Ministry of Higher Education and Scientific Research

Scientific Supervision and Scientific Evaluation Apparatus

Directorate of Quality Assurance and Academic Accreditation Department

Academic Program and Course Description
Chemical Engineering Department

2025

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: 2025

File Completion Date: 14 / 4 /2025

Signature:

Head of Department Name:

Lect. Dr. Muwafaq Mahdi Abd

Date: 14 / 4 /2025

Signature:

Scientific Associate Name:

Prof. Dr. Jabar Qasim Jabar

Date: 14 / 4 / 2025

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: 14/4/2025

Approval of the Dean

Prof. Dr. Anees Abdullah Khadom

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	**1**	**1**	**1.0%**	
College Requirements	**3**	**7**	**7.2%**	
Department Requirements	**26**	**89**	**91.8%**	
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
Third Year /Semester 1	Ch.E301	Engineering Analysis I	3	0
	Ch.E302	Mass transfer I	4	0
	Ch.E303	Biochemical Engineering	2	0
	Ch.E304	Chemical Industries	2	2
	Ch.E305	Heat transfer I	4	2
	Ch.E306	Thermodynamics I	3	0
	Ch.E307	Polymer Technology	2	0
	Ch.E308	Industrial Managements and Economics	2	0
Third Year /Semester 2	Ch.E309	Numerical Methods	3	2
	Ch.E310	Mass transfer II	4	0
	Ch.E311	Engineering Analysis II	3	0
	Ch.E312	Reactor Design I	3	0
	Ch.E313	Heat transfer II	4	0
	Ch.E314	Thermodynamics II	3	0
	Ch.E315	Petrochemical Industries	3	0
	U304	English Language III	1	0
Fourth Year /Semester 1	E402	Graduation Project	1	2
	Ch.E402	Units Operation I	4	2
	Ch.E403	Processes Control I	3	0
	Ch.E404	Reactor Design I	3	0
	Ch.E405	Petroleum Refinery I	3	0
	Ch.E406	Equipment Design	3	0
	Ch.E407	Corrosion Engineering	2	0
Fourth Year /Semester 2	E402	Graduation Project	1	2
	Ch.E409	Units Operation II	4	0
	Ch.E410	Processes Control II	3	2
	Ch.E411	Reactor Design II	4	0
	Ch.E412	Petroleum Refinery II	3	0
	Ch.E413	Natural gas processing	2	0
	E401	Engineering Profession Ethics	1	0

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	➢ Using multiple techniques and devices related to the specialty. ➢ Using laboratory equipment to find

experiments or design a safe experiment. and extract important data. 3- Work ethically and have the ability to identify and identify risks. 4- The ability to complete scientific research related to specialized subjects.	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. Evalution Method

- 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. Faculty

Faculty Members

Academic Rank	Specialization		Special Requirements / Skills (if applicable)		Number of Teaching	
	General	Special			Staff	lecture
Professor	Chemical Engineering	Corrosion			1	
Professor	Chemical Engineering	Mass transfer			1	
Assistant Professor	Chemical Engineering	Biochemical Engineering			1	
Assistant Professor	Chemical Engineering	Electrochemistry			1	
Assistant Professor	College of Languages	Hebrew language			1	
Assistant Professor	Mechanical Engineering	Thermal engineering			1	
Assistant Professor	Civil Engineering	Environmental Engineering			1	
Assistant Professor	Communication engineering	Image processing			1	
Lecturer	Chemical Engineering	Unit operation			1	
Lecturer	Chemical Engineering	Fluid Flow			1	
Lecturer	Chemical Engineering	Mass transfer			1	
Lecturer	Chemical Engineering	Reactor Design			1	
Lecturer	Chemical Engineering	Corrosion			1	
Lecturer	Chemical engineering	Oil Refinery			1	
Lecturer	Nuclear engineering	Environmental Engineering			1	
Lecturer	Mechanical Engineering	Mechanical Design			1	
Lecturer	Science of Chemistry	Organic Chemistry			1	

Lecturer	Electrical Engineering	Power Converters			1	
Assistant Lecturer	Petroleum Engineering	Drilling wells			1	
Assistant Lecturer	Science of Chemistry	Physical Chemistry			1	
Assistant Lecturer	General Law	Human Rights			1	
Assistant Lecturer	Chemical Engineering	Biochemical Engineering			2	
Assistant Lecturer	Chemical Engineering	Mass Transfer			2	

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

14- 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

				Required program Learning outcomes											
Year/ Level	Course Code	CourseName	Basic/ Option	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
Third Year / Semester 1	Ch.E301	Engineering Analysis I	Basic		√			√				√		√	
	Ch.E302	Mass transfer I	Basic	√			√			√			√		√
	Ch.E303	Biochemical Engineering	Basic			√			√		√				√
	Ch.E304	Chemical Industries	Basic	√		√	√	√		√				√	√
	Ch.E305	Heat transfer I	Basic			√			√			√		√	√
	Ch.E306	Thermodynamics I	Basic		√			√		√				√	
	Ch.E307	Polymer Technology	Basic		√			√				√		√	
	Ch.E308	Industrial Managements and Economics	Basic			√			√			√		√	√
Third Year / Semester 2	Ch.E309	Numerical Methods	Basic		√			√		√				√	
	Ch.E310	Mass Transfer II	Basic	√			√				√		√		
	Ch.E311	Engineering Analysis II	Basic	√			√				√		√		
	Ch.E312	Reactor Design I	Basic			√			√			√		√	√
	Ch.E313	Heat Transfer II	Basic	√			√				√		√		
	Ch.E314	Thermodynamics II	Basic			√			√			√		√	√
	Ch.E315	Petrochemical Industries	Basic	√		√	√	√		√				√	√

	U304	English Language III	Basic	√		√	√	√		√				√	√
Fourth Year / Semester 1	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	Basic			√			√			√		√	√
Fourth Year / Semester 2	E402	Graduation Project	Basic		√			√		√				√	
	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	Basic			√			√			√		√	√
	E401	Engineering Profession Ethics	Basic	√		√	√	√		√				√	√

THIRD YEAR (SEMESTER 1)

Engineering Analysis I

Course Description Form

1. Course Name:
Engineering Analysis I
2. Course Code:
Ch.E.301
3. Semester / Year:
Course / 1st semester / 2024
4. Description Preparation Date:
1/9/2024
5. Available Attendance Forms:
Available forms of attendance: direct attendance (in the hall)
6. Number of Credit Hours (Total) / Number of Units (Total)
45 hrs/ (2 Units)
7. Course administrator's name (mention all, if more than one name)
Name: Mohammed Faiq Mohammed AL-Kharkhi Email: muhammed_faiq_eng@uodiyala.edu.iq
8. Course Objectives

Course Objectives	1- Introduction and general review of differential equations. 2- First order differential equations. 3- Second order differential equations. 4- Functions of definite integrals. 5- Error function. 6- Gamma function. 7- Beta function.

9. Teaching and Learning Strategies	
	➢ Theoretical lectures with the use of illustrations. ➢ Practical application of concepts taught theoretically ➢ Solve problems, discuss them, and assign students some homework and reports through the class platform ➢ Identifying the types of equipment and the differences between them.

10. Course Structure

Week	Hours	The output requirements	Unit or subject name	Learning Method	Evaluation method
1	3	1- Introduction and general review of differential equations. 2- First order differential equation.	Derivative: Uses and applications	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
2-3	6	1- Separation of variables. 2- Homogeneous equation.	Derivative: Methods of solution	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
4-5	6	1- Exact equations. 2- Linear equations. 3- Bernoulli equations.	Derivative: Methods of solution	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
6	3	1- Second order differential equations. 2- Non-Linear equations.	Derivative: Uses and applications	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
7-9	9	1- Equations where the dependent variable (y) is missing. 2- Equations where the independent variable (x) is missing. 3- Homogeneous equations.	Derivative: Methods of solution	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
10-11	6	1- Linear second order differential equation with constant coefficients. 1.1- Complementary function. a. Unequal roots to auxiliary equation. b. Equal roots to auxiliary equation. c. Complex roots to auxiliary equation.	Derivative: Methods of solution	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
12-14	9	1.2- Non- homogeneous function (Particular solution). a. The method of undetermined coefficients. b. The method of inverse operators: Properties and applications. c. The method of variation of parameters.	Derivative: Methods of solution	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
15	3	1- Functions of definite integrals. 1.1- Error function. 1.2- Gamma function. 1.3- Beta function.	Functions of definite integrals	Lectures, presentations, and reports	Unannounced exams, Homework 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. Jenson & Jeffreys, "Mathematical Methods in Chemical Engineering", Academic Press, 3rd ed., 1983. 2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, ISBN: 0471728977. 3. John Polking, Al Boggess, & David Arnold "Differential Equations", Prentice Hill, ISBN: 0131437380 4. Stephen Goode, "Differential Equations and Linear Algebra", Prentice Hill, ISBN: 013263757X. 5. 'Modelling and Simulation in Chemical Engineering', Roger E. Franks, John Wiley and Sons, 1972.
2- Main references (sources)	6. 'Mathematical Methods in Chemical Engineering', Seinfeld and Lapidus, Prentice Hall,1974. 7. 'Process Modeling, simulation and Control for Chemical Engineers', W. L. Luyben, 1990.
Mainstream recommended books and references (scientific journals, Reports.....)	/
Electronic references and websites	/

Mass Transfer I

Course Description Form

1. Course Name:
Mass Transfer I
2. Course Code:
Ch.E302
3. Semester / Year:
Courses
4. Description Preparation Date:
1-9-2024
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/ (3 Units)
7. Course administrator's name (mention all, if more than one name)
Name: Prof. Dr. Ahmed Daham Wiheeb Email: ahmed_chem76@uodiyala.edu.iq
8. Course Objectives

Course Objectives	(1) Provides an introductory treatment of mass transfer from a chemical-engineering viewpoint. (2) Provides students a fundamental understanding of the basics of diffusion theory to simple mass transfer problems and prepare students to analysis of chemical engineering unit operations involving mass transfer. (3) Provide students with good skills and ability to solve the mass transfer problems related to chemical engineering units. (4) Provide students with a fundamental understanding of diffusion, mass transfer coefficient, modes of diffusion. (5) Providing education compatible to absorption process calculations for tray and packed towers.

	(6) Providing education compatible to liquid –liquid extraction, principles, calculations.

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	4	1. Basic principles of diffusion. 2. Describe the flick's law of mass transfer. 3. Recognize the fundamentals of the modes of diffusion.	Diffusion, flick's law, modes of diffusion	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
2	4	1. Describe Maxwell's Law for multicomponent mass transfer. 2. Drive the effective diffusivity of (A) in the mixture.	Multi-components mixture, correction of diffusivity	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
3	4	1. Describe diffusion through a varying cross-section area. 2. How the mole flux through a spherical body calculates.	Diffusion in varying cross section area	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
4	4	1. How the diffusivities of gases and vapors calculates.	Diffusivity coefficient in liquid and gas	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
5	4	1. Understand the mass transfer theories.	Mass transfer theory	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
6	4	1. How mass transfer coefficient calculates. 2. Describe the wetted wall column	Mass transfer coefficient, wetted wall column	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
7	4	1. Recognize the fundamentals of the absorption of gas into liquid. 2. How the equilibrium relation of gas and liquid compute.	Absorption, equilibrium of gas and liquid	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture

8	4	1. Compute the number of transfer units, height of transfer units and the tower height for linear and non-linear equilibrium relation.	Packed tower	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
9	4	1. Compute the number of trays and the tower height for linear and non-linear equilibrium relation.	Tray tower	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
10	4	1. Compute the diameter of packed and tray towers.	Calculation of tower diameter, stripping	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
11	4	1. Recognize the fundamentals of the extraction of liquid into liquid. 2. How the equilibrium relation of liquid and liquid compute. 3. How the height of the extraction, differential compute.	Extraction, differential type	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
12	4	1. How the number of the stages for immiscible and co-current flow of linear and non-linear equilibrium compute.	Completely immiscible, co-current flow	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
13	4	1. How the number of the stages for immiscible and current - current flow of linear and non-linear equilibrium compute.	Completely immiscible, counter-current flow	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
14	4	1. How the number of the stages for party miscible and co-current flow of linear and non-linear equilibrium compute.	Party miscible, co-current flow	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
15	4	1. How the number of the stages for party miscible and counter-current flow of linear and non-linear equilibrium compute.	Party miscible, counter-current flow	Lectures, presentations, and reports	Unannounced exams, Homework 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. Anantharaman N. and Meera Sheriffa Begum K. M., Mass transfer theory and practice. 2011 2. Rousseau R.W., Handbook of Separation Process Technology, John Wiley. 2016
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

Biochemical Engineering

Course Description Form

1. Course Name:
Biochemical Engineering
2. Course Code:
Ch.E303
3. Semester / Year:
Courses
4. Description Preparation Date:
1-9-2024
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)
30 hrs/ (2 Units)
7. Course administrator's name (mention all, if more than one name)
Name: Lecturer. Yussur Dh. Abdul Wahhab Email: esar@uodiyala.edu.iq

8. Course Objectives

Course Objectives	Introduction of the basics biochemistry, biology and microbiology with applications in biochemical engineering. Explanation of how biochemical engineering is used for the analysis, control, and development of biological, biochemical, and industrial processes. Quantitative, problem-solving methods emphasized.

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	Basics of Biology, Overview of Biotechnology, Diversity in Microbial Cells, Cell Constituents, Chemicals for Life		Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
2	2	Kinetics of Enzyme Catalysis 1		Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
3	2	Kinetics of Enzyme Catalysis 2		Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
4	2	Immobilized Enzymes: effects of intra and inter-phase mass transfer on enzyme kinetics		Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
5	2	Major Metabolic Pathways:Bioenergetics, Glucose Metabolism,Biosynthesis.		Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
6	2	Microbial Growth: Continuum and Stochastic Models		Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
7	2	Design,Analysis and Stability of Bioreactors		Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
8	2	Exam			
9	2	Design of bioreactor		Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
10	2	Bio-product Recovery & Bio-separations, Manufacture of Biochemical Products		Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
11	2	Bio separation 1		Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
12	2	Bio separation 2		Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
13	2	Review and Exam		Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture

14	2	Kinetics of microbial growth and product formation		Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
15	2	Batch, continuous and fed-batch processes		Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
16	2	Media and air sterilization. Aseptic operation. Aeration and agitation. Scale-up criteria.		Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
Half – year break					

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. Biochemical Engineering Fundamentals by J.E.Bailey & D. F. Ollis, McGraw Hill Book Company, 1986. 2. Biochemical Engineering by H. W.Blanch & D.S. Clark, Marcel Dekker, Inc., 1997. 3. Bioprocess Engineering (Basic Concepts) by M. L.Shuler & F.Kargi,Prentice Hall of India, 2003.
2- Main references (sources)	1. "Principle of Fermentation Technology", P.F. Stanbury and A. Whitaker; Pergamon Press. 2. Bioprocess Engineering Basic Concepts. 2nd edition.. Michael L. Shuler and Fikret Kargi, Prentice Hall, Upper Saddle River, NJ. 3. Bioprocess Engineering Principles Pauline Doran, Academic Press, London. 6. T Panda, Bioreactors analysis and design, Tata McGraw Hill, New Delhi, New York, 2011
Mainstream recommended books and references (scientific journals, Reports.....)	BRUCE A. FINLAYSON, PH.D."INTRODUCTION TO CHEMICAL ENGINEERING COMPUTING" University of Washington Seattle, Washington . A JOHN WILEY & SONS, INC., PUBLICATION 2006
ferences and websites	http://www.umich.edu/~elements/5e/learn/index.html

Chemical Industries

Course Description Form

1. Course Name:
Chemical Industries
2. Course Code:
CHE 315
3. Semester/Year:
Second Semester
4. Description Preparation Date:
1-9-2024
5.Available Attendance Forms:
Weekly lectures
6.Number of Credit Hours (Total)/ Number of Units (Total):
75
7.Course administrator's name (mention all, if more than one name) Name: Ass. Prof. Dr. Adiba A. Mahmmod Email: alnuimiadiba@uodiyala.edu.iq
8. Course Objectives

Course Objectives	Giving the student a general overview of the principles and concepts of petrochemicals and their manufacturing methods, in addition to olefin derivatives and propylene derivatives. Teaching the student petrochemicals and polymer production techniques, the concept of plastics and what is related to them. Make the student able to understand. What are gases and their importance, such as carbon dioxide, ammonia, and magnesium compounds? Teaching the student about nitrogen, helium, and oxygen. Teaching the student how to manufacture sulfuric and nitric acid, in addition to the ceramics, glass, and fiber industries. Rubber industry, paper industry, cement and fertilizer industry. Teach the student also the manufacture of vegetable oils. Soap, detergent and sugar industry.

9. Teaching and Learning Strategies

	1- Lectures. 2- Presenting power point slides. 3- Collect data and prepare reports. 4- Discussions.

10 Course Structure					
Week	Hours	The output requirements	Unit or subject name	Learning Method	Evaluation method
1	3	Introduction to petrochemical (olefins and aromatics)	Production of the basic materials for the petrochemical Industry (olefins and aromatics)	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
2-3	6	Production of Ethylene	Petrochemicals from methane& Ethylene	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
4-5	6	Production of Thermoplastic	Propylene derivatives Thermoplastic& Thermoset Industrial fibers & rubber	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
6-7	6	Explain in detail the industries of Ceramic, glass, nitric acid	Ceramic, glass, nitric acid	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
8	3	semester exam			
9-10	6	Explain in detail the industries of Paper, rubber, fibers, cement & Fertilizers	Paper, cement & Fertilizers	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
11-12	6	Description the industrial of carbon & Sulphuric Acid	Industrial of carbon & Sulphuric Acid	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
13	3	Explain the concept of Gases (carbon dioxide, ammonia)	Gases (carbon dioxide, ammonia)	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
14	3	Explain the concept of nitrogen, helium and oxygen Soap &Detergents Sugar	Nitrogen, helium and oxygen Soap &Detergents Sugar	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
15	3	semester exam			

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. **Shereve's Chemical Process Industries, fifth edition, George T. Austin**.

1- Electronic References , Website : http://www.wolframalpha.com/widgets/view.jsp?id=e602dcdecb1843943960b5197efd3f2a

2- https://www.symbolab.com/solver/series-calculator

3- https://matrixcalc.org/en/vectors.html

Heat Transfer I

Course Description Form

1. Course Name:
Heat Transfer I
2. Course Code:
Ch.E305
3. Semester / Year:
first Semester
4. Description Preparation Date:
1-9-2024
5. Available Attendance Forms:
Weekly lectures / Full time attendance
6. Number of Credit Hours (Total) / Number of Units (Total):
75
7. Course administrator's name (mention all, if more than one name)
Name: Mustafa Sabah Email: mustafa.sabah@uodiyala.edu.iq

8. Course Objectives	
Course Objectives	The primary aim of teaching heat transfer to chemical engineering students is to equip them with a fundamental understanding of heat transfer principles and their applications in the chemical industry. Specific objectives include: Developing a strong foundation in the modes of heat transfer (conduction, convection, and radiation). Understanding the mathematical models and equations used to analyze heat transfer processes. Applying heat transfer principles to solve practical engineering problems in areas such as process design, equipment selection, and energy efficiency. Developing skills in experimental techniques for heat transfer measurements and analysis. Fostering the ability to analyze and troubleshoot heat transfer issues in industrial processes. Cultivating a strong problem-solving approach to heat transfer challenges.
9. Teaching and Learning Strategies	
Strategies	1- Lectures. 2- Presenting power point slides. 3- Collect data and prepare reports. 4- Discussions.

10. Course Structure

Week	Hours	The output requirements	Unit or subject name	Learning Method	Evaluation method
1	4	Students should understand the fundamental concepts of heat transfer and its relevance to chemical engineering processes.	Introduction to Heat Transfer	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
2-3	8	Students should understand applications of heat transfer in industry	Importance of heat transfer in chemical engineering, Applications of heat transfer in industry	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
4-5	8	Students must understand basic thermodynamic principles to analyze heat transfer.	Basic Concepts of Thermodynamics	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
6-7	8	Students should be able to analyze heat transfer through solid bodies and calculate heat transfer rates in different configurations.	Fourier's law of heat conduction, Thermal conductivity	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
8	4		semester exam		
9-10	8	Students should be able to deal with more complex heat transfer problems that involve transfer through more than one dimension.	Steady-state conduction in one, two, and three dimensions, Thermal resistance	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
11-12	8	Students should be able to deal with more complex heat transfer problems involving multiple materials.	Series and parallel thermal resistances, Critical thickness of insulation for composite walls, Heat transfer through cylindrical and spherical walls	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
13	4	Students should be able to deal with more complex and time-dependent heat transfer problems.	Unsteady-State Conduction, Lumped capacitance method, Biot and Fourier numbers, Temperature distribution in solids	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
14	4	Students should be able to deal with problems of intense heat transfer through fins	Types of fins, Fin efficiency and effectiveness, Heat transfer from fins	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
15	4	semester exam			

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

Heat Transfer by Jack Holman

Heat Transfer; A Practical Approach by cengel

International journal of heat and mass transfer.

science direct

Thermodynamics I

Course Description Form

1. Course Name:
Thermodynamics I
2. Course Code:
Ch.E.306
3. Semester / Year:
1st semester / 3rd year
4. Description Preparation Date:
1/9/2024
5. Available Attendance Forms:
3 hrs weekly
6. Number of Credit Hours (Total) / Number of Units (Total)
45 hours / 2 credits
7. Course administrator's name (mention all, if more than one name)
Name: Dr. Ali Z. Al-hassn, Emali: alialhassn.uod@uodiyala.edu.iq
8. Course Objectives

Course Objectives	• The course provides an introductory treatment of thermodynamics from a chemical-engineering viewpoint. • This course provides the students with a fundamental understanding of the basics of energy conversion and prepare the student to evaluate the relative qualities of different thermodynamic systems. • The course should provide students with good skills and ability to solve the thermodynamic problems related to chemical engineering units. • The course also provides a better understanding of the thermodynamic fundamentals themselves.

9. Teaching and Learning Strategies	
Strategies	The course at the beginning present basic definitions and a development of the first law as it applies to nonflow and simple steady-flow processes. Then, it will treat the pressure-volume-temperature behavior of fluids and certain heat effects. After that, the second law and some of its applications are considered followed by a treatment of the thermodynamic properties of pure fluids and applications of the first and second laws to flow processes in

	general.

10. Course Structure

Week	Hours	The output requirements	Unit or subject name	Learning Method	Evaluation method
1	3	• Basic definitions • Fundamental physical quantities Heat and work	Introduction to thermodynamics	blackboard + PowerPoint	Daily exams and homework + monthly exams
2	3	• Joule's Experiments • Internal Energy Formulation of the First Law of Thermodynamics	1st law of thermodynamics	blackboard + PowerPoint	Daily exams and homework + monthly exams
3	3	• The Thermodynamic State and State Functions • Enthalpy • Heat capacity, Reversible process The Phase Rule	1st law of thermodynamics	blackboard + PowerPoint	Daily exams and homework + monthly exams
4	3	• The PVT Behavior of Pure Substances The Virial Equation	Volumetric Properties of Pure Fluids	blackboard + PowerPoint	Daily exams and homework + monthly exams
5	3	• The Ideal Gas (isochoric, isothermal, & adiabatic) • Cubic Equations of State Generalized Correlations for Gases and liquids	Volumetric Properties of Pure Fluids	blackboard + PowerPoint	Daily exams and homework + monthly exams
6	3	• Sensible Heat Effects Heat Effects Accompanying Phase Changes of Pure Substances	Heat Effects	blackboard + PowerPoint	Daily exams and homework + monthly exams
7	3	• The Standard Heat of Reaction • The Standard Heat of Formation The Standard Heat of Combustion	Heat Effects	blackboard + PowerPoint	Daily exams and homework + monthly exams
8	3	• Effect of Temperature on the Standard Heat of Reaction Heat Effects of Industrial Reactions	Heat Effects	blackboard + PowerPoint	Daily exams and homework + monthly exams
9	3	• The Heat Engine principle Carnot Cycle for an Ideal Gas	2nd law of thermodynamics	blackboard + PowerPoint	Daily exams and homework + monthly exams

10	3	• Entropy • Entropy Changes of an Ideal Gas	2nd law of thermodynamics	blackboard + PowerPoint	Daily exams and homework + monthly exams
11	3	Mathematical Statement of the Second Law	2nd law of thermodynamics	blackboard + PowerPoint	Daily exams and homework + monthly exams
12	3	• Relations for a homogenous phase of constant composition Maxwell's equations	Thermodynamic Properties of Fluids	blackboard + PowerPoint	Daily exams and homework + monthly exams
13	3	Residual Properties	Thermodynamic Properties of Fluids	blackboard + PowerPoint	Daily exams and homework + monthly exams
14	3	• Two-Phase Systems Quality of vapor	Thermodynamic Properties of Fluids	blackboard + PowerPoint	Daily exams and homework + monthly exams
15	3	Flow in pipe and Throttling process	Thermodynamics of Flow Processes	blackboard + PowerPoint	Daily exams and homework + monthly exams

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

Required textbooks (curricular book , if any)

1. Introduction to Chemical Engineering Thermodynamics: Smith, J.M., Van ness H.C. and Abbot, M.M., 7th Edn. MGH., 2005.
2. A Text Book of Chemical Engineering Thermodynamics, Narayanan, PHI

Main references (source)

1. Chemical Engineering Thermodynamics: Y.V.C. Rao.
2. Chemical Process Principles (Vol-2): O.A.Hougen, K.M. Watson and R.A.Ragatz
3. Chemical and Process Thermodynamics: Kyle PHI.

Recommended book and references (scientific journals , reports …….)

Electronic References , Website

http://web.mit.edu/10.213/www/handouts.shtml

Polymer Technology

Course Description Form

1. Course Name:
Polymer Technology
2. Course Code:
Ch.E316
3. Semester / Year:
Semester 1 / Y3
4. Description Preparation Date:
1-9-2024
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)
30 hrs/ (2 Units)
7. Course administrator's name (mention all, if more than one name)
Name: Mohanad Ali Sultan Email: maalazzawi85@uodiyala.edu.iq

8. Course Objectives

Course Objectives	1-A historical overview of polymers and their development stages. 2- Naming polymers and sources of polymers. 3- Methods of preparing polymers and polymerization mechanisms. 4- The conditions of the polymerization process and what is the difference between addition polymerization and condensation polymerization. 5- The molecular weight of polymers and methods for its determination. 6 - The technology of polymer manufacturing and some types of plastics, as well as knowledge of the types of reactors used.

9. Teaching and Learning Strategies

Strategies	➢ Theoretical lectures with the use of illustrations. ➢ Practical application of concepts taught theoretically ➢ Solve problems, discuss them, and assign students some homework and reports through the e-learning platform ➢ Identifying the types of preparation methods and the differences between them.

10. Course Structure

Week	Hours	The output requirements	Unit or subject name	Learning Method	Evaluation method
1-2	2	1- A historical overview of polymers. 2- Polymers, monomers, and structural units. 3- Classification based on polymer sources 4- Classification based on the chemical nature of the polymer. 5- The technological classification of polymers	Polymers and their naming. And the classification of polymers.	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
3-4	2	1- Step-growth polymerization (condensation). 2- By ionic addition polymerization (cationic-anionic). 3- By the polymerization of the coordinative addition (spatially regular). 4- Polymerization by group transfer.	Methods of preparing polymers.	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
5-6	2	1- Polymerization of the mass. 2- Polymerization of solutions. 3- Polymerization in the suspensions. 4- Deposition polymerization	Conditions for the polymerization process.	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
7-8	2	1- Methods for determining molecular weight. 2- The concept of the molecular weight of a polymer. 3- The viscosity average of the molecular weight. 4- Polymer structures	Molecular weight	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
9-10	2	1- Polymer blends and interpenetrating polymer networks. 2- Types of polymer blends. 3- Preparation of polymeric mixtures	Polymeric mixtures	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
11	2	1- Crystallization. 2- The glass state. 3- Flow properties	Physical properties	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
12-13	2	1-Tension strength 2- Collision force. 3- Hardness. 4- Properties.	Mechanical properties	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
14-15	2	1- Molding. 2- Extrusion. 3- Thermal forming. 4- Polishing. 5- Some important types of plastics.	Polymer manufacturing techniques	Lectures, presentations, and reports	Unannounced exams, Homework 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. Tim A.Osswald, material science of polymers for engineers, Osswald, menges
2- Main references (sources)	1-Robert O. Ebewele, Polymer science technology Ebewele R., 2000. 2-Mustaf Akay. Introduction to polymer science and technology, Akay M, 2012
Mainstream recommended books and references (scientific journals, Reports.....)	مراجع ومؤلفات متن مقررات - عمر عبدالله حسين الهزازي.(كيمياء البوليمرات الكيمياء الفيزيائية مجزءاً) Chemistry of Polymers

Management industrial & economic

Course Description Form

1. Course Name:
Management industrial & economic
2. Course Code:
Ch.E308
3. Semester / Year: 2nd Semester –
Third class /first semester
4. Description Preparation Date:
1/9/2024
5. Available Attendance Forms:
Class Lectures
6. Number of Credit Hours (Total) / Number of Units (Total)
30 hours
7. Course administrator's name (mention all, if more than one name)
Name: ***walaa abid Mahmood***   **Email:*****whalaa_alkhaisi76@uodiyala.edu.q***
8. Course Objectives

Course Objectives	The student learns about management and practice: functions of management, Production. Type of production Marketing Management: Marketing management process, product life cycle, and marketing strategies. Operations Management: Productivity and Work Study, Operations Strategy, Statistical Process Control, Quality Function Deployment, Introduction to Total Quality Management, and ISO 9000. Studying the concept of economics and its impact on the labor market: estimating the cost of industrial projects, factors affecting the cost of production and investment. Capital investment, cost index, investment profit and cost, depreciation, optimized design, cost of block and heat transfer equipment

9. Teaching and Learning Strategies	
Strategies	• The lecturer prepares lectures on the subject in paper and electronic form and presents them to the students. • The lecturer delivers lectures in detail. • The lecturer requests periodic reports and homework assignments on the basic topics of the subject.

10. Course Stracture

Week	Hours	The output requirements	Unit or subject name	Learning Method	Evaluation method
Week 1 -2	4	Management theory and practice: functions of management	Students know management and its most important basic functions	Lectures Notes PDF power point Video	Unannounced exams and self-evaluation during the lecture
Week 3 -5	6	Production and types of it	Study production in the market and know its types	Lectures Notes PDF power point Video	Unannounced exams and self-evaluation during the lecture
Week 6	Midterm one				
Week 7 to Week 9	6	Productivity and work study, Introduction to Total Quality Management and ISO 9000.	Productivity and its importance Students know ISO how to play a good role in the market	Lectures Notes PDF power point Video	Unannounced exams and self-evaluation during the lecture
Week 10 -11	4	Learn about the concept of economics and how it is classified Factors affecting production and investment	Introduction to economic in industries process	Lectures Notes PDF power point Video	Unannounced exams and self-evaluation during the lecture
Week 12-13	4	Capital investment, Cost index, Profit and cost of invest Depreciation	Methods of calculating total and operating capital investment Depreciation and its types	Lectures Notes PDF power point Video	Unannounced exams and self-evaluation during the lecture
Week 14	**Project for student**				
Week 15	Midterm two				

THIRD YEAR (SEMESTER 2)

Numerical Method

Course Description Form

1. Course Name:
Numerical Methods
2. Course Code:
Ch.E.309
3. Semester / Year:
Course / 2nd semester / 2024
4. Description Preparation Date:
1/9/2024
5. Available Attendance Forms:
Available forms of attendance: Full time attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
75 hrs/ (3 Units)
7. Course administrator's name (mention all, if more than one name)
Name: Mohammed Faiq Mohammed AL-Kharkhi Email: muhammed_faiq_eng@uodiyala.edu.iq

8. Course Objectives	
Course Objectives	1- Numerical methods. 2- Finding the roots of a single nonlinear equation. 3- Solving system of linear equations. 4- Solving system of non-linear equations. 5- Solving the ordinary differential equation. 6- Solving the second and higher order differential equations. 7- Numerical integration. 8- Interpolation.

9. Teaching and Learning Strategies	
Strategies	➢ Theoretical lectures with the use of illustrations. ➢ Practical application of concepts taught theoretically ➢ Solve problems, discuss them, and assign students some homework and reports through the class platform ➢ Identifying the types of equipment and the differences between them.

10. Course Structure

Week	Hours	The output requirements	Unit or subject name	Learning Method	Evaluation method
1-3	15	1- Finite difference. 1.1-Forward difference operator. 1.1.1- First forward difference. 1.1.2- Second forward difference. 1.1.3- Third forward difference. 1.1.4- Fourth forward difference. 1.2- Properties of the difference operator. 1.3- Difference tables. 1.4- Backward difference operator. 1.5- The operator E. 1.5.1- Properties of the operator E.	Numerical differences	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
4-5	10	1- Linear finite difference equations. 1.1- Complementary solution: a. If the roots are different. b. If the roots are identical. c. If the roots are complex. 1.2- Particular solution.	Numerical solution (Linear)	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
6-7	10	1- Numerical methods. 1.1- Error definitions: 1.1.1- Inherent errors (Mistakes). 1.1.2- Round-off errors. 1.1.3- Truncation errors. 1.2- Error measurements. 1.2.1- Absolute error. 1.2.2- Relative error. 1.2.3- Percentage error.	Numerical definitions (Error function)	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
8-9	10	1- Finding the roots of a single nonlinear equation. 1.1- Introduction. 1.2- Graphical methods. 1.3- The Bisection method. 1.4- The Secant method (Linear interpolation method). 1.5- The Newton-Raphson method.	Numerical methods (Applications)	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
10-11	10	1- Solving system of linear equations. 1.1-Matrix inverse method. 1.2-Cramer's rule. 1.3-Cramer's rule method in excel technique. 1.4-Gaussian elimination method. 1.5-Gauss-Seidel method.	Numerical methods (Methods of solution for linear equations)	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture

12	5	1. Solving system of non-linear equations. 1.1- Simple iteration method. 1.2- Newton-Raphson method. 1.2.1- Newton-Raphson method in excel technique.	Numerical methods (Methods of solution for non-linear equations)	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
13-14	10	1- Solving the ordinary differential equation. 1.1-Euler method. 1.2-Euler method in excel technique. 1.3-Modified Euler method. 1.4-Runge-Kutta method. 1.4.1- Second-Order formula. 1.4.1.1- Second-Order Runge-Kutta method in excel technique. 1.4.2- Fourth-Order formula.	Numerical methods (Methods of solution for differential equations)	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
15	5	1- Solving the second and higher order differential equations.	Numerical methods (Methods of solution for second and higher differential equations)	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture

11.Cours Evaluation

- Sudden exams (5 Marks).
- Monthly exams (25) marks
- Seminars + homework (5 marks).
- Reports (5) degrees
- Lab. (10) degrees
- **A final examination of the curriculum (50 Marks).**

12. Learning and Teaching Resources

1- Required prescribed books	1. Jenson & Jeffreys, "Mathematical Methods in Chemical Engineering", Academic Press, 3rd ed., 1983. 2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, ISBN: 0471728977. 3. John Polking, Al Boggess, & David Arnold "Differential Equations", Prentice Hill, ISBN: 0131437380 4. Stephen Goode, "Differential Equations and Linear Algebra", Prentice Hill, ISBN: 013263757X. 5. 'Modelling and Simulation in Chemical Engineering', Roger E. Franks, John Wiley and Sons, 1972.
2- Main references (sources)	6. 'Mathematical Methods in Chemical Engineering', Seinfeld and Lapidus, Prentice Hall,1974. 7. 'Process Modeling, simulation and Control for Chemical Engineers', W. L. Luyben, 1990.
Mainstream recommended books and references (scientific journals, Reports.....)	/
Electronic references and websites	/

Mass Transfer II

Course Description Form

1. Course Name:
Mass Transfer II
2. Course Code:
Ch.E310
3. Semester / Year:
Courses
4. Description Preparation Date:
1/9/2024
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/ (3 Units)
7. Course administrator's name (mention all, if more than one name)
Name: Prof. Dr. Ahmed Daham Wiheeb Email: ahmed_chem76@uodiyala.edu.iq

8. Course Objectives

Course Objectives	1. The course provides an introductory treatment of vapor-liquid equilibrium. 2. The course should provide students with good skills and ability to solve the mass transfer problems related to leaching and distillation units. 3. This course provides the students with a fundamental understanding of different types of distillation units and cooling towers.

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	4	4. Basic principles of Leaching. 5. Describe the mass transfer form solid to liquid solvent. 6. Recognize the fundamentals of the mole flux through the leaching process.	Leaching, batch leaching	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
2	4	3. Describe the continuous leaching process. 4. Drive equation to calculate the number of stages through constant under flow.	Continuous leaching, constant under flow	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
3	4	3. Describe continuous leaching, variable under flow. 4. Drive equation to calculate the number of stages through constant under flow.	Continuous leaching, variable under flow	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
4	4	2. How distillation, vapor-liquid equilibrium determines.	Distillation, vapor-liquid equilibrium	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
5	4	2. Drive the equation used to calculate the height of differential distillation column.	Differential distillation type	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
6	4	3. Describe the mass transfer through flash distillation column. 4. Drive the equations used to calculate the composition and the quantity of the product.	flash distillation column	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
7	4	3. Recognize the fundamentals of mass transfer through the continuous distillation. 4. How the operating lines equations compute.	Continuous distillation (binary system)	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
8	4	2. Compute the number of plates and reflux ratio in continuous distillation using graphical methods and equations.	Calculation the number of stages and reflux ratio in continuous distillation	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
9	4	2. Compute the number of trays for multi-feeds and side stream. 3. Compute the composition of components on the trays and the number of trays using Lewis-	Multi-feeds and side stream, Lewis-Sorial method	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture

		Sorial method.			
10	4	1. Compute the composition of components on the trays and the number of trays using Ponchon-Savarit method.	Ponchon-Savarit method	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
11	4	4. Recognize the fundamentals of the mass transfer through batch distillation column with constant reflux ratio. 5. How the number of trays in batch distillation with constant reflux ratio compute.	Batch distillation with constant reflux ratio	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
12	4	1. Recognize the fundamentals of the mass transfer through batch distillation column with product composition. 2. How the number of trays in batch distillation with constant product composition.	Batch distillation with constant product composition	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
13	4	2. Recognize the fundamentals of the mass transfer multi-component distillation column. 3. Compute the number of plates and reflux ratio in multi-component distillation.	Multi-component distillation	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
14	4	1. Recognize the fundamentals of the humidification and humidity.	Humidification, humidity	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
15	4	2. Drive the equation used to calculate the height of the cooling tower.	Cooling tower calculation	Lectures, presentations, and reports	Unannounced exams, Homework 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

Required prescribed books	1. Anantharaman N. and Meera Sheriffa Begum K. M., Mass transfer theory and practice. 2011 2. Rousseau R.W., Handbook of Separation Process Technology, John Wiley. 2016
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.

Engineering Analysis II

Course Description Form

1. Course Name:
Engineering Analysis II
2. Course Code:
Ch.E.311
3. Semester / Year:
Course / 2nd semester / 2024
4. Description Preparation Date:
1/9/2024
5. Available Attendance Forms:
Available forms of attendance: direct attendance (in the hall)
6. Number of Credit Hours (Total) / Number of Units (Total)
45 hrs/ (2 Units)
7. Course administrator's name (mention all, if more than one name)
Name: Mohammed Faiq Mohammed AL-Kharkhi Email: muhammed_faiq_eng@uodiyala.edu.iq

8. Course Objectives	
Course Objectives	1- Power series (Frobineous method). 2- Bessel function. 3- Partial differential equations. 4- Laplace transform. 5- Mathematical modeling.
9. Teaching and Learning Strategies	
Strategies	➢ Theoretical lectures with the use of illustrations. ➢ Practical application of concepts taught theoretically ➢ Solve problems, discuss them, and assign students some homework and reports through the class platform ➢ Identifying the types of equipment and the differences between them.

10. Course Structure

Week	Hours	The output requirements	Unit or subject name	Learning Method	Evaluation method
1-2	6	1- Power series 1-1 The general power series form: a. Exponential series. b. Logarithmic series. c. Trigonometric series. d. Hyperbolic series. e. Taylor series and Maclaurin series. 1-2 Analytic and non-analytic function.	Series applications	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
3-5	9	1- Frobineous method: 1.1- Roots of indicial equation different, but not by an integer. 1.2- Roots of indicial equation equal. 1.3- Roots of indicial equation differing by an integer. Case I. 1.4- Roots of indicial equation differing by an integer. Case II.	Series Methods	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
6	3	1- Special functions: 1.1- Bessel's equation and Bessel's function.	Special functions (types of series)	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
7-9	9	1- The Bessel's function of the first kind of order zero. 2- The Bessel's function of the first kind of order one. 3- The second solution of the Bessel's equation. 3.1- 2k is not an integer or zero. 3.2- k = 0. 3.3- 2k is an integer. 1.2- Modified Bessel's Equation: Properties.	Special functions (Methods of solutions)	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
10	3	1- Partial differential equations. 1.1- Separation of variables. 1.2- Boundary conditions.	Partial derivatives (Applications)	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
11	3	1- Fourier series.	Fourier series applications	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture

12-13	6	1- Laplace transformation. 1.1- Laplace transforms of some functions. 1.2- Basic properties of Laplace transform. 1.3- The inverse Laplace transformation. 1.4- Laplace transforms of derivatives. 1.4.1- First order derivative. 1.4.2- Second order derivative. 1.4.3- Third order derivative. 1.4.4- nth order derivative. 1.5- Differentiation of the transform with respect to the operator S. 1.6- The Laplace transform of the integral of a function. 1.7- Method of convolution integral. 1.8- Some useful signals and control models. 1.8.1- The step function. 1.8.2- The unit impulse function. 1.8.3- The staircase function. 1.9- Application to control and signal systems. 1.10- The second shift theorem.	Laplace transformation (Applications)	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
14-15	6	1- The mathematical modeling of the problem.	Modeling and simulation (Introduction and how to write a mathematical model)	Lectures, presentations, and reports	Unannounced exams, Homework 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. Jenson & Jeffreys, "Mathematical Methods in Chemical Engineering", Academic Press, 3rd ed., 1983. 2. Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, ISBN: 0471728977. 3. John Polking, Al Boggess, & David Arnold “Differential Equations”, Prentice Hill, ISBN: 0131437380 4. Stephen Goode, “Differential Equations and Linear Algebra”, Prentice Hill, ISBN: 013263757X. 5. ‘Modelling and Simulation in Chemical Engineering’, Roger E. Franks, John Wiley and Sons, 1972.
2- Main references (sources)	6. ‘Mathematical Methods in Chemical Engineering’, Seinfeld and Lapidus, Prentice Hall,1974. 7. ‘Process Modeling, simulation and Control for Chemical Engineers’, W. L. Luyben, 1990.
Mainstream recommended books and references (scientific journals, Reports.....)	/
Electronic references and websites	/

Reactor Design I

Course Description Form

1. Course Name:
Reactor Design I
2. Course Code:
Ch.E404
3. Semester / Year:
Courses
4. Description Preparation Date:
1/9/2024
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	• Define the rate of chemical reactions, and apply the mole balance equations to batch reactors, CSTRs, PFRs, and PBRs • Define the rate of chemical reactions • 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 • 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 • Write balance equations in measure other than conversion and apply these balance evaluations to membrane reactors and semi batch reactors • Determine the reaction order and specific reaction rate from experimental data obtained for either batch or flow reactors Describe how to use equal-area differentiation, polynomial fitting, numerical difference formulas and regression to analyze experimental data to determine the rate law

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	6	1- Define the rate of chemical reactions 2- Apply the mole balance equations to batch reactors, CSTRs, PFRs, and PBRs 3- Describe two industrial reaction engineering systems 4- Describe photos of real reactors	Mole Balances	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
3-4	6	1- Design single stage reactor 2- Design staged CSTR 3- Design PFR, and PBR 4- Ability to use plots.	Conversion and Reactor Sizing	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
5-6	6	1-Calculate the equilibrium conversion for both gas and liquid phase reactions 2-Write the combined mole balance and rate law in measures other than conversion 3- Set up a stoichiometric table for reactions with phase change	Gas Phase Batch CSTR	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
7	3	1- Apply CRE algorithm to gas phase 2- Account for the effects of pressure drop conversion in packed bed tubular reactors and in packed bed spherical reactors 3- Answer what if... questions	Gas Phase Reactions with Pressure Drop Objectives	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
8	3	1- Write balance equations in measure other than conversion. 2- Apply these balance evaluations to membrane reactors and semi batch reactors	Measures Other Than Conversion, Membrane Reactors and Semi-batch Reactors	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture

9-10	6	1- Determine the reaction order and specific reaction rate from experimental data obtained for either batch or flow reactors 2- Describe how to use equal-area differentiation, polynomial fitting, numerical difference formulas and regression to analyze experimental data to determine the rate law	Analysis of Data	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
11	3	1- Calculates extent and conversion values for constant volume systems. 2- Calculates extent and conversion values for changing volume systems.	conversion and extent values for different systems	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
12	3	Midterm	Midterm		
13-14	6	1- generalized mole balance equation . 2- The batch reactor - Homogenous vs heterogeneous reacting systems . 3- Ideal isothermal reactors: PFR and CSTR - Reactor and reaction networks, yield, conversion, and selectivity.	Isothermal ideal reactors	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
15	3	1- Determine and specific reaction rate from experimental data 2- obtained for either batch or flow reactors	reaction order	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

Heat Transfer II

Course Description Form

1. Course Name:
Heat transfer II
2. Course Code:
Ch.E313
3. Semester / Year:
Second Semester
4. Description Preparation Date:
1/9/2024
5. Available Attendance Forms:
Weekly lectures
6. Number of Credit Hours (Total) /
Number of Units (Total): **30**
7. Course administrator's name (mention all, if more than one name)
Name: Mustafa S Mahdi Email: mustafa.sabah@uodiyala.edu.iq

8. Course Objectives

Course Objectives	The primary aim of teaching heat transfer to chemical engineering students is to equip them with a fundamental understanding of heat transfer principles and their applications in the chemical industry. Specific objectives include: Developing a strong foundation in the modes of heat transfer (conduction, convection, and radiation). Understanding the mathematical models and equations used to analyze heat transfer processes. Applying heat transfer principles to solve practical engineering problems in areas such as process design, equipment selection, and energy efficiency. Developing skills in experimental techniques for heat transfer measurements and analysis. Fostering the ability to analyze and troubleshoot heat transfer issues in industrial processes. Cultivating a strong problem-solving approach to heat transfer challenges

9. Teaching and Learning Strategies

Strategies	1- Lectures. 2- Presenting power point slides. 3- Collect data and prepare reports. 4- Discussions.

10. Course Structure

Week	Hours	The output requirements	Unit or subject name	Learning Method	Evaluation method
1	4	Students should be able to differentiate between internal and external forced convection, apply dimensionless numbers to analyze flow and heat transfer, and use correlation equations to estimate heat transfer coefficients	Concept of forced convection, Boundary layer theory,	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
2-3	8	Students should be able to differentiate between internal and external forced convection, apply dimensionless numbers to analyze flow and heat transfer, and use correlation equations to estimate heat transfer coefficients	Dimensionless numbers (Reynolds, Prandtl, Nusselt),	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
4-5	8	Students should be able to differentiate between internal and external forced convection, apply dimensionless numbers to analyze flow and heat transfer, and use correlation equations to estimate heat transfer coefficients	Correlation equations for heat transfer coefficient in internal and external flows	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
6-7	8	Students should understand the principles of natural convection, apply the Grashof number to analyze flow and heat transfer, and consider the effects of combined forced and natural convection	Concept of natural convection, Grashof number, Correlation equations for natural convection heat transfer	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
8	4	semester exam			
9-10	8	Students should be able to classify different types of heat exchangers, understand the concept of overall heat transfer coefficient, and account for fouling effects	Classification of heat exchangers,	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
11-12	8	Students should be able to classify different types of heat exchangers, understand the concept of overall heat transfer coefficient, and account for fouling effects	Overall heat transfer coefficient (U), Fouling factors	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
13	4	Students should be able to calculate heat transfer rates in heat exchangers using LMTD and effectiveness-NTU methods, and analyze the impact of fouling on heat exchanger performance	Log mean temperature difference (LMTD),	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
14	2	Students should be able to calculate heat transfer rates in heat exchangers using LMTD and effectiveness-NTU methods, and analyze the impact of fouling on heat exchanger performance	Effectiveness-NTU method, Fouling and its effects on heat exchanger performance	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
15	4	semester exam			

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

Heat Transfer by Jack Holman

Heat Transfer; A Practical Approach by cengel

International journal of heat and mass transfer.

science direct

Thermodynamics II

Course Description Form

1. Course Name:
Thermodynamics II
2. Course Code:
Ch.E.314
3. Semester / Year:
2nd semester / 3rd year
4. Description Preparation Date:
1/9/2024
5. Available Attendance Forms:
3 hrs weekly
6. Number of Credit Hours (Total) / Number of Units (Total)
45 hours / 2 credits
7. Course administrator's name (mention all, if more than one name)
Name: Dr. Ali Z. Al-Hassn, Emali: alialhassn.uod@uodiyala.edu.iq
8. Course Objectives

Course Objectives	• The course provides an introductory treatment of thermodynamics from a chemical-engineering viewpoint. • This course provides the students with a fundamental understanding of the basics of energy conversion and prepare the student to evaluate the relative qualities of different thermodynamic systems. • The course should provide students with good skills and ability to solve the thermodynamic problems related to chemical engineering units. • The course also provides a better understanding of the thermodynamic fundamentals themselves.

9. Teaching and Learning Strategies	
Strategy	This course covers major thermodynamics principles that are useful to engineering applications. The student will learn how the power cycle can convert heat into work and how the power produced in steam power plant and solving related problems. The refrigeration and the liquefaction processes will be delt with, too. After that, the course will tackle the problems of fluid mixtures with application to vapor/liquid equilibrium. The application of equations of state in thermodynamic calculations, particularly in vapor/liquid equilibrium, is discussed later. Finally, thermodynamics of the chemical reaction equilibrium will be covered.

10. Course Structure

Week	Hours	The output requirements	Unit or subject name	Learning Method	Evaluation method
1	3	• The Steam Power Plant	Conversion of Heat into Work by Power Cycles Basic definitions	blackboard + PowerPoint	Daily exams and homework + monthly exams
2	3	• Carnot cycle • Rankine cycle	Conversion of Heat into Work by Power Cycles Basic definitions	blackboard + PowerPoint	Daily exams and homework + monthly exams
3	3	• Practical power plant cycle • Other engines	Conversion of Heat into Work by Power Cycles Basic definitions	blackboard + PowerPoint	Daily exams and homework + monthly exams
4	3	• The Camot Refrigerator • The Vapor-Compression Cycle	Refrigeration and Liquefaction	blackboard + PowerPoint	Daily exams and homework + monthly exams
5	3	• The Choice of Refrigerant • The Heat Pump	Refrigeration and Liquefaction	blackboard + PowerPoint	Daily exams and homework + monthly exams
6	3	quefaction Processes	Refrigeration and Liquefaction	blackboard + PowerPoint	Daily exams and homework + monthly exams
7	3	• Nature of equilibrium • Raoult's law	Phase equilibrium	blackboard + PowerPoint	Daily exams and homework + monthly exams
8	3	• Ideal gas mixture • Flash calculation	Phase equilibrium	blackboard + PowerPoint	Daily exams and homework + monthly exams
9	3	• Fugacity • Fugacity coefficient	Phase equilibrium	blackboard + PowerPoint	Daily exams and homework + monthly exams
10	3	• Duhem's Theorem • Dew-Point and Bubble-Point Calculations	Vapor-Liquid Equilibrium VLE	blackboard + PowerPoint	Daily exams and homework + monthly exams
11	3	hemical potential and non-ideal gas mixture	Vapor-Liquid Equilibrium VLE	blackboard + PowerPoint	Daily exams and homework + monthly exams
12	3	• Reaction Coordinate • The Standard Gibbs energy change and the equilibrium constant	Chemical-Reaction Equilibria	blackboard + PowerPoint	Daily exams and homework + monthly exams
13	3	fect of Temperature on the Equilibrium Constant	Chemical-Reaction Equilibria	blackboard + PowerPoint	Daily exams and homework + monthly exams
14	3	valuation of equilibrium constant	Chemical-Reaction Equilibria	blackboard + PowerPoint	Daily exams and homework + monthly exams
15	3	elations between Equilibrium Constants and Composition	Chemical-Reaction Equilibria	blackboard + PowerPoint	Daily exams and homework + monthly exams

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

Required textbooks (curricular book , if any)

1. Introduction to Chemical Engineering Thermodynamics: Smith, J.M., Van ness H.C. and Abbot, M.M., 7th Edn. MGH., 2005.
2. A Text Book of Chemical Engineering Thermodynamics, Narayanan, PHI

Main references (source)

4. Chemical Engineering Thermodynamics: Y.V.C. Rao.
5. Chemical Process Principles (Vol-2): O.A.Hougen, K.M. Watson and R.A.Ragatz
6. Chemical and Process Thermodynamics: Kyle PHI.

Recommended book and references (scientific journals , reports …….)

Electronic References , Website

http://web.mit.edu/10.213/www/handouts.shtml

Petrochemical Industries

Course Description Form

1. Course Name:
Petrochemical Industries
2. Course Code:
CHE 315
3. Semester/Year:
Second Semester
4. Description Preparation Date:
1-9-2024
5.Available Attendance Forms:
Weekly lectures (Full time attendance)
6.Number of CreditHours (Total)/Number of Units(Total):
75
7. Course administrator's name (mention all, if more than one name) Name: Ass.Prof. Dr. Adiba A.Mahmmod Email: alnuimiadiba@uodiyala.edu.iq
8. Course Objectives

Course Objectives	Giving the student a general overview of the principles and concepts of petrochemicals and their manufacturing methods, in addition to olefin derivatives and propylene derivatives. Teaching the student petrochemicals and polymer production techniques, the concept of plastics and what is related to them. Make the student able to understand What are gases and their importance, such as carbon dioxide, ammonia, and magnesium compounds? Teaching the student about nitrogen, helium, and oxygen. Teaching the student how to manufacture sulfuric and nitric acid, in addition to the ceramics, glass, and fiber industries. Rubber industry, paper industry, cement and fertilizer industry. Teach the student also the manufacture of vegetable oils. Soap, detergent and sugar industry.

9. Teaching and Learing Strategies

Strategy	1- Lectures. 2- Presenting power point slides. 3- Collect data and prepare reports. 4- Discussions.

10. Course Structure

Week	Hours	The output requirements	Unit or subject name	Learning Method	Evaluation method
1	3	Introduction to petrochemical (olefins and aromatics)	Production of the basic materials for the petrochemical Industry (olefins and aromatics)	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
2-3	6	Production of Ethylene	Petrochemicals from methane& Ethylene	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
4-5	6	Production of Thermoplastic	Propylene derivatives Thermoplastic& Thermoset Industrial fibers & rubber	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
6-7	6	Explain in detail the industries of Ceramic, glass, nitric acid	Ceramic, glass, nitric acid	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
8	3	semester exam			
9-10	6	Explain in detail the industries of Paper, rubber, fibers, cement & Fertilizers	Paper, cement & Fertilizers	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
11-12	6	Description the industrial of carbon & Sulphuric Acid	Industrial of carbon & Sulphuric Acid	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
13	3	Explain the concept of Gases (carbon dioxide, ammonia)	Gases (carbon dioxide, ammonia)	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
14	3	Explain the concept of nitrogen, helium and oxygen Soap &Detergents Sugar	Nitrogen, helium and oxygen Soap &Detergents Sugar	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
15	3	semester exam			

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. **Shereve ,s Chemical Process Industries, fifth edition, George T. Austin**.

2. Electronic References , Website : http://www.wolframalpha.com/widgets/view.jsp?id=e602dcdecb1843943960b5197efd3f2a
3. https://www.symbolab.com/solver/series-calculator
4. https://matrixcalc.org/en/vectors.html

FOURTH YEAR
(SEMESTER 1)

Unit Operation I

Course Description Form

1. Course Name:
Unit Operation I
2. Course Code:
Ch. E402
3. Semester / Year:
Courses
4. Description Preparation Date:
1/9/2024
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	**5.** Units Operation (physical). **6.** Units Operation (chemical). **7.** Raw materials, processes and products. **8.** 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	5. 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	3. Free and aggregated sedimentation 4. The theory of the motion of molecules in a fluid 5. 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
- Lab 10 marks
- A final examination of the curriculum (50 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)	5. Coulson J.M. & Richardson J.F., Chemical Engineering, Volume 1, six edition, ELBS, Pergamum Press. 2002. **6.** 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

Reactor Design I

Course Description Form

1. Course Name:
Reactor Design I
2. Course Code:
ChE202
3. Semester / Year:
Course I 2024
4. Description Preparation Date:
1/9/2024
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	The output requirements	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	1- Calculate the equilibrium conversion for both gas and liquid phase reactions 2- Write the combined mole balance and rate law in measures other than conversion 3- 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	1. Apply CRE algorithm to gas phase 2- Account for the effects of pressure drop conversion in packed bed tubular reactors and in packed bed spherical	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	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars.

		reactors Answer what if... questions		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	• Oral and ppt. presentations.
5	3	1- 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	3	1- Determine the reaction order and specific reaction rate from experimental data obtained for either batch or flow reactors 2- Describe how to use equal-area differentiation, polynomial fitting, numerical difference formulas and regression to analyze experimental data to determine the rate law	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.

7	3	1- Define different types of selectivity and yield 2- 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	1- Write net rates of reaction for each species present 2- Write the combined mole balance, rate law and stoichiometry for multiple reactions	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 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	1- Discuss each term in the energy balance 2- 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	In-class questions and discussion. • Quizzes. • Homework and assignments. • Seminars. • Oral and ppt. presentations.

				presentations by the students are made to participate in the lecture.	
11	3	1- 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	1- 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. • 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	1- 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	1- 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	1- Analyze batch reactors and semibatch not operated isothermally 2- Analyze the startup of nonisothermal CSTRs 3- 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	1- Define a catalyst, a catalytic mechanism and a rate limiting step 2- 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",

Petroleum Refinery I

Course Description Form

1. Course Name:
Petroleum Refinery I
2. Course Code:
Ch.E412
3. Semester / Year:
Course I / 2024
4. Description Preparation Date:
22/8/2024
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	The output requirements	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.	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	**5.** Proposing effective solutions to operational and technical problems in refineries.	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	**6.** Apply occupational safety and health procedures in the refining environment.	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	**7.** Identify potential risks and how to deal with them to reduce accidents.	Crude Distillation Desalting Crude Oils	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
8	3	**8.** Keeping up with the latest technological developments in the field of oil refining.	First exam - first semester	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
9	3	**9.** Applying modern technology to improve process efficiency and reduce costs.	Crude Distillation Desalting Crude Oils	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
10	3	**10.** Contributing to research and development to develop new technologies and methods in oil refining.	Atmospheric Distillation Unit	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams

11	3	**11.** Providing new ideas to improve operations and increase their efficiency.	Material and Energy Balances	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
12	3	**12.** Analysis of costs and returns associated with refining operations. Understand the 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	13.Understand the financial challenges facing the refining industry and how to overcome them.	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 ,2001 , Dekker
- Oil and Gas Journal

Equipment Design

Course Description Form

1. Course Name:
Equipment Design
2. Course Code:
Ch.E406
3. Semester / Year:
Course / 1st semester / 2024
4. Description Preparation Date:
1/9/2024
5. Available Attendance Forms:
Available forms of attendance: direct attendance (in the hall)
6. Number of Credit Hours (Total) / Number of Units (Total)
45 hrs/ (2 Units)
7. Course administrator's name (mention all, if more than one name)
Name: Mohammed Faiq Mohammed AL-Kharkhi Email: muhammed_faiq_eng@uodiyala.edu.iq
8. Course Objectives

Course Objectives	1- Define the types of equipment. 2- Define a project with its related main, sub, PID, and control flowsheets. 3- Define the types of materials of construction for equipment. 4- Doing the economic survey for the whole project including the steps of complete project. 5- Doing the material and energy balances as the required calculations that applied in complete design for equipment and the whole project. 6- Doing Cost estimation. 7- Doing the equipment selection for the suitable process. 8- Doing the selection of the suitable site for plant. 9- Doing the control design for the whole process. 10- Doing the design for equipment including the chemical and mechanical designs.

9. Teaching and Learning Strategies

Strategies	➢ Theoretical lectures with the use of illustrations. ➢ Practical application of concepts taught theoretically ➢ Solve problems, discuss them, and assign students some homework and reports through the class platform ➢ Identifying the types of equipment and the differences between them.

10. Course Structure

Week	Hours	The output requirements	Unit or subject name	Learning Method	Evaluation method
1-2	6	1- Define the types of equipment. 2- Basics of Design 3- The role of chemical engineer in the design. 4- Types of process either continuous or batch. 5- The state of operation either steady or unsteady state.	Equipment specifications and engineer role	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
3-4	6	1- Define a project with its related main flowsheet. 2- Sub-flowsheet. 3- PID flowsheet. 4- Control flowsheet.	Flowsheet selection and design.	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
5-6	6	1- Define the types of materials of construction for equipment. 2- Introducing physical properties. 3- Introducing chemical properties. 4- Introducing mechanical properties.	Materials selection and specifications	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
7-8	6	1- Doing the economic survey for the whole project including the steps of complete project.	Economic review	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
9-10	6	1- Doing the material balance for the complete design of equipment. 2- Doing the energy balance for the complete design of equipment.	Material and energy calculations	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture

11	3	1- Doing Cost estimation. 2- Define the types of cost. 3- Evaluation the cost of project.	Cost calculation and estimations	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
12-13	6	1- Doing the equipment selection for the suitable process. 2- Doing the selection of the suitable site for plant.	Selection strategy for equipment and site layout	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture
14-15	6	1- Doing the control design for the whole process. 2-Doing the design for equipment including the chemical and mechanical designs.	Complete design of equipment	Lectures, presentations, and reports	Unannounced exams, Homework 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. HYSYS (or ChemCAD) User and Tutorial Guides.
2- Main references (sources)	2. Chau, Pao C. "Process Control : A First Course with MATLAB", Cambridge University Press, 2002. 3. Davis, Timothy A. and Sigmon, Kermit, "MATLAB Primer, 7th Ed." Chapman & Hall/CRC, 2004.
Mainstream recommended books and references (scientific journals, Reports.....)	/
Electronic references and websites	/

Corrosion Engineering

Course Description Form

1. Course Name:
Corrosion Engineering
2. Course Code:
CHE 408
3. Semester/Year:
First Semester
4. DescriptionPreparationDate:
1-9-2024
5.AvailableAttendanceForms:
Weekly lectures (Full time lecture)
6.NumberofCreditHours(Total)/NumberofUnits(Total):
30
7.Courseadministrator's name (mentionall,if morethanone name)
Name: Ass. Prof. Dr. Adiba A. Mahmmod Email: alnuimiadiba@uodiyala.edu.iq ....
8. Course Objectives

Course Objectives	Giving the student an overview of the principles and concepts of corrosion science, and the distinction between chemical and electrochemical corrosion, in addition to making the student able to know free energy and its relationship to corrosion, the Nernist equation, and the corrosion potential. Calculating the corrosion rate of any metal in many ways, including the weight loss method, Polarization method, impedance method, and knowledge of the Tafel diagram . It also made the student able to know the effect of temperature, the effect of concentration of the medium, and the effect of the speed of the medium , the effect of time & adding inhibitors to the corrosion rate and the efficiency of the production process in factories, in addition to the student's knowledge of fuel cells and electroplating.

9. Teaching and Learning Strategies	
Strategy	1- Lectures. 2- Presenting power point slides. 3- Collect data and prepare reports. 4- Discussions.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	1. Definition of corrosion 2. corrosion cells 3. Anode & Cathode 4. control processes on corrosion 5. Examples	Introduction	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
2-3	4	1.Gibbs Free Energy 2. Nernst Equation 3. Corrosion Potential 4. Examples	Corrosion Dynamic	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
4-5	4	1. Polarization definition 2.Polarization types 3.Corrosion Rates 4.Methods of measuring corrosion rates	Polarization	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
6-7	4		PASSIVITY	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
8	2	semester exam			
9-10	4	1. Introduction 2.Effect of temperature 3. Effect of medium concentration 4. Examples	Factors affecting corrosion	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
11-12	4	1. Effect of medium concentration 2. Effect of Time 3. Examples	Factors affecting corrosion	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
13	2	1. Introduction 2. Fuel cells	Electrochemistry	Lectures, presentations, and reports	Unannounced exams and self-assessment during

		3. Electro plating 4. Examples	applications		the lecture
14	2	1. Introduction 2. Corrosion by H_2S 3. Corrosion by CO_2 4. Examples	Corrosion in the oil industry	Lectures, presentations, and reports	Unannounced exams and self-assessment during the lecture
15	2	semester exam			

11.Cours Evaluation

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

12. Learning and Teaching Resources

1. R. Winston Revie, Herbert H. Uhlig, *CORROSION AND CORROSION CONTROL*, Forth Edition, John Wiley & Sons, Inc, USA, 2008.
2. Mars Fontana, *CORROSION ENGINEERING*, Third edition, MicGraw – Hill, Singapore, 1987

1. 1 Nathan, C.C., *Corrosion Inhibitors*, NACE (1973).
2. West, J.M., *Electrodeposition and Corrosion Processes*, V.N.R. Co. (1971).

Corrosion science journal

http://www.corrosion-doctors.org/

FOURTH YEAR (SEMESTER 2)

Unit Operation II

Course Description Form

1. Course Name:
Unit Operation II
2. Course Code:
Ch. E409
3. Semester / Year:
Courses
4. Description Preparation Date:
21/8/2024
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	16	**9.** Type of Filters, Filtration theory **10.** Plate and frame filter press, leaf filter. **11.** Basic principles of unit operation. **12.** filtration at Constant ΔP **13.** 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	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

Control process II

Course Description Form

1. Course Name:
Control process II
2. Course Code:
Ch.E410
3. Semester/Year:
Course II 2024
4. Description Preparation Date:
4-9-2024
5.AvailableAttendanceForms:
Lectures in class
6.Number of Credit Hours (Total)/Number of Units (Total)
60/ 3
7.Courseadministrator's name (mention all, if more than one name)
Name: Ass. Lect. Sattar Golam

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.*

Reactor Design II

Course Description Form

1. Course Name:
Reactor Design II
2. Course Code:
Ch.E411
3. Semester / Year:
Courses
4. Description Preparation Date:
21/9/2024
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 e 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	Lectures, presentations, and reports	Unannounced exams, Homework and self-assessment during the lecture

			Application to a PFR		
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

Petroleum Refinery II

Course Description Form

1. Course Name:
Petroleum Refinery II
2. Course Code:
Ch.E412
3. Semester / Year:
Course II / 2024
4. Description Preparation Date:
22/9/2024
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	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	effective solutions to operational and technical problems in refineries. **18.** Apply 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	Isomerization	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
6	3		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	operations. Understand the financial challenges facing the refining industry and how to overcome them. 13.Understand the financial challenges facing the refining industry and how to overcome them.	Sulfur Recovery Processes	using the blackboard And Datashow+ Discussion	Daily exams And homework In addition to Monthly exams
12	3		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 **,2001 ,** Dekker • Oil and Gas Journal

Natural Gas Processing

COURSE SPECIFICATION

1. Teaching Institution	University of Diyala - College of Engineering
2. University Department/Centre	Chemical Engineering Department
3. Course title/code	Natural Gas Processing / Ch. E.413
4. Modes of Attendance offered	Yearly system with full study
5. Semester/Year	2nd Semester/Academic Year 2024 – 2025
6. Number of hours tuition (total)	30 hrs (2 hrs per week)
7. Date of production/revision of this specification	12/9/2024
8. Aims of the Course Learn the basics of natural gas, processing methods, purification and increasing it efficiency.	

9· Learning Outcomes, Teaching ,Learning and Assessment Method

A- Knowledge and Understanding

- Definition the basics of natural gas.
- Classification of natural gas.
- Natural gas utilization.
- Natural gas reservoirs.
- Natural gas processing.
- Liquefying and compressing the natural gas.
- Heating value of natural gas.

B- Subject-specific skills

- Calculating the heating value for the natural gas.
- Separation units used in the natural gas processing.

C- Thinking Skills

- The ability of characterization the natural gas type.
- The ability to know the importance of the natural gas processing.

D- General and Transferable Skills (other skills relevant to employability and personal development)

- Activity with society.
- The work with a team.
- How engineering is benefit for society and environment.
- Calculating the heating value for the natural gas from the experimental data.

Teaching and Learning Methods

1. Lectures
2. Presenting Power point (PPT) slides
3. Problems discussion (Tutorial)

Assessment methods

1. Daily exams
2. Monthly exams
3. Home work
4. Final exams

Week	Hours	Unit/Module or Topic Title	ILOs	Teaching Method	Assessment Method
1	2	1. Natural gas definition. 2. Chemical composition of natural gas.	Introduction	1.Lectures (PPT) 2. Tutorial	Oral exam
2	2	1. Classification of natural gas. 2. Natural gas utilization.	Classification of natural gas	1.Lectures (PPT) 2. Tutorial	Oral exam
3	2	1. Natural gas reservoirs. 2. Natural gas properties.	Gas Reservoirs	1.Lectures (PPT) 2. Tutorial	Quiz
4	2	1. Impurities in the natural gas. 2. Impurities effects.	Impurities	1.Lectures (PPT) 2. Tutorial	Monthly exam
5	2	1. World picture of natural gas. 2. Importance of the natural gas processing	Importance of natural gas	1.Lectures (PPT) 2. Tutorial	Oral exam
6	2	1. Condensate and Water Removal.	Natural gas processing	1.Lectures (PPT) 2. Tutorial	Oral exam
7	2	1. Acid Gas Removal.	Natural gas processing	1.Lectures (PPT) 2. Tutorial	Oral exam
8	2	1. Sulfur Recovery Unit	Natural gas processing	1.Lectures (PPT) 2. Tutorial	Oral exam
9	2	1. Dehydration	Natural gas processing	1.Lectures (PPT) 2. Tutorial	Monthly exam
10	2	1. Mercury Removal from Natural Gas.	Natural gas processing	1.Lectures (PPT) 2. Tutorial	Oral exam
11	2	1. Nitrogen Rejection.	Natural gas processing	1.Lectures (PPT) 2. Tutorial	Oral exam
12	2	1. NGL Recovery.	Natural gas processing	1.Lectures (PPT) 2. Tutorial	Oral exam
13	2	1. Natural Gas Liquids Fractionation	Natural gas processing	1.Lectures (PPT) 2. Tutorial	Quiz
14	2	1. Liquefied Natural Gas. 2. Compressed Natural Gas.	Trnasportation of natural gas	1.Lectures (PPT) 2. Tutorial	Oral exam
15	2	1. Heating Value of Fuel.	Fuel evaluating	1.Lectures (PPT) 2. Tutorial	Monthly exam

11. Infrastructure	
Required reading: 1. Himmelblau David M. "Basic Principles and Calculations in Chemical Engineering". 7th Ed. 2003. Prentice Hall PTR. 2. Felder Richard M., Rousseau Ronald W. "Elementary Principles of Chemical Processes" 3nd Ed. 2001. John Willey & Sons. 3. Reklaitis G.V., Schneider Daniel R. "Introduction to Material and Energy Balances" 1983. John Wiley & Sons. 4. Hougen Olaf A., Watson Kenneth M. "Chemical Processes Principles". 2004, John Wiley and Sons & CBS Publishers. Others Lecture notes Students answers for problems	
Special requirements (include for example workshops, periodicals, IT software, websites)	Internet knowledge for chemical engineering
Community-based facilities (include for example, guest Lectures , internship , field studies)	Internship, field studies

Engineering Profession Ethics

Course Description Form

1. Course Name:
Engineering Profession Ethics
2. Course Code:
Ch.E.403
3. Semester / Year:
Course / 2nd semester / Fourth
4. Description Preparation Date:
9/2/2024
5. Available Attendance Forms:
Available forms of attendance: direct attendance (in the hall)
6. Number of Credit Hours (Total) / Number of Units (Total)
15 hrs/ (1 Unit)
7. Course administrator's name (mention all, if more than one name)
Name: Mohammed Faiq Mohammed AL-Kharkhi Email: muhammed_faiq_eng@uodiyala.edu.iq

8. Course Objectives

Course Objectives	Enable the student to define ethical and professional responsibilities and develop engineering skills, solve engineering ethics problems.

9. Teaching and Learning Strategies

Strategies	➢ Enable the student to acquire knowledge and familiarity with the aspects of engineering ethics and acquire skills in following the ethical, scientific and cognitive methods and behaviors provided by the program.

10. Course Structure

Week	Hours	The output requirements	Unit or subject name	Learning Method	Evaluation method
1	1	* The ethical issue in the practice of the engineering profession *Engineering from concept to product * Engineering from problem solving to decision making	Engineering career	Lectures displayed in PowerPoint format	Daily exams + monthly exams
2	1	* Definition of engineering ethics * Illustrative cases	Engineering career	Lectures displayed in PowerPoint format	Daily exams + monthly exams
3	1	* Professions and ethical principles	Engineering career	Lectures displayed in PowerPoint format	Daily exams + monthly exams
4	1	* Ethical rules of rights and duties	Theories of professional ethics	Lectures displayed in PowerPoint format	Daily exams + monthly exams
5	1	* Laws - virtues and philosophy of excuses	Theories of professional ethics	Lectures displayed in PowerPoint format	Daily exams + monthly exams
6	1	* The influence of customs and traditions on professional motivation	Theories of professional ethics	Lectures displayed in PowerPoint format	Daily exams + monthly exams
7	1	* Engineering as experimental practices	Engineering as a social experiment	Lectures displayed in PowerPoint format	Daily exams + monthly exams
8	1	* Engineers' responsibility for their experimental practices	Engineering as a social experiment	Lectures displayed in PowerPoint format	Daily exams + monthly exams
9	1	* Space shuttle Challenger crash	Engineering as a social experiment	Lectures displayed in PowerPoint format	Daily exams + monthly exams
10	1	* Safety and hazards * Risk assessment and attempt to reduce them	Commitmen t to safety measures	Lectures displayed in PowerPoint	Daily exams + monthly exams

				format	
11	1	* A look at some engineering accidents	Commitment to safety measures	Lectures displayed in PowerPoint format	Daily exams + monthly exams
12	1	* Responsibility and keeping business secrets * Engineer Rights	Workplace Responsibilities and Duties	Lectures displayed in PowerPoint format	Daily exams + monthly exams
13	1	* Loyalty and whistleblowing	Workplace Responsibilities and Duties	Lectures displayed in PowerPoint format	Daily exams + monthly exams
14	1	* Multinational Companies *Environmental Conservation * Weapons Manufacturing and Development	The global dimensions of the engineering profession	Lectures displayed in PowerPoint format	Daily exams + monthly exams
15	1	* NSPE Blog * ABET Blog	Blogs	Lectures displayed in PowerPoint format	Daily exams + monthly exams

11.Cours Evaluation	
Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily, oral, monthly, written exams, reports .... etc **• A final examination of the curriculum (60 Marks).**	
12. Learning and Teaching Resources	
1- Required prescribed books	1) Introduction to the ethics of the engineering profession. Ronald Schanzinger and Mike Martin. Translated to Arabic by Prof. Yahya Khalif
2- Main references (sources)	1. Introduction to engineering ethics: Mike W. Martin, Roland Schinzinger. 2nd ed. McGraw-Hill, New York, 2010 2. Govindarajan M, Natarajan S, Senthil Kumar V. S, Engineering Ethics, Prentice Hall of India, New Delhi, 2004.
Mainstream recommended books and references (scientific journals, Reports.....)	ABET Code of Ethics of Engineers National society of Professional Engineers (NSPE)
Electronic references and websites	https://www.nspe.org/resources/ethics/code-ethics