of the total module grade

12. Learning and Teaching Resources

1- Fogler, H.S. , "Element of chemical Reaction Engineering" Prentic Hall (2000).

2- Levespiel,O., "Chemical Reaction Engineering" Wiley&Sons (1999).

3- Smith,J.M.," Chemical Engineering Kinetics" 3rd ed., McGraw Hill (1981).

4-Ronald W. Missen et al., (1999), "Introduction to chemical reaction engineering and kinetics",

Course Description Form

1. Course Name:
Reactor Design II
2. Course Code:
Ch.E411
3. Semester / Year:
Courses I 2025 - 2026
4. Description Preparation Date:
21/7/2025
5. Available Attendance Forms:
Available forms of attendance: direct attendance (in the hall) or indirect (e-learning)
6. Number of Credit Hours (Total) / Number of Units (Total)
45 hrs/ (3 Units)
7. Course administrator's name (mention all, if more than one name)
Name: Assist Prof. Dr. Salah N. Farhan Email: drsalahchem@uodiyala.edu.iq

8. Course Objectives

Course Objectives	• Describe how to use equal-area differentiation, polynomial fitting, numerical difference formulas and regression to analyze experimental data to determine the rate law • Define different types of selectivity and yield • Choose a reaction system that would maximize the selectivity of the desired product given the rate laws for all reactions occurring in the system • Write net rates of reaction for each species present • Write the combined mole balance, rate law and stoichiometry for multiple reactions • Discuss each term in the energy balance • Describe the algorithm for CSTRs that are not operated isothermally • Size adiabatic and nonadiabatic CSTRs • Discuss reactor staging for adiabatic reaction • Discuss optimum impact temperatures • Describe the algorithm for PFRs and PBRs with heat exchange • Size adiabatic and nonadiabatic PFRs and PBRs • Carry out an analysis to determine the Multiple Steady States (MSS) in a CSTR along with the ignition and extinction temperatures • Analyze multiple reactions carried out in CSTRs, PFRs and PBRs which are not operated isothermally in order to determine the concentrations and temperature as a function of position (PFR/PBR) and operating variables. • Analyze batch reactors and semibatch not operated isothermally

	• Analyze the startup of nonisothermal CSTRs • Analyze multiple reactions in batch and semibatch reactors not operated isothermally Define a catalyst, a catalytic mechanism and a rate limiting step

9. Teaching and Learning Strategies

Strategies	➢ Theoretical lectures with the use of illustrations. ➢ Practical application of concepts taught theoretically ➢ Assigning students to perform seminars by assigning them a topic to be discussed by their colleagues ➢ Solve problems, discuss them, and assign students some homework and reports through the e-learning platform

10. Course Structure

Week	Hours	The output requirements	Unit or subject name	Learning Method	Evaluation method
1-2	4	Define different types of selectivity and yield Choose a reaction system that would maximize the selectivity of the desired product given the rate laws for all reactions occurring in the system	Selectivity and Relative Rates of Reaction	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
3-4	4	Write net rates of reaction for each species present Write the combined mole balance, rate law and stoichiometry for multiple reactions	Algorithms for Multiple Reactions	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
5-6	4	Discuss each term in the energy balance Describe the algorithm for CSTRs that are not operated isothermally ɛe adiabatic and nonadiabatic CSTRs	Energy Balance and Adiabatic Operation	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
7	4	Discuss reactor staging for adiabatic reaction Discuss optimum impact temperatures	Energy Balance and Its Application to the CSTR	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
8	4	Describe the algorithm for PFRs and PBRs with heat exchange Size adiabatic and nonadiabatic PFRs and PBRs	Derivation Energy Balance and Its Application to a PFR	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
9-10	4	Carry out an analysis to determine the Multiple Steady States (MSS) in a CSTR along with the ignition and extinction temperatures	Multiple Steady States	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture

11	4	Analyze multiple reactions carried out in CSTRs, PFRs and PBRs which are not operated isothermally in order to determine the concentrations and temperature as a function of position (PFR/PBR) and operating variables.	Multiple Reactions with Heat Effects	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
12	4	Analyze batch reactors and semibatch not operated isothermally Analyze the startup of nonisothermal CSTRs Analyze multiple reactions in batch and semibatch reactors not operated isothermally	Unsteady State Nonisothermal Reactor Design		
13-14	4	Define a catalyst, a catalytic mechanism and a rate limiting step Describe the steps in a catalytic mechanism and how one goes about deriving a rate law and a mechanism and rate limiting step consistent with the experimental data	Catalysis	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
15	4	Size isothermal reactors for reactions with Lanqmuir-Hinschelwood kinetics Discuss the different types of catalyst deactivation and the rector types and describe schemes that can help offset the deactivation Analyze catalyst decay and conversion for CSTRs and PFRs with temperature-time trajectories, moving bed	Catalysis	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture

11.Cours Evaluation

• Sudden exams (4 Marks).
• Monthly exams (30) marks
• Seminars + homework (6 marks).
• Reports (5) degrees
• A final examination of the curriculum (60 Marks).

12. Learning and Teaching Resources

1- Required prescribed books	
2- Main references (sources)	1- Fogler, H.S. , "Element of chemical Reaction Engineering" Prentic Hall (2000). 2-Levespiel,O., "Chemical Reaction Engineering" Wiley&Sons (1999). 3- Smith,J.M.," Chemical Engineering Kinetics" 3rd ed., McGraw Hill (1981).
Mainstream recommended books and references (scientific journals, Reports.....)	• Chemical Engineering Journal • Chemical Engineering Science
Electronic references and websites	• The ChemEng Student Blog • The Chemical Engineer. • AIChE | All Conferences & Events