Ministry of Higher Education and Scientific Research
Scientific Supervision and Scientific Evaluation Apparatus
Directorate of Quality Assurance and Academic Accreditation
Department

Academic Programand Course Description Chemical Engineering Department

2025-2026

Introduction:

The educational program is a well-planned set of courses that include procedures and experiences arranged in the form of an academic syllabus. Its main goal is to improve and build graduates' skills so they are ready for the job market. The program is reviewed and evaluated every year through internal or external audit procedures and programs like the External Examiner Program.

The academic program description is a short summary of the main features of the program and its courses. It shows what skills students are working to develop based on the program's goals. This description is very important because it is the main part of getting the program accredited, and it is written by the teaching staff together under the supervision of scientific committees in the scientific departments.

This guide, in its second version, includes a description of the academic program after updating the subjects and paragraphs of the previous guide in light of the updates and developments of the educational system in Iraq, which included the description of the academic program in its traditional form (annual, quarterly), as well as the adoption of the academic program description circulated according to the letter of the Department of Studies T 3/2906 on 3/5/2023 regarding the programs that adopt the Bologna Process as the basis for their work.

In this regard, we can only emphasize the importance of writing an academic programs and course description to ensure the proper functioning of the educational process.

Concepts and terminology:

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

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

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

Program Mission: Briefly outlines the objectives and activities necessary to achieve them and defines the program's development paths and directions.

Program Objectives: They are statements that describe what the academic program intends to achieve within a specific period of time and are measurable and observable.

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

Teaching and learning strategies: They are the strategies used by the faculty members to develop students' teaching and learning, and they are plans that are followed to reach the learning goals. They describe all classroom and extracurricular activities to achieve the learning outcomes of the program.

Academic Program Description Form

University Name: University of Diyala

Faculty/Institute: College of Engineering

Scientific Department: Chemical Engineering Department

Academic or Professional Program Name: Bachelor

Final Certificate Name: Bachelor of Science in Chemical Engineering

Academic System: Course

Description Preparation Date: 2026

File Completion Date: 30 / 6 /2026

Signature:

Head of Department Name:

Lect. Dr. Muwafaq Mahdi Abd

Date: 30/6/2026

Signature:

Scientific Associate Name:

Prof. Dr. Jabar Qasim Jabar

Date: 30/6/2026

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

Department of Quality Assurance and University Performance

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

Signature: 30/6/2026

Approval of the Dean

Prof. Dr. Anees Abdullah Khadom

Scanned with CamScanner

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	**7**	**13**	**13.8%**	
College Requirements	**2**	**8**	**8.5%**	
Department Requirements	**19**	**73**	**77.7%**	
Summer Training	**1 month**	**Without credit**	**-**	**Compulsory training**
Others				

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

7. Program Description

Year	Course code	Course Name	Credit Hours	
			Theoretical	Practical
Year 1 /Semester 1	E 101	Mathematics I	4	0
	CHE 101	Organic Chemistry	2	2
	CHE 102	Principles of Chemical Engineering	4	0
	CHE 103	Engineering Mechanics	3	0
	U 101	Human Rights and Democracy	2	0
	U 103	Computer skills	1	2
Year 1 /Semester 2	E 102	Mathematics II	4	0
	CHE 104	Analytical Chemistry	2	2
	CHE 105	Material Balance	4	0
	CHE 106	Engineering Drawing	1	3
	U 104	English Language	2	0
	CHE 107	Engineering Workshops	0	3
	UD 02	Arabic Language	2	0
Year 2 /Semester 1	CHE 201	Engineering Mathematics I	3	0
	CHE 202	Energy Balance	4	0
	CHE 203	Fluid Flow I	3	0
	CHE 204	Physical Chemistry	3	2
	CHE 205	Petroleum and Natural Gas	3	2
	CHE 206	Computer Programming I	2	2
	UD205	Extinct Ba‘ath Party Crimes	2	0
Year 2 /Semester 2	CHE 207	Engineering Mathematics II	3	0
	CHE 208	Fluid Flow II	3	2
	CHE 209	Pollution and Industrial Safety	3	0
	CHE 210	Engineering Statistic	1	0
	CHE 211	Computer Programming II	2	2
	CHE 212	Materials Engineering	3	2
	UD206	English Language	2	0
	UD207	Arabic Language	2	0

Year 3 /Semester 1	CHE-301	Engineering Analysis	3	0
	CHE-302	Mass Transfer I	3	0
	CHE-303	Thermodynamic I	2	0
	CHE-304	Heat Transfer I	3	2
	CHE-305	Chemical and Petrochemical Industries	3	2
	CHE-306	Industrial Management and Economics	3	0
Year 3 /Semester 2	CHE-307	Numerical Methods	2	2
	CHE-308	Mass Transfer II	3	0
	CHE-309	Thermodynamic II	2	0
	CHE-310	Heat Transfer II	3	0
	CHE-311	Reactor Design I	3	0
	CHE-313	Polymer Technology	2	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 experiments or design a safe experiment. and extract important data. 3- Work ethically and have the ability to identify and identify risks.	➢ Using multiple techniques and devices related to the specialty. ➢ Using laboratory equipment to find data. ➢ Develop and provide a safe work environment by selecting the most appropriate devices and equipment.
Ethics	
1- Professional work, taking into account costs and occupational safety. 2- Working in the spirit of one team and ensuring human victory 3- Anticipating problems and finding appropriate solutions to them.	➢ Ethics and professionalism of the profession. ➢ The impact of industrial activities on society, both negatively and positively. ➢ Compatibility with environmental issues and environmental preservation

9. Teaching and Learning Strategies

1. Theoretical lectures with the use of illustrations.
2. Practical laboratory application of concepts taught theoretically.
3. Assigning students to perform seminars by assigning them a topic to be

discussed with their colleagues.
4. Solve problems, discuss them, and assign students some homework and reports through the e-learning platform.

10. 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.

.

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
Year 1 / Semester 1	E 101	Mathematics I	Basic	√	√	√		√	√	√		√	√	√	√
	CHE 101	Organic Chemistry	Core	√	√	√		√	√	√		√	√	√	√
	CHE 102	Principles of Chemical Engineering	Core	√	√	√		√	√	√		√	√	√	√
	CHE 103	Engineering Mechanics	Basic	√	√	√		√	√	√		√	√	√	√
	U 101	Human Rights and Democracy	Basic	√	√	√		√	√	√		√	√	√	√
	U 103	Computer skills	Basic	√	√	√		√	√	√		√	√	√	√
Year 1 / Semester 2	E 102	Mathematics II	Basic	√	√	√		√	√	√		√	√	√	√
	CHE 104	Analytical Chemistry	Core	√	√	√		√	√	√		√	√	√	√
	CHE 105	Material Balance	Core	√	√	√		√	√	√		√	√	√	√
	CHE 106	Engineering Drawing	Basic	√	√	√		√	√	√		√	√	√	√
	U 104	English Language	Basic	√	√	√		√	√	√		√	√	√	√
	CHE 107	Engineering Workshops	Basic	√	√	√		√	√	√		√	√	√	√
	UD 02	Arabic Language	Basic	√	√	√		√	√	√		√	√	√	√

Year 2 / Semester 1	CHE 201	Engineering Mathematics I	Core	√	√	√		√	√	√		√	√	√	√
	CHE 202	Energy Balance	Core	√	√	√		√	√	√		√	√	√	√
	CHE 203	Fluid Flow I	Core	√	√	√		√	√	√		√	√	√	√
	CHE 204	Physical Chemistry	Core	√	√	√		√	√	√		√	√	√	√
	CHE 205	Petroleum and Natural Gas	Core	√	√	√		√	√	√		√	√	√	√
	CHE 206	Computer Programming I	Core	√	√	√		√	√	√		√	√	√	√
	UD205	Extinct Ba‘ath Party Crimes	Basic	√	√	√		√	√	√		√	√	√	√
Year 2 / Semester 2	CHE 207	Engineering Mathematics II	Core	√	√	√		√	√	√		√	√	√	√
	CHE 208	Fluid Flow II	Core	√	√	√		√	√	√		√	√	√	√
	CHE 209	Pollution and Industrial Safety	Core	√	√	√		√	√	√		√	√	√	√
	CHE 210	Engineering Statistic	Basic	√	√	√		√	√	√		√	√	√	√
	CHE 211	Computer Programming II	Core	√	√	√		√	√	√		√	√	√	√
	CHE 212	Materials Engineering	Core	√	√	√		√	√	√		√	√	√	√
	UD206	English Language	Basic	√	√	√		√	√	√		√	√	√	√
	UD207	Arabic Language	Basic	√	√	√		√	√	√		√	√	√	√
Year 3 / Semester 1	CHE-301	Engineering Analysis	Core	√	√	√		√	√	√		√	√	√	√
	CHE-302	Mass Transfer I	Core	√	√	√		√	√	√		√	√	√	√

	CHE-303	Thermodynamic I	Core	√	√	√		√	√	√		√	√	√	√
	CHE-304	Heat Transfer I	Core	√	√	√		√	√	√		√	√	√	√
	CHE-305	Chemical and Petrochemical Industries	Core	√	√	√		√	√	√		√	√	√	√
	CHE-306	Industrial Management and Economics	Core	√	√	√		√	√	√		√	√	√	√
Year 3 / Semester 2	CHE-307	Numerical Methods	Core	√	√	√		√	√	√		√	√	√	√
	CHE-308	Mass Transfer II	Core	√	√	√		√	√	√		√	√	√	√
	CHE-309	Thermodynamic II	Core	√	√	√		√	√	√		√	√	√	√
	CHE-310	Heat Transfer II	Core	√	√	√		√	√	√		√	√	√	√
	CHE-311	Reactor Design I	Core	√	√	√		√	√	√		√	√	√	√
	CHE-313	Polymer Technology	Core	√	√	√		√	√	√		√	√	√	√

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

YEAR 1
(SEMESTER 1)

	Ministry of Higher Education and Scientific Research - Iraq University of Diyala College of Engineering Department of Chemical Engineering	

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	MATHEMATICS I			**Module Delivery**	
Module Type	BASIC			**Theory** **Lecture** **Tutorial**	
Module Code	E 101				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	1		**Semester (s) offered**	1	
Administering Department	Chemical Engineering		**College**	Engineering	
Module Leader	Ali I. Abdalla		**e-mail**	alialnuaimmy@uodiyala.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	MSc	
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Review Committee Approval			**Version Number**	1.0	

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	-
Co-requisites module	None	**Semester**	-
Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر			
Module Aims أهداف المادة الدراسية	This module aims to provide students with an understanding of, and competence in the use of, mathematical techniques that are relevant to the solution of engineering problems. It will also give students a firm foundation from which to develop solutions to a wider and deeper range of engineering problems that they will encounter throughout their undergraduate engineering program of study.		
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Preliminaries : Explain mathematical coordinate systems, representing line, slope of line, shifting of lines 2. Vectors: Demonstrate an understanding of vectors in plane and space. 3. Function: Demonstrate an understanding of function and related variables, range and domain of function, types of functions and their graphs. 4. Limits and Continuity: Demonstrate an understanding of the fundamental concepts of calculus including limits, continuity, and differentiability. 5. Derivatives: Apply the techniques of differentiation at different types of functions including transcendental functions 6. Applications of derivatives: Apply the techniques of differentiation to solve problems involving rates of change, linearization, curve sketching, mean value theorem and Initial value problem. 7. Complex numbers: Demonstrate an understanding of complex numbers with basic operations and their mathematical and graphical representations including Euler's Formula		
Indicative Contents المحتويات الإرشادية	The topics listed under the indicative content below are the underpinning areas of knowledge and understanding that will be obtained from successful completion of the module. The mathematical topics are illustrated in the context of relevant engineering scenarios. • **Preliminaries** Cartesian coordinates, polar coordinates, slope of lines, angle of inclination. • **Functions**, types of functions, graph of the functions, domain and range of function • **Review of trigonometric function:** graph of trigonometric function, range and domain of trigonometric functions, identities. • **Limits and Continuity:** Properties, limits involving infinity,		

	continuity. • **Transcendental functions**: Inverse function, graph of inverse function, Logarithmic and exponential functions, inverse trigonometric functions, hyperbolic functions, inverse hyperbolic functions. • **Derivatives:** Definition, rules of derivative, Implicit differentiation, L hospital's rule, derivative of inverse functions • **Applications of derivatives:** rate of change problems, Relative maximum and relative minimum, Curve sketching with 1^{st} and 2^{nd} derivative, Linearization, Mean value theorem, Initial value problem,. • **Complex numbers:** Basic definitions. The geometric representations of the complex numbers**,** argand diagram, Basic operations with complex numbers, Euler's Formula • **Vectors**: Introduction to vectors
Course Description	This course lays the foundation for a robust understanding of mathematical concepts that underpin the various disciplines within engineering. It covers a breadth of topics ranging from coordinate systems, slopes of lines, and angles of inclination to the introduction of two- and three-dimensional coordinate systems. A focus is also given to the understanding and manipulation of functions, including domain and range determination and function composition. The course incorporates a substantial overview of trigonometry, limits, continuity, derivatives, including their applications in real-world engineering contexts in addition to complex numbers and their mathematical representation. By the end of the course, students will have a sound understanding of these principles, preparing them for more advanced engineering courses in their respective fields.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Begin In Mathematics I, then employ a range of teaching strategies to ensure first-year engineering students fully grasp the various mathematical concepts. Instructional methods include interactive lectures, where core mathematical principles are explained in detail, and practical problem-solving sessions to provide hands-on learning experiences. Collaborative group work encourages peer-to-peer learning and reinforces understanding through shared insights. Regular formative assessments will be conducted to monitor students' understanding of the material, and feedback will be promptly given to guide their learning process. Instructors will maintain office hours for personalized support, and online resources will be available to supplement classroom instruction. Emphasis will be placed on relating mathematical concepts to real-world engineering applications to make the learning experience more relevant and engaging. These strategies aim to develop students' critical thinking skills, enhance their problem-solving abilities, and prepare them for advanced engineering studies.

Student Workload (SWL) الحمل الدراسي للطالب				
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 55 **In class tests** 5 **Tutorial** **15** **Final Exam** **3**		78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Assignment** **20** **Preparation for tests** **20** **Homework** **32**		72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل		150		

Module Evaluation تقييم المادة الدراسية					
		Time(hr)/ Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	20% (20)	3,5, 10, 12, 14	LO #1, 2, 3, 4 ,5 and 7
	Assignments	6	10% (10)	4, 8, 12	LO # 1, 2, 3, 4, 5 and 6
	Home Work	6	10% (10)	2,5,7,9,11,13	LO # 1, 2, 3, 4, 5,6 and 7
Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1,4
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Cartesian coordinates, slope of lines, angle of inclination, functions, types of functions, graph of the functions, domain and range ,identifying functions, Circles and parabolas
Week 2	Introduction to vectors
Week 3	•Preliminaries Sum, differences, products and quotients of Composite functions, shifting a graph of a function, scaling and reflecting a graph of a function, Absolute value

Week 4	•Review of trigonometric function graph of trigonometric function, range and domain, identities
Week 5	•Limits and Continuity Properties, limits involving infinity, continuity
Week 6	•Transcendental functions Inverse function, graph of inverse function, Logarithmic and exponential functions, trigonometric functions , inverse trigonometric functions, hyperbolic functions, inverse hyperbolic functions
Week 7	•Derivatives Definition, rules of derivative, slopes , tangent lines, chain rule, derivative of trigonometric functions, Implicit differentiation, L hospital's rule
Week 8	derivative of inverse trigonometric functions, derivative of exponential and logarithmic functions
Week 9	•Applications of derivatives Speed and acceleration, Relative maximum and relative minimum
Week 10	Curve sketching with 1st and 2nd derivative
Week 11	Linearization
Week 12	rate of change problems
Week 13	Mean value theorem -Initial value problem
Week 14	Complex numbers**:** Basic definitions. The geometric representations of the complex numbers**,** argand diagram
Week 15	Basic operations with complex numbers, Euler's Formula
Week 16	**Final Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	George B. Thomas and Ross L. Finney, "Calculus and Analytic Geometry, Addison- Wesley	Yes
Recommended Texts	Thomas Calculus, by George B.Thomas,Jr,Elevnth Edition Media Upgrade 2008 Calculus Early Transcendental (Sixth Edition) James Stewart	Yes
Websites		

	Ministry of Higher Education and Scientific Research - Iraq University of Diyala College of Engineering Department of Chemical Engineering	

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Organic Chemistry**			**Module Delivery**	
Module Type	**Core**			**Theory** **Lecture** **Lab** **Tutorial** **Seminar**	
Module Code	**CHE 101**				
ECTS Credits	**6**				
SWL (hr/sem)	**79**				
Module Level	1		**Semester of Delivery**	1	
Administering Department	Chemical engineering		**College**	College of Engineering	
Module Leader	Mohanad Ali Sultan		**e-mail**	maalazzawi@uodiyala.edu.iq	
Module Leader's Acad. Title	Lecture		**Module Leader's Qualification**	MSc	
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date			**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1. To develop problem solving skills and understanding of basic principles of organic chemistry. 2. To understand sstructure, properties and synthesis , apply fundamental reactions of organic compounds. 3. This course deals with the basic concept of organic chemistry. 4. Recognize Structure Relationships Between Chemicals. 5. To understand Stability-Reactivity Principles. 6. Recognize and Apply Functional Groups.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Discuss polarization of a bond with electronegativity. understand nuclephile and electrophile groups and their properties. 2. Describe different bond types of carbon and its hybriorbitals .Express the differences between valence bond and molecular orbital approaches 3. Evaluate effects of atomic properties on acidity and basicity. enlighten relationship between acidity constant pKa and an acid-base reaction. Relate structure of molecule with strength of acidity and basicity write side chain reactions of aromatic compounds. 4. Explain the reactions and properties of halogen compounds. 5. Identify alkane, alkene and alkyn. 6. prepare alkane, alkene and alkynes using different methods. 7. Interpret the reactions and properties of alchols and phenols. Recognize the main differences between the acidities of alcohols and phenols. Explain the reactions and properties of ethers and epoxides. 8. Recognize the main differences between open chain ethers and epoxides. 9. Recognize the concept of aromaticity and the main properties of aromatic compounds. Explain aromaticity concept. 10. Explain reactions of ketones. Explain preparation methods of aldehydes Describe preparation methods of ketones 11. Evaluates the importance of carbonyl function in organic chemistry. 12. Explain Carboxylic Acid Nomenclature. Describe Structure and Bonding Physical Properties . Identify Acidity of Carboxylic Acids
Indicative Contents المحتويات الإرشادية	• Introduction (3 hrs) • Alkanes and Cycloalkanes (3 hrs) • Alkyl halides (3 hrs) • Alkenes and Cycloalkenes (3 hrs) • Addition Reactions of Alkenes (3 hrs) • Alkynes (5 hrs) • Arenes and Aromaticity (5 hrs) • Alcohols (5 hrs)

	• Aldehydes and Ketones (5 hrs) • Carboxylic Acids (5 hrs) • Carboxylic Acid Derivatives (2 hrs) • Amine (3 hrs)
Course Description وصف المادة الدراسية	Hydrocarbons, aliphatic, ring, olefins, acytelines, aromatics, Orbitals, Thermal cracking process, hydrogenation, reduction, Special reactions: oxidation and combustion, addition, substitution, nitration, Sulphonation, halogenation, polymerization, Halides, Alcohols and phenols, Ethers, Aldehydes and ketones, Carboxylic acids, esters, amino-acids, amides, Amines and some.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Begin to establish a strong conceptual understanding of the principles of organic chemistry. Use real-life examples and measurements to help students relate abstract concepts to everyday experiences. Encourage discussions and questions to clear up any misconceptions. In addition, provide students with real-world problem scenarios that require the application of organic chemistry principles. Encourage active participation and group discussions to enhance critical thinking and problem-solving skills. Guide students through the problem-solving process and provide constructive feedback.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** **28** **In class tests** **2** **Tutorial** **15** **Lab** **30** **Final Exam** **4**	79	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Libraray, dorm, home, memorize** **49** **Preparation for tests** **10** **Homework** **12**	71	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.7
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**150**		

Module Evaluation تقييم المادة الدراسية					
		Time/number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	2 , 4 , 8 , 12	LO #1, #4 and #5, #10
	Assignments	4	10% (10)	5, 10, 12, 14	LO #5, #9 , #10, #11
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #7, #9 , #11
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #5
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction - Atoms, molecules, bonding, polar and nonpolar molecules, intermolecular forces, solubilities, Lewis structures, acids and bases. Writing Organic Structures, Bond strength , Intro. to electrophiles & nucleophiles
Week 2	Alkanes and Cycloalkanes: Introduction to Hydrocarbons Molecular Formulas, nomenclature, alkyl group, Rings (cycloalkanes, polycyclic compounds)
Week 3	Alkyl halides IUPAC Nomenclature of Alkyl Halides substitution reactions of alkyl halides.Elimination reactions Physical Properties of Alcohols and Alkyl Halides: Intermolecular Forces
Week 4	Alkenes and Cycloalkenes structure and bonding, nomenclature, Physical Properties of Alkenes, Preparation of Alkenes:
Week 5	Addition Reactions of Alkenes

	Addition of Sulfuric Acid to Alkenes Acid-Catalyzed Hydration of Alkenes Hydroboration–Oxidation of Alkenes Addition of Halogens to Alkenes Epoxidation of Alkenes Ozonolysis of Alkenes Reactions of Alkenes with Alkenes
Week 6	Alkynes Sources of Alkynes Nomenclature Physical Properties of Alkynes Structure and Bonding in Alkynes: sp Hybridization Acidity of Acetylene and Terminal Alkynes Preparation of Alkynes by Alkylation of Acetylene
Week 7	Mid-term Exam
Week 8	Alkynes Reactions of Alkynes Hydrogenation , Hydration of Alkynes Metal–Ammonia Reduction of Alkynes Addition of Hydrogen Halides to Alkynes
Week 9	Arenes and Aromaticity Benzene The Structure of Benzene, The Stability of Benzene Substituted Derivatives of Benzene and Their Nomenclature Physical Properties of Arenes
Week 10	Reactions of Arenes: Oxidation of Alkylbenzenes , Reactions of Benzylic Halides Reactions of Benzylic Halides Addition Reactions of Alkenylbenzenes Hückel's Rule
Week 11	Alcohols Sources of Alcohols Preparation of Alcohols by Reduction of Aldehydes and Ketones Preparation of Alcohols by Reduction of Carboxylic Acids Preparation of Alcohols from Epoxides Preparation of Diols Reactions of Alcohols: Esterification , Oxidation of Alcohols
Week 12	Aldehydes and Ketones Nomenclature Structure and Bonding: The Carbonyl Group Physical Properties Sources of Aldehydes and Ketones Reactions of Aldehydes and Ketones

	Acetal Formation
Week 13	Carboxylic Acids Carboxylic Acid Nomenclature Structure and Bonding Physical Properties Acidity of Carboxylic Acids
Week 14	Substituents and Acid Strength Salts of Carboxylic Acids Sources of Carboxylic Acids Synthesis of Carboxylic Acids Reactions of Carboxylic Acids
Week 15	Amine Amine Nomenclature Structure and Bonding Physical Properties Basicity of Amines mines as Natural Products Preparation of Amines by Alkylation of Ammonia Reactions of Amines:
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Melting point determination
Week 2	Lab 2: Boiling point determination
Week 3	Lab 3: Simple Distillation
Week 4	Lab 4: saturation and combustion tests for organic test
Week 5	Lab5: Distinguish between aliphatic and aromatic hydrocarbons
Week 6	Lab 6: Preparation of aspirin
Week 7	Lab 7: Identification of functional groups
Week 8	Lab8: Saponfication reaction
Week 9	Lab 9: Preparation of ester
Week 10	Lab 10: Identification of carboxylic acid and phenols

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Any textbooks for organic chemistry	Yes
Recommended Texts	Organic Chemistry 8th edition by Francis A. Carey University of Virginia and Robert M. Giuliano Villanova University Organic Chemistry (fifth edition)by Francis A. Carey Tata Mc Graw Hill publishing company Limited, New Delhi.	No
Websites		

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note:

NB Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

	Ministry of Higher Education and Scientific Research - Iraq University of Diyala College of Engineering Department of Chemical Engineering	

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Principles of Chemical Engineering**			**Module Delivery**	
Module Type	CORE			**Theory** **Lecture** **Tutorial**	
Module Code	CHE 102				
ECTS Credits	7				
SWL (hr/sem)	78				
Module Level	1		**Semester (s) offered**	1	
Administering Department	Chemical Engineering		**College**	Engineering	
Module Leader	Dr. Mohammed H. Msaed		**e-mail**	Mhmmsaed1@uodiyala.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor	None		**e-mail**		
Peer Reviewer Name	None		**e-mail**		
Review Committee Approval			**Version Number**		

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	Fundamentally, chemical engineering is the discipline that transforms scientific breakthroughs into large scale industrial processes. This course serves as an introduction to the principles and calculation techniques used in chemical engineering by developing knowledge and expertise in the basic principles of chemical engineering. It also comprehensively introduces problem-solving methods for material balances without chemical reactions.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	**Knowledge and Understanding** Having successfully completed this module, the student will be able to demonstrate knowledge and understanding of: • Definition of the dimensions, units and their conversions. • Describing the Dimensional Consistency (Homogeneity). • Explanation the concentrations, mole and density. • Discussion the Temperature and pressure. • Showing the General strategy for solving material balance problems. • Solving the Material Balances for Batch and Semi-Batch Processes. • Solving material balance problems for single units without reaction.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Understanding Review (4 hrs). • Understanding Definition the dimensions, units and their conversions(6 hrs). • Understanding Dimensional Consistency (6 hrs). • Express of concentrations, mole and density (8 hrs). • Temperature and pressure (16 hrs). • General strategy for solving material balance problems (6 hrs). • Material Balances for Batch and Semi-Batch Processes (16 hrs). • Solving material balance problems for single units without reaction (16 hrs).
Course Description	This module is designed to provide first-year Chemical Engineering students with the foundational concepts of principles of chemical engineering, including the dimensions, units, and their conversion, dimensional consistency (homogeneity), moles, density, concentration, choosing a basis, temperature, pressure, introduction to material balance, material balances for batch and semi-batch processes, general strategy for solving material balance problems, solving material balance problems for single units without reaction.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Beginning to establish a strong understanding of the principles of chemical engineering, in particular, material balance. Using real industrial examples to help students relate the basic concepts of material balance to real industrial processes. Encouraging the discussions and questions to clear up any misconceptions. In addition, encouraging active participation and group discussions to enhance critical thinking and problem-solving skills.

	Guiding the students through the problem-solving process and providing constructive feedback.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** **57** **In class tests** **3** **Tutorial** **15** **Final exam** **3**		78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing** **40** **Preparation for tests** **40** **Homework** **17**		97	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل		175		

Module Evaluation
تقييم المادة الدراسية

		Time/ Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	20% (20)	2,4,6,9,11 and 13	LO #1, 2, 6, and 7
	Assignments	2	10% (10)	3,5,7,9,11 and 14	LO # 1,2,3,5 and 6
	Home work	1	10% (10)	14	LO # 4-7
Summative assessment	**Midterm Exam**	1	10 % (10)	7	LO # 1-4
	Final Exam	1	50% (50)	16	All
Total assessment			100% (100Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Definition of dimensions and units
Week 2	Conversion of units and conversion factors
Week 3	Dimensional Consistency (Homogeneity)
Week 4	Express of concentrations, mole and density
Week 5	Express of concentrations and choosing a basis
Week 6	Temperature
Week 7	Pressure
Week 8	Introduction to Material Balances and Open, Closed, Steady-State Unsteady-State Systems
Week 9	The material balance for a single component process
Week 10	Multiple Component Systems

Week 11	Accounting for Chemical Reactions in Material Balances
Week 12	Material Balances for Batch and Semi-Batch Processes
Week 13	General Strategy for Solving Material Balance Problems
Week 14	Solving material balance problems for single units without reaction
Week 15	Solving material balance problems for single units without reaction
Week 16	**Final Exam**

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	David M Himmelblau, Basic principles and calculations in chemical engineering, Prentice Hall.	Yes
Recommended Texts	Richard M Felder & Ronald W. Rousseau Elementary Principles of Chemical Processes, Wiley India.	No
Websites	Nil	

APPENDIX:

GRADING SCHEME
مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note:

NB Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

	Ministry of Higher Education and Scientific Research - Iraq University of Diyala College of Engineering Department of Chemical Engineering	

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	**Engineering Mechanics**	**Module Delivery**	
Module Type	BASIC	**Theory** **Lecture** **Tutorial**	
Module Code	CHE 103		
ECTS Credits	5		
SWL (hr/sem)	125		
Module Level	1	**Semester (s) offered**	1
Administering Department	Chemical Engineering	**College**	Engineering
Module Leader	Khalid Ahmed	**e-mail**	khalideng@uodiyala.edu.iq
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	M. Sc.
Module Tutor	None	**e-mail**	
Peer Reviewer Name	None	**e-mail**	
Review Committee Approval		**Version Number**	1.0

Relation With Other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	This course aims to teach the students to learn and recognize the Engineering Mechanics. The student learns the followings: 1. Understand and apply Newton's laws to analyze forces and predict force

	reactions. 2. Understand the concept of vectors to use them in analyzing forces, velocity, and related quantities. 3. Understand the concept of forces to apply them to determine their effects on mechanical systems. 4. To use free-body diagrams to represent and simulate mechanical systems in order to analyze forces and identify points of force application. 5. Learn how to Analyze forces in 2D mechanical systems using the concept of force components in two dimensions. 6. Learn how to analyze forces in 3D mechanical systems using the concept of force components in three dimensions. 7. Learn how to apply the principles of the moment of force to analyze and calculate moments and their effects on mechanical systems. 8. Understand the concept of coupling and use it to analyze and calculate its effects on mechanical systems. 9. Learn how to apply the principles of equilibrium for a rigid body to stabilize mechanical systems. 10. Understand the concepts of dry friction and friction forces to use them in analyzing and calculate friction in mechanical systems. 11. Apply the principles of equilibrium in bodies involving dry friction to analyze and calculate friction forces required for equilibrium in mechanical systems. 12. Learn how to determine the centroid and center of gravity of bodies to achieve stable system designs. 13. Calculate the center of volume and area to enhance the system design. 14. Learn how to apply the principles of the moment of inertia to improve systems design. 15. Learn how to use the Parallel Axis Theorem to determine the moment of inertia in optimizing the system design. In general, students will be able to analyze and predict weights and forces, ensure equilibrium and stability in mechanical systems, and determine the effects and locations of forces to achieve better system designs.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	**On successful completion of this course, students will be able to:** 1. Understand Newton's laws and apply them to analyze forces and predict force reactions. 2. Understand the concept of vectors and use them to analyze forces, velocity, and related quantities. 3. Understand the concept of forces and apply them to determine their effects on mechanical systems. 4. Understand the concept of free-body diagrams and use them to represent and simulate mechanical systems in order to analyze forces and determine their points of effect. 5. Understand the concept of forces in 2D components and apply them to analyze forces in mechanical systems. 6. Understand the concept of forces in 3D components and apply them to analyze forces in mechanical systems. 7. Understand the principles of the moment of force and use them to analyze and calculate moments and their effects on mechanical systems. 8. Understand the concept of coupling and apply it to analyze and calculate

	coupling effects on mechanical systems. 9. Understand the principles of equilibrium for a rigid body and use them to stabilize mechanical systems. 10. Understand the concept of dry friction and friction forces and apply them to analyze and calculate friction forces in mechanical systems. 11. Understand the principles of equilibrium for bodies involving dry friction and apply them to analyze and calculate friction forces to achieve equilibrium in mechanical systems. 12. Understand the concept of the centroid and use it to determine the center of gravity and centroids of bodies to enhance system stability. 13. Understand the concepts of finding the center of volumes and areas and apply them to achieve stable system designs. 14. Understand the principles of the moment of inertia and apply them to improve system design. 15. Understand the concept of the Parallel Axis Theorem and use it to determine the moment of inertia for better system design. **In general, students will be able to analyze and predict weights and forces, perform equilibrium and stability calculations in mechanical systems, and determine the effects and locations of forces to achieve better system designs.**
Indicative Contents المحتويات الإرشادية	1. Introduction to statics science, Newton's fundamental laws [3 hrs] 2. Vectors [3 hrs] 3. Forces [3 hrs] 4. Free body diagrams [3 hrs] 5. Force analysis in 2D components [3 hrs] 6. Force analysis in 3D components [3 hrs] 7. Moment of force, Midterm Exam [3 hrs] 8. Coupling [3 hrs] 9. Equilibrium for a Rigid Body [3 hrs] 10. Friction [3 hrs] 11. Equilibrium of bodies involving dry friction [3 hrs] 12. Center of gravity [3 hrs] 13. Centroid of areas [3 hrs] 14. Moment of inertia [3 hrs] 15. Parallel axis theorem [3 hrs]
Course Description	This course familiarizes students with the principles of applying Newton's laws of motion to solve engineering problems. Emphasis is placed on drawing free body diagrams and self-checking strategies. Topics include introduction to forces; 2D equilibrium of particles and rigid bodies; center of gravity and centroids; friction; force vectors analysis, equilibrium of particles, force systems resultant, moments and couples, equilibrium of rigid bodies; friction, center of gravity and centroids, moment of inertia.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy that will be adopted in delivering this module through classes and in involving the student in solving example problems, home works, class works, and reports/seminars to refine and expanding their critical thinking skills in this field. This will helps students to understand the course material.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** **In class tests** **Final Exam**	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing** **Preparation for tests** **Homework**	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 11	LO #1-11
	Assignments	2	20% (10)	6 and 12	LO # 1-12
	Home work	2	5% (10)	4 and 9	LO # 1-9
	Report	1	5%(10)	15	LO # 1-15
Summative assessment	**Midterm Exam**	2	10% (10)	7	LO # 1-6
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to statics science, Newton's fundamental laws
Week 2	Vectors
Week 3	Forces
Week 4	Free body diagrams
Week 5	Force analysis in 2D components
Week 6	Force analysis in 3D components

Week 7	Moment of force, Midterm Exam
Week 8	Coupling
Week 9	Equilibrium for a Rigid Body
Week 10	Friction
Week 11	Equilibrium of bodies involving dry friction
Week 12	Center of gravity
Week 13	Centroid of areas
Week 14	Moment of inertia
Week 15	Parallel axis theorem
Week 16	Final Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Engineering Mechanics SI Version, J. L. Meriam, and L.G. Kraige Sixth Edition Publisher: John Wiley and Sons Inc.	Yes
Recommended Texts	Applied Statics and Strength of Materials Leonard Spiegel, George F. Limbrunner Publisher: Prentice Hall	Yes
Websites	https://www.adelaide.edu.au/course-outlines/109875/1/sem-1/	

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note:				
NB Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.				

Ministry of Higher Education and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	حقوق الانسان والديمقراطية	**Module Delivery**	
Module Type	Suport		
Module Code	U 101	**Theory** **Lecture** **Seminar**	
ECTS Credits	2		
SWL (hr/sem)	30		
Module Level	1	**Semester of Delivery**	1
Administering Department	Chemical Engineering	**College**	Engineering
Module Leader	Mohamed Ali Hameed	**e-mail**	amohamed_902@uodiyala.edu.iq
Module Leader's Acad. Title	Assist. Proff.	**Module Leader's Qualification**	Ph.D.
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	
Scientific Committee Approval Date		**Version Number**	1.0

Relation with other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1- يتعلم الطالب خلال السنه الدراسية اساسيات حقوق الانسان والديمقراطية ما حقوقه كيف يدافع عنها بالطرق القانونية وما هي ضماناتها الداخلية والدولية. 2-استحصال المعرفة في مجال الديمقراطية وأنواع أنظمتها واثرها على حقوق الانسان . 3-تنمية شخصية الطالب وتعزيز وعيهم في الأنظمة السياسية الديمقراطية وتفاصيلها وكيفية تطبيقها على ارض الواقع واهمية ان يكون فعال في المجتمع من خلال احترامه لحقوق الاخرين ومعرفه ان الحقوق والحريات تنتهي عند بداية حقوقهم وحرياتهم ويؤدي واجباته بدلا من اكتساب الحقوق فقط. 4- تعزيز ثقافة السلام القائمة على العدل والمساواة.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1 -تمكين الطالب من معرفة اساسيات الدفاع عن حقوقه وحقوق الاخرين بعد معرفتها ومعرفة أهميتها له وللمجتمع بصورة عامة وأيضا معرفه كل شخص حدود حقوقه وحريته . ٢- تمكين الطالب في المشاركة السياسية وذلك من خلال معرفته بأهمية مشاركته في الانتخابات وتأثير هذه المشاركة على سير الانتخابات وتشكيل السلطة فيما بعد. ٣- معرفه الطالب ضمانات حقوقه وحرياته وما هي مصادرها . ٤ - معرفة الفرق بين الحقوق والحريات. ٥- تمكين الطالب من معرفة ما هي المفهوم العلمي للديمقراطية وما هي جذورها وانواعها واشكالها . ٦- يتعلم الطالب كيف يؤثر النظام الديمقراطي على حقوق الانسان وما هي العلاقة بينها . ٧ - ادراك الطالب ضرورة ان يكون مواطن فعال في المجتمع ايضا معرفه شروط الناخب وشروط المرشح للانتخابات. ٨- معرفه أنظمة الانتخابات وايهما افضل. ٩ - فهم الطالب للقانون الدولي لحقوق الانسان وايضا معرفة مختصرة عن المنظمات الدولية والية عملها كالأمم المتحدة ومنظمة الصليب الأحمر وغيرها .
Indicative Contents المحتويات الإرشادية	1 الجزء الأول -تعريف حقوق الانسان وحقوق الانسان في الحضارات القديمة. (تعريف الحق وتعريف الانسان ومعرفة أهمية حقوق الانسان بالنسبة للإنسان والمجتمع أيضا دراسة حقوق الانسان في الحضارات كالحضارة المصرية والعراقية واليونانية والرومانية) (٤ساعات) الجزء الثاني معرف حقوق الانسان في الأديان السماوية واهمها الإسلام (٢ساعة) مصادر حقوق الانسان تتضمن (مصادر دولية كالإعلان العالمي لحقوق الانسان والعهدان الدوليان والمصادر الإقليمية التي تشمل الاتفاقيات الإقليمية كالاتفاقية الاوربية والأمريكية والدستور) (٢ساعة) ضمانات حقوق الانسان (كالضمانات الدستورية والقانونية) (٢ساعة) الاتفاقيات الدولية والإقليمية لحقوق الانسان (٢ساعة) الحريات العامة وانواعها والمقارنة فيما بينها (٢ساعة) مستقبل حقوق الانسان والعولمة وحقوق الانسان (٢ساعة) تعريف وتاريخ وأنواع الديمقراطية (دراسة تعريف ونشأة وتطور الديمقراطية مبادئها وانواعها كالديمقراطية

	المباشرة وغير المباشرة والنظام الرئاسي والبرلماني (٦ساعات) تعريف الانتخاب وشروطه وأنواع النظم الانتخابية وتعريف المجلس النيابي (٦ساعات) العلاقة بين الديمقراطية وحقوق الانسان (٢ساعة)
Course description وصف المادة	إن حقوق الإنسان والديمقراطية توصف بأنها موضوع مهم وحيوي اذ تسهم في تمكين الطالب من معرفة حقوقه وحرياته وأهمية التمسك بها والدفاع عنها . حيث يهدف إلى تعريف الطالب ما هي حقوق الإنسان ، وما تأثيرها وأهميتها على الإنسان والمجتمع بشكل عام ، وما هي العلاقة بينها وبين الديمقراطية . و دراسة الديمقراطية كدراسة علمية .

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	1-زيادة وعي الطالب بأهمية معرفه حقوقه وواجباته اتجاه المجتمع وعلاقة حقوق الانسان بالنظام الديمقراطي 2-ثقافة عامة في مجموعة من المجالات ومنها المجال القانوني و السياسي والاجتماعي ورفع ثقة الطالب بنفسه من خلال ربط المادة النظرية بالواقع العملي

Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ أسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	30	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	17	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	1.1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	50		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 #,3,and #6 #7#8
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7

	Projects / Lab.				
	Report	1	10% (10)	13	LO #5, #8 and #9
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	محاضرة تعريفية عن المادة واهميتها ..
Week 2	تعريف الحق والانسان وحقوق الانسان واهمية حقوق الانسان ,حقوق الانسان في الدين الإسلامي والحضارات القديمة .
Week 3	مصادر حقوق الانسان الدولية والإقليمية والمحلية .
Week 4	ضمانات حقوق الانسان الدستورية والقانونية وضمانات حقوق الانسان على الصعيد الدولي.
Week5	ضمانات حقوق الانسان في الإسلام
Week 6	دور المنضمات الإقليمية في حماية حقوق الانسان.
Week 7	خصائص حقوق الانسان وتعريف الحريات العامة وانواعه والمقارنة بينها وبين الحقوق القانون الدولي لحقوق الانسان والقانون الدولي الإنساني ومنظمة الصليب الأحمر.
Week 8	مستقبل حقوق الانسان وسبل تطويرها .
Week 9	العولمة وحقوق الانسان .
Week 10	تعريف الديمقراطية وتطورها التاريخي ومبادئها . الديمقراطية بين العالمية والخصوصية . اشكال الديمقراطية / الديمقراطية المباشرة.
Week 11	الديمقراطية شبه المباشرة والديمقراطية التمثيلية / اركان النظام التمثيلي / اشكال النظام التمثيلي.
Week 12	المجلس النيابي وانواعه / الانتخاب وشروطه / هيئة الناخبين.
Week 13	تنظيم عملية الانتخاب / تحديد الدوائر الانتخابية / القوائم الانتخابية / المرشحون/ الحملة الانتخابية / التصويت .
Week 14	نظم الانتخابات.
Week 15	علاقة الديمقراطية بحقوق الانسان وكيفية التأثير والتأثر فيما بينها .
Week 16	الامتحان النهائي

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	حقوق الانسان و الطفل و الديمقراطية /تاليف ماهر صالح علاوي وريا ض عزيز هادي وعلي عبد الرزاق محمد و اخرون / العاتك / بيروت / ٢٠٠٩	نعم
Recommended Texts	عباس الدليمي / حقوق الانسان الفكر و الممارسة فخري رشيد ،صلاح ياسين /المنظمات الدولية / العاتك لصناعة الكتاب / بغداد عصام العطية / القانون الدولي العام / المكتبة القانونية /بغداد /2012	لا
Websites		

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Computer Skills			**Module Delivery**	
Module Type	Basic			**Theory** **Lecture** **Lab**	
Module Code	U 103				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	1		**Semester of Delivery**	1	
Administering Department	Chemical Engineering		**College**	College of Engineering	
Module Leader	Sura F. Yousif		**e-mail**	sura.fahmy@uodiyala.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	MSc	
Module Tutor	-		**e-mail**	-	
Peer Reviewer Name	-		**e-mail**	-	
Scientific Committee Approval Date			**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1. Training students on the basics of using the computer and providing them with the necessary skills to deal with the computer with high efficiency.

	2. Assisting the student in distinguishing and developing his scientific and artistic abilities. 3. Enriching the student's skills to be able to deal with the computer with high efficiency. 4. Providing students with a way to use other modern technologies related to the educational process.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Enabling the student to know the concepts of information technology by learning the basics of the computer. 2. Enabling the student to know about the use of GUI operating systems. 3. Enabling the student to deal with the skills of using the operating system (Windows operating system) through exploring, customizing, and controlling its settings. 4. Enabling the student to work on the word processing program (Microsoft Word). 5. Enabling the student to work on the spreadsheet program (Microsoft Excel). 6. Enabling the student to work on the presentation program (Microsoft PowerPoint).
Indicative Contents المحتويات الإرشادية	**Indicative content includes the following.** • Course introduction (4 hrs) • Working with GUI operating systems with a focus on Microsoft Windows OS (8 hrs) • Microsoft Office Word (MS Word) (16 hrs) • Microsoft Office Excel (MS Excel) (16 hrs) • Microsoft Office PowerPoint (MS PowerPoint) (16 hrs)
Description	Overview of computers: basic components, applications. GUI operating systems: Microsoft Windows operating system. Microsoft Office Word: getting started with Word, editing a document and formatting text and paragraphs, adding tables and inserting graphic objects, controlling page appearance and proofing a document. Microsoft Office Excel: getting started with Excel, sorting, selecting and subtotaling data, formulas and functions, worksheet formatting and presentation. Microsoft Office PowerPoint: getting started with PowerPoint, developing a PowerPoint presentation, adding graphical elements to your presentation and modifying objects in your presentation, adding graphical elements, tables and charts to your presentation and modifying objects in your presentation, prepare to deliver your presentation.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	**In this course, students are guided by:** • Using different examples. • Using different styles of discussion that aim to connect the theoretical and practical sides. • Asking questions and giving exercises that require analysis and conclusions related to lectures. • Encourage students to participate in discussions and do the practical work. • Encourage students to work in groups.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا				
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 13 **In class tests** 4 **Lab** 43 **Final Exam** 4	**64**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**4**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing** 14 **Preparation for tests** 14 **Homework** 8	**36**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**2.4**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**100**		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	6 and 12	LO #1 to #3 and #4 to #6
	Assignments	2	10% (10)	2 and 13	LO #3 to #6
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #3, #4 and #6
Summative assessment	Midterm Exam	2hr	10% (10)	9	LO #1 - #5
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Overview of computers and their basic components and applications
Week 2	Operating computer using GUI operating systems
Week 3	The basic use of Microsoft Windows operating system
Week 4	**Microsoft Office Word:** Getting Started with Word
Week 5	**Microsoft Office Word:** Editing a Document and Formatting Text and Paragraphs
Week 6	**Microsoft Office Word:** Adding Tables and Inserting Graphic Objects
Week 7	**Microsoft Office Word:** Controlling Page Appearance and Proofing a Document
Week 8	**Microsoft Office Excel:** Getting Started with Excel
Week 9	**Microsoft Office Excel:** Sorting, Selecting and Subtotaling data
Week 10	**Microsoft Office Excel:** Formulas and Functions
Week 11	**Microsoft Office Excel:** Worksheet Formatting and Presentation
Week 12	**Microsoft Office PowerPoint:** Getting Started with PowerPoint

Week 13	**Microsoft Office PowerPoint:** Developing a PowerPoint Presentation, Adding Graphical Elements to Your Presentation and Modifying Objects in Your Presentation
Week 14	**Microsoft Office PowerPoint:** Adding Graphical Elements, tables and charts to Your Presentation and Modifying Objects in Your Presentation
Week 15	**Microsoft Office PowerPoint:** Prepare to deliver your presentation
Week 16	**Final exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Introduction to the lab and get started with use of computer
Week 2	Basic use of Windows operating system
Week 3	General view of Windows OS tools with a focus on Microsoft Office tools
Week 4	**Microsoft Office Word:** Getting Started with Word
Week 5	**Microsoft Office Word:** Editing a Document and Formatting Text and Paragraphs
Week 6	**Microsoft Office Word:** Adding Tables and Inserting Graphic Objects
Week 7	**Microsoft Office Word:** Controlling Page Appearance and Proofing a Document
Week 8	**Microsoft Office Excel:** Getting Started with Excel
Week 9	**Microsoft Office Excel:** Sorting, Selecting and Subtotaling data
Week 10	**Microsoft Office Excel:** Formulas and Functions
Week 11	**Microsoft Office Excel:** Worksheet Formatting and Presentation
Week 12	**Microsoft Office PowerPoint:** Getting Started with PowerPoint
Week 13	**Microsoft Office PowerPoint:** Developing a PowerPoint Presentation, Adding Graphical Elements to Your Presentation and Modifying Objects in Your Presentation
Week 14	**Microsoft Office PowerPoint:** Adding Graphical Elements, tables and charts to Your Presentation and Modifying Objects in Your Presentation
Week 15	**Microsoft Office PowerPoint:** Prepare to deliver your presentation

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	• Joan Lambert and Steve Lambert, Windows 10 step by step, 1st Edition 2015. • Joan Lambert and Curtis Frye, Microsoft Office 2016 step by step, 1st Edition 2015.	Yes
Recommended Texts	• Michael Miller, ABSOLUTE BEGINNER'S GUIDE TO COMPUTER BASICS, 5th EDITION, QUE Indianapolis, Indiana 46240, 2010. • Paul McFedries, TEACH YOURSELF VISUALLY MICROSOFT WINDOWS 10, ANNIVERSARY	No

YEAR 1
(SEMESTER 2)

Ministry of Higher Education and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	Mathematics II	**Module Delivery**	
Module Type	Basic	**Theory** **Lecture** **Tutorial**	
Module Code	E 102		
ECTS Credits	6		
SWL (hr/sem)	150		
Module Level	1	**Semester (s) offered**	2
Administering Department	Chemical Engineering	**College**	Engineering
Module Leader	Ali I. Abdalla	**e-mail**	alialnuaimmy@uodiyala.edu.iq
Module Leader's Acad. Title	lecturer	**Module Leader's Qualification**	MSc
Module Tutor	None	**e-mail**	
Peer Reviewer Name	None	**e-mail**	
Review Committee Approval		**Version Number**	1.0

Relation With Other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	E 101	**Semester**	1
Co-requisites module	None	**Semester**	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	This module aims to provide students with an understanding of, and competence in the use of, mathematical techniques that are relevant to the solution of engineering problems. It will also give students a firm foundation from which to develop solutions to a wider and deeper range of engineering problems that they will encounter throughout their undergraduate engineering program of study.

Module Learning Outcomes مخرجات التعلم للمادة الدراسية	8. Integration: Demonstrate an understanding of the fundamental concept of integration and antiderivative including types of integrations 9. Integration and transcendental functions: Extend the concept of integration to cover the integration of different types of transcendental functions 10. Numerical integration: Explain the fundamentals of numerical integration focusing on trapezoidal rule and Simpson's rule**.** 11. Methods of integration: Apply the techniques of integration to evaluate the integrals that cannot be solved directly. 12. Application of definite integrals: Extend the concept of integration to solve several problems involving area, volume, length of curve, surface area by revolution, center of mass and moment of inertia. 13. Area with polar coordinates: Demonstrate an understanding of polar coordinate system and its difference with Cartesian coordinate system, graphing and problems solution of such system. 14. Matrix: Explain the concept of matrix in mathematics, matrix algebra and solution of system of linear equations.
Indicative Contents المحتويات الإرشادية	The topics listed under the indicative content below are the underpinning areas of knowledge and understanding that will be obtained from successful completion of the module. The mathematical topics are illustrated in the context of relevant engineering scenarios. • **Integration:** Definition, antiderivative, definite and indefinite integral**.** • **Integration and transcendental functions:** integration of trigonometric and inverse trigonometric functions, integration of exponential and logarithmic functions, Integration of hyperbolic and inverse hyperbolic functions. • **Numerical integration:** Introduction, trapezoidal rule and Simpson's rule**.** • **Methods of integration:** Substitution method, integration by parts**,** Trigonometric substitution method**,** integration by partial fraction**.** • **Application of definite integrals:** Area**,** Volume**,** Lengths of curves in the plane**,** Areas of surfaces of revolution, Center of mass, moment of inertia**.** • **Area of polar coordinates**: Definition, polar equation, relating polar and Cartesian coordinates, Graph in polar coordinates, applications using polar coordinate system • **Matrix:** definition, matrix algebra, Determinant of matrix, Grammar's rule, Inverse of matrix, Gauss Elimination Method
Course Description	This course discuss the foundation for a robust understanding of mathematical concepts that underpin the various disciplines within engineering. It covers the integration and its types followed by methods of integration. The concept of numerical integration is also highlighted. Students will be able to utilize integration to solve several problems such as area between curves and volume by revolution. A focus is also given to the understanding of polar coordinate system and how to graph the curves and solve difficult integral in an easy way using such system. Matrix topic is also covered in this course so the students will be able to solve system of linear equations using matrix in different approaches. By the end of the course, students will have a sound understanding of these principles, preparing them for more advanced engineering courses in their respective fields
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategies include the following: • Beginning In Mathematics II, then employ a range of teaching strategies to ensure first-year engineering students fully grasp the various mathematical concepts. • Instructional methods include interactive lectures, where core mathematical principles are explained in detail, and practical problem-solving sessions to provide hands-on learning experiences. • Collaborative group work encourages peer-to-peer learning and reinforces

	understanding through shared insights. • Regular formative assessments will be conducted to monitor students' understanding of the material, and feedback will be promptly given to guide their learning process. • Instructors will maintain office hours for personalized support, and online resources will be available to supplement classroom instruction. • Emphasis will be placed on relating mathematical concepts to real-world engineering applications to make the learning experience more relevant and engaging. These strategies aim to develop students' critical thinking skills, enhance their problem-solving abilities, and prepare them for advanced engineering studies.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 55 **In class tests** 5 **Tutorial** 15 **Final Exam** 3	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Assignment** 20 **Preparation for tests** 30 **Homework** 22	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.1
Total SWL (h/sem)	150		

Module Evaluation
تقييم المادة الدراسية

		Time/ Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	3	20% (20)	3,5, 10, 12, 14	LO #1, 2, 3, 4 ,5 and 7
	Assignments	6	10% (10)	4, 8, 12	LO # 1, 2, 3, 4, 5 and 6
	Home Work	6	10% (10)	2,5,7,9,11,13	LO # 1, 2, 3, 4, 5,6 and 7
Summative assessment	**Midterm Exam**	2 hr	10% (20)	7	LO # 1,4
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	**Integration:** Definition, antiderivative, definite and indefinite integral
Week 2	**Integration and transcendental functions:** (trigonometric and inverse trigonometric functions, exponential and logarithmic functions)

Week 3	**Integration and transcendental functions:** Integration and transcendental functions (hyperbolic and inverse hyperbolic functions)
Week 4	• **Numerical integration** Introduction, trapezoidal rule and Simpson's rule
Week 5	• **Methods of integration** Substitution method, integration by parts
Week 6	• **Methods of integration** Trigonometric substitution method
Week 7	• **Methods of integration** Integration by partial fraction method**.**
Week 8	• **Application of definite integrals** Areas under the curve, area between curves,
Week 9	• **Application of definite integrals** Volume by revolution
Week 10	• **Application of definite integrals** Length of curve in the plane**,** Area of surface of revolution
Week 11	• **Application of definite integrals** Center of mass, moment of inertia
Week 12	• **Application of definite integrals** Area by polar coordinates
Week 13	• **Matrix** Definition, matrix algebra
Week 14	• **Matrix** Determinant of matrix, Grammar's rule
Week 15	• **Matrix** Inverse of matrix, Gauss Elimination Method
Week 16	**Final Exam**

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	George B. Thomas and Ross L. Finney, "Calculus and Analytic Geometry, Addison- Wesley	Yes
Recommended Texts	Thomas Calculus, by George B.Thomas,Jr,Elevnth Edition Media Upgrade 2008 Calculus Early Transcendental (Sixth Edition) James Stewart	Yes
Websites		

	Ministry of Higher Education and Scientific Research - Iraq University of Diyala College of Engineering Department of Chemical Engineering	

MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Analytical Chemistry**			**Module Delivery**	
Module Type	**Core**			**Theory** **Lecture** **Lab** **Tutorial** **Seminar**	
Module Code	**CHE 104**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	1		**Semester of Delivery**	2	
Administering Department	Chemical Engineering		**College**	Engineering	
Module Leader	Nabaa Burhan Ali		**e-mail**	nabaa_burhan_eng@uodiyala.edu.iq	
Module Leader's Acad. Title	Assistant Lecturer		**Module Leader's Qualification**	MSc	
Module Tutor	None		**e-mail**		
Peer Reviewer Name	None		**e-mail**		
Scientific Committee Approval Date			**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1.During the semester, the student learns an idea about analytical chemistry and the main principles of analysis methods. 2.Learn and understand the methods of instrumental analysis

	3.Learn and understand ways to express the concentrations of solutions. 4.Learn and understand the methods of leaching in analytical chemistry theoretically and practically. 5.Identify the types of solutions and solve the required issues. 6.Learn and understand gravimetric methods of analysis. 7.Learn about complex acid-base systems. 8.Learn and understand the Nernst equation and the measurement of concentration by cell potential
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1.Understanding and teaching students the concepts of analytical chemistry, which is one of the branches of chemistry. 2.Enabling students to obtain knowledge and understanding of the fields of analytical chemistry. 3.To make the student understand the basics and types of analytical chemistry, as well as enable students to obtain knowledge and understanding of the practical framework in the subject of analytical chemistry. 4.Enabling students to obtain knowledge and understanding of the different methods of analysis. 5.Enabling students to obtain knowledge and understanding to determine the appropriate methods of analysis for the required samples. 6.To make the student understand the solution of problems related to acid-base dissolutions. 7.Enable the student to obtain knowledge and understanding in the subject of chemical equilibrium (Equivalent calculations, balance in precipitation, partial precipitation) 8.Understanding and teaching students the effect of electrolytes on chemical balance 9.Understanding the student and teaching the student the methods of gravimetric analysis 10.Enable the student to obtain knowledge and understanding in the topic of titration in analytical chemistry (pH, titration charts, indicators of bases and acids, principles of titration equation) 11.Understanding and teaching students the Nernst equation and measuring concentration according to cell potential 12.Enable the student to obtain knowledge and understanding in the subject matter of inorganic materials and interactions
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: The Nature of Analytical Chemistry (The Role of Analytical Chemistry , Quantitative Analytical Methods , A Typical Quantitative Analysis , An Integral Role for Chemical Analysis) [4 hrs] Calculations Used in Analytical Chemistry (Some Important Units of Measurement , Solutions and Their Concentrations, Chemical Stoichiometry) [6 hrs] Sampling, Standardization, and calibration (Analytical Samples and Methods, Sampling, Automated Sample Handling , Standardization and Calibration.[4 hrs] **Aqueous Solutions and Chemical Equilibria**(The Chemical Composition of Aqueous Solutions, Chemical Equilibrium, The Method of Successive Approximations, Buffer Solutions) [20 hrs] Effect of Electrolytes on Chemical Equilibria(The Effect of Electrolytes on

	Chemical Equilibria , Activity Coefficients) [8 hrs] Solving Equilibrium Problems for Complex Systems(Solving Multiple-Equilibrium Problems Using a Systematic Method , Calculating Solubilities by the Systematic Method) [8 hrs] Gravimetric Methods of Analysis (Specific Surface Area of Colloids,Calculation of Results from Gravimetric Data, Applications of Gravimetric Methods) [6 hrs] Titrations in Analytical Chemistry(Some Terms Used in Volumetric Titrations, Standard Solutions ,Volumetric Calculations, Gravimetric Titrations ,Titration Curves [14 hrs] Complex Acid/Base Systems(Complex Acid/Base Systems, Mixtures of Strong and Weak Acids or Strong andWeak Bases ,Polyfunctional Acids and Bases ,Buffer Solutions Involving Polyprotic Acids) [9 hrs]
Course Description	This course provides students an idea of analytical chemistry and its methods, perform the required analytical operations on samples, determining the appropriate methods for each sample, as well as identifying ways to express the concentrations of solutions and units used, solving the required problems, Equilibrium problems for complex systems are solved, Nernst equation and measurement of concentrations by potentials of cells, applying the necessary experiments in the analytical chemistry laboratory, Preparing primary and secondary standard solutions by applying theoretical calculations and then preparing solutions practically and learning about titration methods in chemistry.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1. Explanation of analytical chemistry topics by subject specialists. 2. provide them with practical problem-solving skills related to analysis. 3. Topics related to chemical analysis methods are presented. 4. Emphasis is placed on the issues of titration, its types, and performing the titration in practice. 5. Topics related to the calculation of equilibrium constants are presented. 6. Explanation and clarification of some inorganic materials and their interactions.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل		79	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
In class lectures	**28**			
In class tests	**2**			
Tutorial	**15**			
Lab	**30**			
Final Exam	**4**			

Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل الحمل الدراسي غير المنتظم للطالب خلال الفصل **Libraray, dorm, home, memorize 45** **Preparation for tests 14** **Homework 12**	71	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.7
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**150**		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	4	10% (10)	3, 6,10 and 13	LO #1, 2, 4, 5, 8, 9, 11 and 12
	Assignments	4	10% (10)	2, 5, 9 and 12	LO #1, 4, 10 and 11
	Projects / Lab.	1	10% (10)	Continuous	All
	Seminars	1	10% (10)	13	LO # 6 – 11
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	**The Nature of Analytical Chemistry**
Week 2	Calculations Used in Analytical Chemistry
Week 3	Sampling, Standardization, and calibration
Week 4	Aqueous Solutions and Chemical Equilibria
Week 5	Effect of Electrolytes on Chemical Equilibria
Week 6	Solving Equilibrium Problems for Complex Systems
Week 7	Mid-term Exam - Gravimetric Methods of Analysis
Week 8	Titrations in Analytical Chemistry
Week 9	Principles of Neutralization Titrations, Solutions and Indicators for Acid/Base titrations
Week 10	Titration Curves for Weak Acids , Determining Dissociation Constants of Weak Acids and Bases.
Week 11	Complex Acid/Base Systems
Week 12	Calculation of the pH of Solutions of NaHA , Titration Curves for Polyfunctional Acids

Week 13	Principles of Neutralization Titrations
Week 14	Nernest equation and measurement of concentration by potential of the cell
Week 15	Selected Inorganic materials and reactions
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Preparation of primary standard solution (preparation of pure sodium carbonate solution)
Week 2	Lab 2: Preparation of secondary standard solution of hydrochloric acid
Week 3	Lab 3: Titrate a dilute hydrochloric acid solution and find the normality of sodium hydroxide
Week 4	Lab 4: Quantitative determination of the components of a solution composed of a mixture of sodium carbonate and sodium hydroxide
Week 5	Lab 5: Titrations curves
Week 6	Lab 6: Refracting titrant
Week 7	Lab 7: Quantitative determination of chlorine ions in drinking water
Week 8	Lab 8: Titration of potassium permanganate solution and finding the normality of ferrous sulfate solution
Week 9	Lab 9: Water hardness measurement
Week10	Lab 10: The acidity of vinegar
Week11	Lab 11: Purification of table salt
Week12	Lab 12: Determination of the amount of ammonia in ammonium salts
Week13	Lab 13: Paper chromatography
Week14	Lab 14: detection of ions
Week15	Lab 15: Detection of elements by organic compounds

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	*Skoog, D.A., West, D.M., Holler, F.J. and Crouch, S.R., 2013. Fundamentals of analytical chemistry. Cengage learning.*	Yes
Recommended Texts	*David H., 2000. Modern Analytical Chemistry. 1st ed.*	Yes

Ministry of Higher Education and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	**Material Balance**	**Module Delivery**	
Module Type	**Core**	**Theory** **Lecture** **Tutorial**	
Module Code	**CHE 105**		
ECTS Credits	**7**		
SWL (hr/sem)	**78**		
Module Level	1	**Semester (s) offered**	2
Administering Department	Chemical Engineering	**College**	Engineering
Module Leader	Dr. Mohammed H. Msaed	**e-mail**	Mhmmsaed1@uodiyala.edu.iq
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	Ph.D.
Module Tutor	None	**e-mail**	
Peer Reviewer Name	None	**e-mail**	
Review Committee Approval		**Version Number**	

Relation With Other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	Principles of Chemical Engineering	**Semester**	1
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	Learn the basic concepts of material balances in chemical engineering processes. It also comprehensively introduces problem-solving methods with and without chemical reactions.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	**Knowledge and Understanding** Having successfully completed this module, the student will be able to demonstrate knowledge and understanding of: • Definition of Chemical Reaction Equation and Stoichiometry.

	• Determination the Limiting and Excess Reactants, Conversion and Selectivity. • Solving the Material Balances for Processes Involving Chemical Reaction. • Describing the Processes Involving Multiple Reactions. • Explanation the Element Material Balances. • Solving the Material Balances Involving Combustion. • Showing the Material Balance Problems Involving Multiple Units. • Describing the Recycle with and without Chemical Reaction. • Describing the Bypass, Purge, and the Industrial Application of Material Balances.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • The Chemical Reaction Equation and Stoichiometry (6 hrs). • Limiting and Excess Reactants, Conversion, Selectivity and Yield (12 hrs). • Material Balances for Processes Involving Chemical Reaction (12 hrs). • Processes Involving Multiple Reactions (3 hrs). • Element Material Balances (6 hrs). • Material Balances Involving Combustion (6 hrs). • Material Balance Problems Involving Multiple Unit (12 hrs)s. • Recycle with and without Chemical Reaction (12 hrs). • Bypass, Purge, and the Industrial Application of Material Balances (9 hrs).
Course Description	This This module is designed to provide first-year Chemical Engineering students with the foundational concepts of material balances, including the chemical reaction equation and stoichiometry, limiting and excess reactants, conversion, selectivity and yield, material balances for processes involving chemical reaction, processes involving multiple reactions, element material balances, material balances involving combustion, material balance problems involving multiple units, recycle with and without chemical reaction, bypass, purge, and the industrial application of material balances.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Beginning to establish a strong understanding of the basics of material balance processes. Using real industrial examples to help students relate the basic concepts of material balance to real industrial processes. Encouraging the discussions and questions to clear up any misconceptions. In addition, encouraging active participation and group discussions to enhance critical thinking and problem-solving skills. Guiding students through the problem-solving process and providing constructive feedback.

Student Workload (SWL) الحمل الدراسي للطالب				
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** **57** **In class tests** **3** **Tutorial** **15** **Final Exam** **3**		78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing** **40** **Preparation for tests** **40** **Homework** **17**		97	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6.5
Total SWL (h/sem)		175		

الحمل الدراسي الكلي للطالب خلال الفصل	

Module Evaluation
تقييم المادة الدراسية

		Time/ Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	6	20% (20)	2,4,6,9,11 and 13	LO #1, 2, 6, and 7
	Assignments	6	10% (10)	3,5,7,9,11 and 14	LO # 1,2,3,5 and 6
	Home work	1	10% (10)	14	LO # 4-9
Summative assessment	**Midterm Exam**	1	10% (10)	7	LO # 1-5
	Final Exam	1	50% (50)	16	All
Total assessment			100% (100Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	The Chemical Reaction Equation and Stoichiometry
Week 2	Terminology for Applications of Stoichiometry
Week 3	Limiting and Excess Reactants
Week 4	Conversion and degree of completion
Week 5	Selectivity and Yield
Week 6	Material Balances for Processes Involving Chemical Reaction
Week 7	Material Balances for Processes Involving Chemical Reaction
Week 8	Processes Involving Multiple Reactions
Week 9	Element Material Balances
Week 10	Material Balances Involving Combustion
Week 11	Material Balance Problems Involving Multiple Units
Week 12	Material Balance Problems Involving Multiple Units
Week 13	Recycle with and without Chemical Reaction
Week 14	Bypass, Purge, and the Industrial Application of Material Balances
Week 15	Bypass, Purge, and the Industrial Application of Material Balances
Week 16	**Final Exam**

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	David M Himmelblau, Basic principles and calculations in chemical engineering, Prentice Hall.	Yes
Recommended Texts	Richard M Felder & Ronald W. Rousseau Elementary Principles of Chemical Processes, Wiley India.	No

Ministry of Higher Education and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	**Engineering Drawing**	**Module Delivery**	
Module Type	**Basic**	**Theory** **Lecture** **Lab** **Practical**	
Module Code	CHE 106		
ECTS Credits	**5**		
SWL (hr/sem)	**100**		
Module Level	1	**Semester (s) offered**	2
Administering Department	Chemical Engineering	**College**	Engineering
Module Leader	Yaser I. Jasem	**e-mail**	Yaser_ij@uodiyala.edu.iq
Module Leader's Acad. Title	Assist. Proff.	**Module Leader's Qualification**	MS.c.
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	
Review Committee Approval		**Version Number**	1.0

Relation With Other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	**Semester**	-
Co-requisites module	None	**Semester**	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	Engineering drawing is the principal method of communication for engineers, the objective is to introduce the students, to the techniques of constructing the various types of polygons, curves and scales. In addition to engineering drawing, students become familiar with the AutoCAD user interface. Understand the fundamental concepts and features of AutoCAD. Use the precision drafting tools in AutoCAD to develop accurate technical drawings—present

	drawings in a detailed and visually impressive manner.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	At the end of this course the students will be able to: 1- Get information about the important tools for engineering drawing. This will give student basic knowledge of technical drawings professions and means of communications to others. 2- Learning how to draw the shapes, angels and lines and others which is essential for engineer 3- Develop student's imagination and ability to represent the shape size and specifications of physical objects. 4- Understand the main idea of using dimension for engineering drawing 5- Familiarize with different drawing equipment, technical standards and procedures for construction of geometric figures. This will give students ability to draw three-dimension objects on the paper and to draw the pectoral drawings. 6- Explain the principle of projection and sectioning 7- Utilize the power and precision of AutoCAD as a drafting and design tool used in the mechanical design and manufacturing industries. 8- Apply basic CAD concepts to develop and construct accurate 2D geometry through creation of basic geometric constructions. 9- Create, manipulate and edit 2D drawings and figures. 10- Apply elements of mechanical drafting such as layers, dimensions, drawing formats, and 2D figures in projects.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Paper size, Lettering & title blocks • Orthographic projection • Isometric and oblique projection • Perspective drawing • Basic geometrical solids • Development of surfaces • **Creating Basic Drawings** • Manipulating Objects • Implementing Drawing Organization and Inquiry Commands • Altering Objects • Annotate a Drawing • Dimension Drawings • Hatching Objects • Creating Additional Drawing Objects and working on Projects • Plotting the Drawing Output
Course Description	This course introduces students to the introduction to the drawing tools and how to use them, lines drawing, Basic engineering processes, Composition of the engineering drawings, Letters, numbers, dimensions, Projection, Sectioning, Isometric drawing. Understand the fundamental concepts and features of AutoCAD. Use the precision drafting tools in AutoCAD to develop accurate technical drawings. Present drawings in a detailed and visually impressive manner. Develop a level of comfort and confidence with AutoCAD through hands-on experience.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Begin to establish a strong conceptual understanding of the principles of engineering drawing. Use the reality of work examples and measurements to help students relate abstract concepts to the planning. Encourage discussions and questions to clear up any misconceptions. In addition, provide students with the tool to deal with schematic

	problems. Encourage active participation and group discussions to enhance critical thinking and problem-solving skills. Guide students through the problem-solving process and provide constructive feedback.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures 26** **Lab 45** **Practical 15** **In class tests 4** **Final Exam 3**	93	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing 6** **Preparation for tests 8** **Homework 18**	32	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2,3
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation
تقييم المادة الدراسية

		Time (hr)	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	15% (15)	5, 12	LO #1, 2, 3,7,8 and LO# 4,5,6,9,10
	Assignments	6	5% (5)	7, 12	LO # 7, 8 and LO# 9,10
	Homework	2	20% (20)	Continuous	
Summative assessment	**Midterm Exam**	2	10% (10)	7	LO #1, 2, 3,4,7,8 and LO# 4,5,6,9,10
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	- Definition of tools and how to use them, - Introduction 1. Status Bar and Command Prompt 2. AutoCAD Commands 3. Dynamic Input 4. Menus, Ribbons, and Toolbars 5. Cursor and Colors 6. Undo and Redo

Week 2	- Initial principles of drawing, - Drawing Aids 1. Open Existing Drawings 2. Creating a New Drawing 3. Saving Drawings **4.** Exiting AutoCAD
Week 3	- Letters and numbers, 5. SNAP Command 6. Grid Command 7. Running Object Snaps 8. Osnap Settings **9.** UNITS Command
Week 4	- Dimensions, - Draw Commands 1. Line Command 2. Cartesian Coordinate System 3. Orthogonal Lines **4.** Polar Tracking
Week 5	- Line drawing, - 5. Circles 6. Arc Command 7. Polyline Command **8.** Explode Command
Week 6	- Line drawing, 9. Rectangle 10. Ellipse
Week 7	- Engineering operations, - Edit Commands 1. The Move Command 2. The Copy Command 3. The Offset Command 4. The Extend Command **5.** Trim Command
Week 8	- Engineering operations, 6. The Erase Command 7. The Zoom Command 8. The Pan Command 9. The Mirror Command 10. The Rotate Command **11.** The Scale Command
Week 9	- Projection drawing, 12. The Break Command 13. The Stretch Command **14.** The Explode Command
Week 10	- Projection drawing, 15. The Fillet Command 16. The Chamfer Command 17. The Array Command **18.** The Lengthen Command
Week 11	- Projection drawing, - Dimensions 1. Linear Dimensions
Week 12	- Drawing of sectional Views, 2. Aligned Dimensions **3.** Radial Dimensions
Week 13	- Drawing of sectional Views, 4. Angular Dimensions

	5. Continued and Baseline Dimensions
Week 14	- Isometric, 6. Modifying Dimensions
Week 15	- Isometric, 7. Dimension Styles * Creating
Week 16	**Final Exam**

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1. Parkinson, A.C., 1961. A First Year Engineering Drawing 2. J Luzadder, W., 1965. Fundamentals of Engineering Drawing, by Warren J. Luzadder. Prentice-hall. 3. Text book 1: James A. Leach, "AutoCad 2002 companion", 2003. 4. Text book 2: AutoCAD 2D Tutorials, AutoCAD 2013, By Kristen S. Kurland, 2012.	Yes
Recommended Texts	3. Text book 3: 2D_AutoCAD.	Yes
Websites		

Ministry of Higher Education and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	**English language**	**Module Delivery**	
Module Type	**Suplement**	**Theory** **Lecture** **Seminar**	
Module Code	**U 104**		
ECTS Credits	**2**		
SWL (hr/sem)	**50**		
Module Level	1	**Semester (s) offered**	2
Administering Department	Chemical Engineering	**College**	Engineering
Module Leader	Ali Ismaael	**e-mail**	Essa9781@uodiyala.edu.iq
Module Leader's Acad. Title	Assistant Lecturer	**Module Leader's Qualification**	Master
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	
Review Committee Approval		**Version Number**	1.0

Relation With Other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	----	**Semester**	-
Co-requisites module	None	**Semester**	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	The module aims to develop the students' English skills in reading, writing, listening and speaking.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	15. Read and understand simple texts in English. 16. Answer simple comprehension questions and match sentences about texts. 17. Reconstruct texts by reordering sentences.

	18. Understand the main idea of a text. 19. Identify specific information in a text. 20. Writing and paraphrasing paragraphs.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. i) Grammar has a core place in language teaching and learning. ii) A wide variety of practice tasks in all the four skills are essential to language learning. iii) Everyday expressions, particularly of spoken English, also need a place in the syllabus. These can be functional, social, situational or idiomatic
Course Description	Each unit is organized to enhance students' basic knowledge of vocabulary and grammar through reading texts. The students will learn how to form simple sentences and use them in real life situations as well as in writing different assignments. By the end of the course, students will be able to produce basic sentences and communicate in simple real-life situations.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Headway's trusted methodology combines solid grammar and practice, vocabulary development, and integrated skills with communicative role-plays and personalization. Authentic material from a variety of sources enables students to see new language in context, and a range of comprehension tasks, language and vocabulary exercises, and extension activities practice the four skills. 'Everyday English' and 'Spoken grammar' sections practice real-world speaking skills, and a writing section for each unit at the back of the book provides models for students to analyze and imitate.

Student Workload (SWL) الحمل الدراسي للطالب				
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 26 **In class tests** 2 **Seminars** 2 **Final Exam** 3		33	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing** 5 **Preparation for tests** 8 **Homework** 4		17	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	1.1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل		50		

Module Evaluation تقييم المادة الدراسية					
		Time (hr)	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5, 10, 12, 14	LO #1, 2, 3, and 4
	Assignments	6	20% (20)	2, 4, 6, 8, 10, 12	LO # 1, 2, 3, 4, 5 and 6
	Seminars	2	10% (10)	Continuous	

Summative assessment	**Midterm Exam**	2 hr	10% (10)	7	LO # 1-3
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	GRAMMAR, READING , MAIN COURSE SPEAKING, LISTENING ,VOCABULARY am/is/are my/your This is... Introduction dialogues, Everyday English dialogues Introductions, Good morning! Practicing introduction dialogues. People meet each other and introduce someone else. How are you? What's this in English? Numbers 1-10 and plurals.
Week 2	He/she/they His/her. Questions Where are they from?, Two people are on holiday in New York. Students ask and answer questions about where people are from. Countries, Numbers 10-20 A set of cities and countries: Brazil, Spain… Adjectives: awful, really good, fantastic, beautiful Nouns: centre, hospital, building, park
Week 3	Verb to be is recycled and extended to include negative and question forms. We're in Las Vegas! Roleplay: in a band. An interview with the band Metro 5. Jobs: a nurse, a doctor.. Personal information: surname, first name, address, married … Social expressions: I'm sorry, thanks, please…
Week 4	Possessive adjectives. Possessive 's. Has/ have Adjective + noun Irregular Plurals Paddy McNab and his family, My best friend. The alphabet, On the phone, Saying email addresses. Who are they? Listen and identify the people. The family: mother, son.. Describing a friend: very beautiful, really funny…
Week 5	Present Simple: I/you/we/they a/an Adjective + noun Colin Brodie from Dundee. Role play: At a party. Where is Colin? Who is he with? At a party: Flavia and Terry are at a party in London. The lexical set of sports/food/drinks. Languages and nationalities.
Week 6	Present Simple: He/she Question and negatives Adverbs of frequency Prepositions of time Lois Maddox Talking about daily routines, Asking and answering questions about daily routines, Lifestyle questionnaire Listening a phone conversation between Lois and Elliot. Days of the week. The time. Words that go together: watch TV, get up early…
Week 7	Question words Subject pronouns Object pronouns Possessive pronouns This and that A postcard from San Francisco, A holiday postcard. Describing lifestyles, preferences and places, Roleplay: conversations in town. Listening the requests with Can I……..? Adjectives: lovely, terrible, comfortable, friendly… Opposite adjectives: new/old, big/small Places: chemist, post office
Week 8	There is /are Prepositions: in, on, under, next to Vancouver-the best city in the world, What to do and where to go. Talking and asking about rooms and furniture, Giving directions. My home town, Steve talks about living in Vancouver. Rooms and furniture: living room, bedroom … In and out of town: beach, mountain, sailing,…
Week 9	Was/were born Past simple: irregular verbs It's a Jackson Pollock. Telling a story from pictures, Saying the dates in English. Magalie Dromand, Magalie dromand talks about her family. Saying years People and jobs Irregular verbs Have, do, go: have lunch, do homework, go shopping
Week 10	Past simple: regular and irregular Questions Negatives Ago Dialogues with simple past. Did you have a good weekend? Asking about holidays, A questionnaire, My last holiday, Roleplay: asking and giving directions. Angie and Rick are at work, Jack and Millie's holiday. Weekend activities: go to the cinema, have a meal… Time expressions: on Monday, last night… Sports and leisure: tennis, skiing, windsurfing… Play or go: play tennis, go skiing… Seasons: winter, summer…
Week 11	Can / can't, Adverbs, Adjective + noun Requests and offers The Internet, What can you do on the internet? Talking about what you can do, Talking about everyday problems, Five people talk about what they do on the internet. Verbs: draw, run, drive… Verb+noun: Listen to the radio, chat to friends Adjective+noun: fast car, busy city, dangerous sport Opposite adjectives: dangerous/ safe, old/modern, old/young.
Week 12	I'd like, You are what you eat, Discussion-what is a good diet? Conversation with Adam, Shopping: bread, milk, fruit, Please and thank you Some /any, Like and would like People from different parts of

	the world describe what they eat. Roleplay: Ordering a meal. Birthday wishes, What people want on their birthday. stamps, cheese, ham… Food: cereal, salad, pasta, fish… In a restaurant: menu, starter, desert, soup, salmon
Week 13	Present continuous, Present simple and present continuous. This week is different, Colin, a millionaire, gives money to homeless teenagers What's the matter? Why don't you ….? What is Nigel wearing? Nigel is on holiday, What's the matter. Colours: blue, red, green… Clothes: jacket, trousers, shoes and socks… Opposite verbs: buy/sell, love/hate, open/close…
Week 14	Future plans, Revision: question words, tenses. Seven countries in seven days, Life's big events: three people talk about their family, education, work and ambitions. A mini autobiography. Eddie is talking to a friend about his holiday plans, social expressions Transport: travel by bus, coach, motorbike, plane… Revision
Week 15	Irregular verbs, phonetic symbols, consonants and vowels.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	New Headway Beginner, by lizand john soars	Yes
	https://www.learnenglish.de/ https://www.englishgrammar.org/ https://www.phrasebank.manchester.ac.uk/	
Websites		

Ministry of Higher Education and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Engineering Workshops			**Module Delivery**	
Module Type	BASIC			**Theory** **Practical**	
Module Code	CHE 107				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	1		**Semester of Delivery**	2	
Administering Department	Chemical Engineering		**College**	Engineering	
Module Leader	Yasseen Alwan Jaddoa		**e-mail**	yasseenalwan_eng@uodiyala.edu.iq	
Module Leader's Acad. Title	Assistant Lecturer		**Module Leader's Qualification**	MSc.	
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date			**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	**أ- الاهداف المعرفية** 1- أفهام وتعليم الطالب مفاهيم ومبادى مادة الورش الهندسية العامة . 2- تمكين الطلبة من الحصول على المعرفة و الفهم

	الكامل لكافة مهارات الورش الهندسية . 3- افهام الطالب وتعريفه بكافة المهارات نظريا وعمليا وتعريفه بكافة أجزاء الماكنة التي يتم تطبيق المهارة بالإضافة الى التطبيق العملي على الماكنة لكل طالب ولكافة المهارات. 4- تمكين الطلبة من الحصول على المعرفة والفهم لكل أجزاء الماكنة وفائدة كل جزء . 5- تمكين الطلبة من الحصول على المعرفة والفهم على تشخيص انواع الاعمال التي تنجزها كل ماكنة وطريقة العمل عليها . **ب - الأهداف المهاراتية الخاصة بالبرنامج** 1 - شرح المهارات بالتفصيل وتطبيقها على الماكنة عمليا والتاكيد على الطلبة بضرورة الالتزام بقواعد السلامة المهنية . 2 - تزودهم بمعلومات وطرق حل المشاكل العملية المتعلقة بجميع المهارات. 3 - يتم عرض مواضيع كافة المهارات نظريا . 4 - يتم التركيز على العملي في المهارات وضرورة مشاركة الطالب في العملي.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	**مخرجات التعلم للمادة الدراسية** 1- بناء الطالب علميا وعمليا وتأهيله للعمل في مجال تقنيات الهندسة . 2- بناء وإعداد الطالب نفسيا ليقوم بدوره كمهندس يعتمد عليه في هذا المجال. 3- بناء طلبة قادرين على التنافس مع مهندسين اخرين لفرص العمل و الحصول على المقاعد المطلوبة في اكمال دراسات عليا . 4- قابلية التقديم لاختبارات خارجية من قبل هيئات محلية أو أقليمية أو عالمية لغرض اكمال الدراسة او التعيين. 5- حث الطالب على الإبداع والتفكير في مشاريع التخصص ومواكبة التطور الحاصل في هذا المجال. 6- تزويد الطلبة بمهارات علمية وعملية ومهارات ذاتية تمكنه من حل المشاكل العملية والتعامل معها بمفاهيم علمية .
Indicative Contents المحتويات الإرشادية	**المحتويات الإرشادية** **اولا-: السلامة المهنية .** يتم تعريف الطالب بقواعد وإجراءات السلامة المهنية لجميع المهارات وجميع الأقسام لاجل سلامة المستخدم من مخاطر التعامل مع هذه الأدوات والمكائن (3 ساعات). **ثانيا -: مهارة القياسات.** شرح نظري لمهارة القياسات وتعريف الطالب بجميع العدد والأدوات المستخدمة في عملية القياس بالتفصيل ومن ثم يتم التطبيق العملي لمهارة القياسات حيث يقوم كل طالب باجراء عملية القياس لمختلف الأدوات إضافة الى تسليم ومناقشة التقارير الخاصة بالمهارة (6ساعات) **ثالثا :- مهارة اللحام .** شرح نظري لمهارة اللحام وتعريف الطالب بجميع العدد والأدوات المستخدمة في عملية اللحام وشرح طرق اللحام بالتفصيل إضافة الى التطبيق العملي حيث يقوم كل طالب

بعملية اللحام وذلك لاكتساب الخبرة العملية إضافة الى تسليم ومناقشة التقارير الخاصة بالمهارة (6ساعات).

رابعا :- مهارة البرادة .

شرح نظري لمهارة البرادة وتعريف الطالب بجميع العدد والأدوات المستخدمة في عملية البرادة وشرح طرق البرادة بالتفصيل إضافة الى التطبيق العملي حيث يقوم كل طالب بعملية البرادة يدويا وذلك لاكتساب الخبرة العملية إضافة الى تسليم ومناقشة التقارير الخاصة بالمهارة (6ساعات).

خامسا :- مهارة السباكة .

شرح نظري لمهارة السباكة وتعريف الطالب بجميع العدد والأدوات المستخدمة في عملية السباكة وشرح طرق السباكة بالتفصيل إضافة الى التطبيق العملي حيث يقوم كل طالب بعملية السباكة يدويا وذلك لاكتساب الخبرة العملية إضافة الى تسليم ومناقشة التقارير الخاصة بالمهارة (6ساعات)

سادسا :- مهارة التفريز .

شرح نظري لمهارة التفريز وتعريف الطالب بجميع أجزاء ماكنة التفريزاضافة الى العدد والأدوات المستخدمة في عملية التفريز وشرح طرق التفريز بالتفصيل إضافة الى التطبيق العملي حيث يقوم كل طالب بالعمل على ماكنة التفريز وتنفيذ التمارين المختلفةعلى الماكنة وذلك من اجل اكتساب الخبرة العملية إضافة الى تسليم ومناقشة التقارير الخاصة بالمهارة (6ساعات).

سابعا :- مهارة التجليخ .

شرح نظري لمهارة التجليخ وتعريف الطالب بجميع أجزاء ماكنة التجليخ اضافة الى العدد والأدوات المستخدمة في عملية التجليخ وشرح طرق التفريز بالتفصيل إضافة الى التطبيق العملي حيث يقوم كل طالب بالعمل على ماكنة التفريز وتنفيذ التمارين المختلفةعلى الماكنة وذلك من اجل اكتساب الخبرة العملية إضافة الى تسليم ومناقشة التقارير الخاصة بالمهارة (6ساعات).

ثامنا :- مهارة الخراطة .

شرح نظري لمهارة الخراطة وتعريف الطالب بجميع أجزاء ماكنة الخراطة اضافة الى العدد والأدوات المستخدمة في عملية الخراطة وشرح طرق الخراطة بالتفصيل إضافة الى التطبيق العملي حيث يقوم كل طالب بالعمل على ماكنة الخراطة وتنفيذ التمارين المختلفةعلى الماكنة وذلك من اجل اكتساب الخبرة العملية إضافة الى تسليم ومناقشة التقارير الخاصة بالمهارة (6ساعات).

تاسعا :- مهارة التأسيسات الكهربائية .

شرح نظري لمهارة التأسيسات الكهربائية وتعريف الطالب بجميع العدد والأدوات المستخدمة في عمليات التأسيسات الكهربائية وشرح طرق التأسيسات الكهربائي إضافة الى التطبيق العملي حيث يقوم كل طالب بالعمل على ربط الدوائر الكهربائية المختلفة وذلك من اجل اكتساب الخبرة العملية إضافة الى تسليم ومناقشة التقارير الخاصة بالمهارة (6ساعات).

Course Description	The industrial safety, Tools of instrument (such as vernier caliper), Micrometer as tool of measurement. The general idea about abrasion and its type. The tools and materials that used in abrasion. General idea about some materials that can be used. In making files and their kinds. Milling. General concept and explaining the use of lathe. The ways of operating lathe. Turning tools and minerals used in making them. Drilling and gearing. The angles of tools that used in turnings. Maintenance of lathe. General idea about carpentry. Tools of measuring used in carpentry.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	*امتحانات يومية باسئلة عملية وعلمية . *درجات مشاركة لاسئلة المنافسة الصعبة بين الطلاب . *وضع درجات للواجبات البيتية والتقارير المكلفة بهم . امتحانات فصلية للمنهج الدراسي اضافة الى امتحان نصف السنة والامتحان النهائي.*

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures 43** **In class tests 2** **Final Exam 3**	48	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Libraray, dorm, home, memorize 34** **Preparation for tests 10** **Homework 8**	52	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**100**		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative	**Midterm**	2hr	10% (10)	7	LO #1 - #7

assessment	**Exam**				
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	شرح نظري وعملي لمبادئ السلامة المهنية وبيان خطورة عدم الالتزام بها على حياة الطالب.
Week 2	شرح نظري لمهارة القياسات وتعريف جميع العدد والأدوات المستخدمة في القياس.
Week 3	تطبيق عملي لمهارة القياسات.
Week 4	شرح نظري لمهارة اللحام وتعريف جميع العدد والأدوات المستخدمة في عملية اللحام.
Week 5	تطبيق عملي لمهارة اللحام.
Week 6	شرح نظري لمهارة البرادة وتعريف جميع العدد والأدوات المستخدمة في عملية البرادة.
Week 7	تطبيق عملي لمهارة البرادة.
Week 8	شرح نظري لمهارة السباكة وتعريف جميع أجزاء فرن السباكة.
Week 9	تطبيق عملي لمهارة السباكة.
Week 10	شرح نظري لمهارة التفريز وتعريف الطالب بجميع أجزاء ماكنة التفريز.
Week 11	تطبيق عملي لمهارة التفريز.
Week 12	شرح نظري لمهارة التجليخ وتعريف الطالب بجميع أجزاء ماكنة التجليخ.
Week 13	تطبيق عملي لمهارة التجليخ.
Week 14	شرح نظري لمهارة التاسيسات الكهربائية مع التطبيق العملي.
Week 15	شرح نظري لمهارة الخراطة وتعريف الطالب بجميع أجزاء ماكنة الخراطة.
Week 16	تطبيق عملي لمهارة الخراطة.

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	التعريف بمبادئ السلامة المهنية.
Week 2	شرح مهارة القياسات.
Week 3	شرح مهارة اللحام.
Week 4	شرح مهارة البرادة.

Week 5	شرح مهارة السباكة
Week 6	شرح مهارة التجليخ.
Week 7	شرح مهارة الخراطة و التفريز.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	MECH6014 - Mechanical Workshop Practice Tarafdar, J.C. and Raliya, R., "The Nanotechnology", Published by Scientific Publisher (SP), India, (2012).	Yes
Recommended Texts	MECH6028 - Mechanical Workshop Practice 2 - CIT Modules	No
Websites	https://www.coursera.org/browse/workshop-and-engineering/workshop -	

Ministry of Higher Education and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	**اللغة العربية 1**	**Module Delivery**	
Module Type	**Basic learning activities**		☒**Theory** ☐**Lecture** ☐**Lab** ☐**Tutorial** ☐**Practical** ☐**Seminar**
Module Code	**UD 12**		
ECTS Credits	**2**		
SWL (hr/sem)	**50**		

Module Level	UGI	**Semester of Delivery**	
Administering Department	Chemical Engineering	**College**	Engineering
Module Leader	Ali Esmaeel	**e-mail**	
Module Leader's Acad. Title	Assistant Lecturer	**Module Leader's Qualification**	Ph.D.
Module Tutor		**e-mail**	E-mail
Peer Reviewer Name	Name	**e-mail**	E-mail
Scientific Committee Approval Date	3/11/2024	**Version Number**	1.0

Relation with other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	الهدف الأساس في تدريس اللغة العربية للأقسام العلمية : • اخذ الطالب الى روعة بيان القران الكريم ، وادراكه يقينا ان التعبير القراني تعبير فني مقصود ، كل لفظة ، وكل حرف وضع وضعا فنياً مقصوداً • تقويم اللسان العربي . واعتماد العربية الفصحى في الحديث والكتابة ، ولزيادة رصيد الطالب من ادب وتراث ، على تناول النصوص المختارة من العصور الأدبية المختلفة ، لزيادة رصيد ادب لتراث والادب المعاصر . • التأكيد على دور الطالب في المتابعة واثراء المعرفة باللغة العربية وفنونها بجهد خاص ، ذا ما وضعنا مفاتيح المنهاج الدراسي لتقع على الطالب بعد ذلك مهمة فتح الأبواب والنوافذ الى مصادر المعرفة الواسعة . في جعل العربية الفصيحة تحتل موضع الصدارة وتجاوز العامية ، خدمة الى لغتنا العربية المقدسة. وحفاظا على قوتها وجمالها . • ومن نافلة القول في اهداف تدريس اللغة العربية : هي الجانب المحقق للوحدة وتلزمنا دوافع الوفاء بالحرص عليها والمحافظة على جوهرها .
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	يمكن ايجاز مخرجات العلم لمادة اللغة العربية العامة لاقسام غير الاختصاص بالنسبة لمرحلة الدراسة الأولى بالاتي :- 1 - سيتمكن الطالب من التعرف على خصائص اللغة العربية كلغة سامية ، وفهم الخصائص المشتركة للغات السامية ، ومكانة اللغة العربية ضمن هذه العائلة اللغوية مما يعزز من ادراكه لاصولها وتطورها عبر التاريخ . 2- تحليل أصوات اللغة العربية من حيث أماكن وطرق النطق ، والتمييز بين مختلف الأصوات العربية . 3- معالجة القضايا الصرفية وتحليل بنية الكلمات العربية ، وفهم كيفية تكوينها وتغييرها لأداء معان مختلفة مما يطور مهاراته في تكوين وصياغة الكلمات بشكل صحيح . 4- تحديد التراكيب النحوية في اللغة العربية واستخدامها بشكل سليم مما يعزز قدرته على بناء جمل صحيحة نحويا ومعبرة بوضوح . 5- فهم العلاقات الدلالية مثل الترادف والتضاد والتضمين بين الكلمات مما يوسع من ادراكه لمعاني الكلمات ، وتوظيفها في سياقات مختلفة . 6- اتباع قواعد الاملاء الصحيحة وتطبيقها مما يسهم في تحسين كتابته ويضمن وضوح المعنى ، ودقته . 7- تحليل الأنواع الأدبية وتوظيف البلاغة في التعبير مما يعزز من فهمها للنصوص الأدبية ويطور مهارته في الكتابة بأسلوب مؤثر وبلاغي.
Indicative Contents المحتويات الإرشادية	1- مقدمة حول اللغة العربية كجزء من اللغات السامية • التعريف باللغة العربية واصولها واهم خصائصها . • مكانة اللغة العربية ضمن عائلة اللغات السامية وتاريخ تطورها . • دراسة خصائص اللغة العربية المتأصلة في جذورها السامية . 2- أصوات اللغة العربية : النطق والأداء • مقدمة في علم الصوتيات واهمية الفهم الدقيق لاصوات اللغة . • تقسيم الأصوات حسب أماكن النطق : الأصوات الحلقية ، الشفوية ، اللثوية وغيرها . • دراسة طرق النطق المختلفة (مثل : الانفجار والاحتاك) والتطبيقات العلمية للنطق الصحيح 3- التحليل الصرفي للكلمات العربية .

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	33	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	2.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	17	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	1.1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**50**		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	4	20% (5)	3 , 6,8,11	LO #1...#3, #4…#6, #7&#8, #9... #11
	Assignments	2	10% (5)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.				
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	1hr	10% (10)	7	LO #1 - #7
	Final Exam	2hr	50% (50)	15	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	**(الفصل الأول) التعبير القرآني): نص قراني محدد من سورة الكهف (قصة موسى والخضر عليهم السلام) من الاية رقم "60" الى الاية رقم "82" .**
Week 2	**المهارات اللغوية : (1) الحروف الشمسية و القمرية .**
Week 3	**(3) كتابة حرفي الضاد و الظاء .**
Week 4	**(4) كتابة التاء المربوطة و الطويلة .**
Week 5	**(5) علامات الترقيم .**
Week 6	**(الفصل الثاني) الأصوات و المعجم العربي : (6) الأصوات العربية : الأصوات الصامتة و الصائتة .**
Week 7	**(7) أنواع المعاجم (معجمات الألفاظ و معجمات المعاني) و طريقة استخراج الألفاظ من المعجم .**
Week 8	**(الفصل الثالث) القواعد النحوية : (8) أنواع الكلم (الاسم ، و الفعل ، و الحرف) .**
Week 9	**(9) المفرد ، و المثنى ، و الجمع ، و علامات إعرابها .**
Week 10	**(10) الجملة الفعلية و الجملة الاسمية .**
Week 11	**(11) من الأدوات النحوية : أدوات الجر ، أدوات نصب الفعل المضارع ، أدوات جزم الفعل المضارع .**
Week 12	**(الفصل الرابع) البلاغة و الأدب : (12) من الفنون البلاغية : التشبيه .**

Week 13	(13) نصوص من (الشعر الجاهلي = امرئ القيس) ، و (الإسلامي = حسان بن ثابت) .
Week 14	(14) نصوص من (الشعر العباسي = المتنبي) ، و (الأندلسي = الموشحات) .
Week 15	(15) نصوص نثرية عربية قديمة (الخطب ، و الوصايا ، و المقامات) .

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	1 – التعبير القرآني - تأليف الدكتور فاضل السامرائي 2--اللغة العربية العامة لأقسام غير الاختصاص / تأليف مجموعة من أساتذة اللغة العربية. 3- شذا العرف في فن الصرف – تاليف الدكتور احمد الحملاوي 4- البلاغة الواضحة ا – تاليف الدكتور احمد مطلوب	
Recommended Texts		
Websites		

YEAR 2
(SEMESTER 1)

Ministry of Higher Education and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	Engineering Mathematics I	**Module Delivery**	
Module Type	Core	☒**Theory** ☒**Lecture** ☐**Lab** ☐**Practical** ☐**Seminar**	
Module Code	CHE 201		
ECTS Credits	4		
SWL (hr/sem)	100		

Module Level	UGII	**Semester of Delivery**	Three
Administering Department	Chemical engineering	**College**	College of Engineering
Module Leader	Ali I. Abdalla	**e-mail**	alialnuaimmy@uodiyala.edu.iq
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	MSc.
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	
Scientific Committee Approval Date		**Version Number**	1.0

Relation with other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	E 102	**Semester**	Two
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	1-Provide a Strong Foundation in Mathematical Concepts • Introduce fundamentals of calculus, linear algebra, and other core mathematical tools • Develop logical understanding and mathematical skills to solve engineering

	problems 2- Develop Problem-Solving Skills • Equip students with techniques to interpret objectives, mathematize, solve, and communicate results • Cultivate critical thinking and creativity in applying mathematics to engineering problems 3- Facilitate Active Learning • Use a mix of lectures, tutorials, discussions, and hands-on exercises for active learning • Provide guided practice with relevant engineering problems 4- Teach Applications to Engineering Fields • Relate mathematical concepts to real-world engineering scenarios and applications • Integrate engineering examples and case studies throughout the curriculum • Demonstrate the importance and symbiosis between mathematics and engineering The overall goal is to develop students' mathematical maturity and ability to apply advanced concepts to solve complex engineering problems. This requires a combination of solid foundational knowledge, practice with relevant applications, and explicit connections between theory and practice.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	**Module Learning Outcomes** 1. Demonstrate an understanding the concept of translation of axes and apply this concept on conic sections. 2. Understand functions of several variables, partial derivatives, total derivatives, and the chain rule 3. Relative minima and maxima of functions of two variables, linearization, small change problems 4. Polar coordinates system (Definition, polar equation, relating polar and Cartesian coordinates). 5. Graph of functions and equations in polar coordinates system and find the area using such system. 6. Understand vectors, vector fields, vector operations like dot and cross product , and find the equations of line and plane in the space 7. Solve optimization problems using Lagrange multipliers method.
Course Description	**Course Description** Engineering Mathematics I is a foundational course that introduces students to the key mathematical concepts and techniques essential for success in various engineering disciplines. The course typically covers the following topics: 1- Differential Calculus • Basic differential calculus for functions of one and several variables • Maxima and minima for functions of several variables 2- Polar Coordinate System • Polar equations • Relating Polar and Cartesian coordinates • Graph of Polar equations • Area calculation using polar coordinate system 2-Linear Algebra • Vectors in 3-space

	• Vector equations of lines and planes • Gradient vector and vector field • Lagrange Multipliers The course is typically delivered through a combination of lectures, tutorials, classwork, and homework. Assessment includes a final exam worth 50%, mid-term exam worth 10% and other coursework such as homework assignments, classwork and tests worth 40%.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1- Integrate Lectures and Tutorials for Active Learning • Mix direct instruction in lectures with guided practice in tutorials for active learning • Include a variety of learning activities like problem-solving, discussions, and hands-on exercises 2- Use Relevant Examples and Applications • Use examples and problems with engineering contexts embedded throughout the course • Include some engineering guest lectures to explain real-world applications of the mathematical concepts • Relate the mathematics to specific engineering disciplines like fluid mechanics, structures, etc 3- Establish High Expectations and Develop Critical Thinking • Establish high expectations for students' mathematical understanding • Develop critical thinking and problem-solving skills • Cultivate creativity in applying mathematics to engineering problems The overall goal is to help students develop a strong conceptual understanding of the mathematics that is directly applicable to their engineering studies. This requires a combination of solid foundational knowledge, practice with relevant problems, and explicit connections to engineering applications. Both students and instructors play an active role in employing effective learning and teaching strategies to achieve this goal.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** **41** **In class tests** **4** **Tutorial** **15** **Final Exam** **3**	**63**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**4.2**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	**37**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**2.47**

Library, dorm, home memorizing 12 **Preparation for tests 13** **Homework 12**			
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**100**		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	**2**	**20% (20)**	**3 and 10**	**LO #1, 2, 3, 4 ,5 and 7**
	Assignments	**4**	**10% (10)**	**5 and 11**	**LO #1, 2, 3, 4 ,5 and 7**
	homework	**4**	**10%(10)**	**4 and 12**	**LO #1, 2, 3, 4 ,5 and 7**
Summative assessment	**Midterm Exam**	**2 hr**	**10% (10)**	**8**	**LO #1 - #4**
	Final Exam	**3 hr**	**50 % (40)**	**16**	**All**
Total assessment			**100% (100)**		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Analytical geometry. Translation of axes equations.
Week 2	Conic sections (Circles – parabola-ellipse – hyperbola)
Week 3	Functions of two or more variables, limit, continuity
Week 4	Partial derivatives, Total differentials
Week 5	Geometrical meaning of partial derivatives
Week 6	Higher order partial derivatives, implicit differentiation
Week 7	Relative minima and maxima of functions of two variables, linearization, small change problems
Week 8	**Midterm one**
Week 9	Polar coordinates system (Definition, polar equation, relating polar and Cartesian coordinates)
Week 10	Graph in polar coordinates,
Week 11	Area with polar coordinates
Week 12	Vectors (Definition, properties, vectors in surface and in space)
Week 13	Scalar and cross product of vectors, product of three vectors
Week 14	Equations of lines. Equations of planes
Week 15	Lagrange multipliers.
Week 16	**Final Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1. George B. Thomas and Ross L. Finney, "Calculus and Analytic Geometry, Addison- Wesley, ISBN:0201531747. 2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley	Yes
Recommended Texts	George F. Simmons, "Calculus with Analytic Geometry", McGraw-Hill, ISBN: 0070576424	yes
Websites	https://www.geogebra.org/calculator https://www.desmos.com/calculator https://www.symbolab.com/solver/integral-calculator	

	Ministry of Higher Education and Scientific Research - Iraq University of Diyala College of Engineering Department of Chemical Engineering	

MODULE DESCRIPTOR
وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	**Energy Balance**	**Module Delivery**	
Module Type	**Core**	**Theory** **Lecture** **Tutorial**	
Module Code	**CHE 202**		
ECTS Credits	**6**		
SWL (hr/sem)	**78**		
Module Level	2	**Semester (s) offered**	3
Administering Department	Chemical Engineering	**College**	Engineering
Module Leader	Yussur Dh. Abdulwahhab	**e-mail**	esar@uodiyala.edu.iq
Module Leader's Acad. Title	Assistant Lecturer	**Module Leader's Qualification**	MSc.
Module Tutor	None	**e-mail**	
Peer Reviewer Name	None	**e-mail**	
Review Committee Approval		**Version Number**	

Relation With Other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	Material Balance	**Semester**	2
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	Learn the basic concepts of gases and energy balances in chemical engineering processes. It also comprehensively introduces problem-solving methods with and without chemical reactions.
Module Learning Outcomes	**Knowledge and Understanding** Having successfully completed this module, the student will be able to demonstrate knowledge and understanding of:

مخرجات التعلم للمادة الدراسية	• Definition of the ideal gas law, ideal gas mixtures, partial pressure, critical parameters, reduced parameters, normal boiling point. • Determination the compressibility Factor and describing the gaseous mixtures and vapor pressure. • Solving the Antoine equation and material balances for involving ideal gases. • Describing the liquid properties and Vapor-Liquid equilibrium for multicomponent systems. • Definition of Henry's law, Raoult's law, bubble point temperature, dew point temperature and Gibb's phase rule. • Definition of Energy, Latent heat of vaporization and Enthalpy of reaction. • Solving the energy balance with chemical reaction and application of energy balance in the industry. • Explanation the mmechanical energy balance, heat of solution calculation and heat capacity. • Solving the material and energy balance for complete projects. • Solving the unsteady state for material and energy balance.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • The ideal gas law, ideal gas mixtures, partial pressure, critical parameters, reduced parameters, normal boiling point (6 hrs). • The compressibility Factor and describing the gaseous mixtures and vapor pressure (6 hrs). • Antoine equation and material balances for involving ideal gases (12 hrs). • The liquid properties and Vapor-Liquid equilibrium for multicomponent systems (6 hrs). • Henry's law, Raoult's law, bubble point temperature, dew point temperature and Gibb's phase rule (6 hrs). • Latent heat of vaporization and Enthalpy of reaction (6 hrs). • The energy balance with chemical reaction and application of energy balance in the industry. (12 hrs). • The mmechanical energy balance, heat of solution calculation and heat capacity (6 hrs). • The material and energy balance for complete projects (9 hrs). • The unsteady state for material and energy balance (9 hrs).
Course Description	This module is designed to provide second-year Chemical Engineering students with the foundational concepts of gases energy balances, including the ideal gas law, ideal gas mixtures, partial pressure, Critical Parameters, Reduced Parameters, Compressibility Factor, Equations of State, Gaseous Mixtures, Vapor Pressure, Liquids, Normal boiling point, Antoine equation, Material balances involving ideal gases, Liquid Properties, Vapor-Liquid Equilibrium for Multicomponent Systems, Henry's law, Raoult's law, Bubble Point Temperature, Dew Point Temperature and Gibb's phase rule. The energy balance part including, Energy definition, Energy forms, Latent heat of vaporization, Enthalpy of reaction, Energy balance without chemical reaction, Energy balance with chemical reaction, Application of energy balance in the industry, Mechanical energy balance, Heat of solution calculation, Definitions of different kinds of humidity, Humidity charts and their uses, Heat capacity, Enthalpy-concentration charts and their uses, Degree of freedom of systems, Material and energy balance for complete projects, Unsteady state material balance.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Beginning to establish a strong understanding of the basics of gases and energy

	balance processes. Using real industrial examples to help students relate the basic concepts of gases and energy balance to real industrial processes. Encouraging the discussions and questions to clear up any misconceptions. In addition, encouraging active participation and group discussions to enhance critical thinking and problem-solving skills. Guiding students through the problem-solving process and providing constructive feedback.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** **57** **In class tests** **3** **Tutorial** **15** **Final Exam** **3**	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing** **30** **Preparation for tests** **30** **Homework** **12**	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation
تقييم المادة الدراسية

		Time/ Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	20% (20)	3 and 6	LO #1, 2, 6, and 7
	Assignments	2	10% (10)	2 and 14	LO # 1,2,3,5 and 6
	Home work	2	10% (10)	3 and 10	LO # 4-9
Summative assessment	**Midterm Exam**	1	10% (10)	7	LO # 1-5
	Final Exam	1	50% (50)	16	All
Total assessment			100% (100Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	The ideal gas law, ideal gas mixtures, partial pressure, Critical Parameters, Reduced Parameters, Compressibility Factor , Equations of State, Gaseous Mixtures 2.Vapor Pressure and Liquids.
Week 2	Normal boiling point, Antoine equation, Material balances involving ideal gases, Liquid Properties and Vapor-Liquid Equilibrium for Multicomponent Systems.
Week 3	Henry's law, Raoult's law, Bubble Point Temperature, Dew Point Temperature and Gibb's phase rule.

Week 4	Energy definition, Energy forms, Latent heat of vaporization and Enthalpy of reaction.
Week 5	Energy balance with and without chemical reaction.
Week 6	Application of energy balance in the industry.
Week 7	Mechanical energy balance and Heat of solution calculation
Week 8	Definitions of different kinds of humidity and Humidity charts and their uses.
Week 9	Heat capacity, Enthalpy-concentration charts and their uses and Degree of freedom of systems
Week 10	Material and energy balance for complete projects.
Week 11	Material and energy balance for complete projects.
Week 12	Material and energy balance for complete projects.
Week 13	Unsteady state material balance
Week 14	Unsteady State energy balance
Week 15	Unsteady State energy balance
Week 16	**Final Exam**

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	**Available in the Library?**
Required Texts	David M Himmelblau, Basic principles and calculations in chemical engineering, Prentice Hall.	Yes
Recommended Texts	Richard M Felder & Ronald W. Rousseau Elementary Principles of Chemical Processes, Wiley India.	No
Websites	Nil	

	Ministry of Higher Education and Scientific Research - Iraq University of Diyala College of Engineering Department of Chemical Engineering	

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Fluid Flow I**			**Module Delivery**	
Module Type	**Core**			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☐ **Practical** ☐ **Seminar**	
Module Code	**CHE 203**				
ECTS Credits	**4**				
SWL (hr/sem)	**100**				
Module Level	2		**Semester of Delivery**	2	
Administering Department	Chemical engineering		**College**	College of Engineering	
Module Leader	Walaa abid mahmood		**e-mail**	whalaa_alkhaisi76@uodiyala.edu.iq	
Module Leader's Acad. Title	Assistant Lecturer		**Module Leader's Qualification**	MSc.	
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date			**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	The primary purpose of the study of fluid flow is to develop the ability to predict the application of fluid in industries. In physics, physical chemistry, and engineering, fluid dynamics is a sub discipline of fluid mechanics that describes the flow of fluids—liquids and gases. It has several sub-disciplines, including aerodynamics (the study of air and other gases in motion) and hydrodynamics (the study of liquids in motion).

	Fluid dynamics has a wide range of applications, including calculating forces and moments on aircraft, determining the mass flow rate of petroleum through pipelines, predicting weather patterns, understanding nebulae in interstellar space, and modeling fission weapon detonation.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Students who successfully finish this course will be eligible to: 1.Explain the fluid, fluid dynamics, and explain the physical characteristics of fluids: pressure, bulk modulus of elasticity, density, specific gravity, viscosity, kinematic viscosity, Newton's law of viscosity, surface tension and capillarity, varieties of fluids, Newtonian, non-Newtonian, ideal, and real fluids 2.Unit-free aggregate definition and fluid flow applications of dimensional analysis 3.The concept of pressure measurement instruments, the static fluid and its uses, and the fluid's pressure difference between its two states of rest and motion 4.Definition of the equation of continuity and momentum with applications defining the different kinds of energy lost during fluid flow as a result of pressure drops 5.Considering the energy computations required for fluid transport through the use of the

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, homework's and examples. Practical examples helps students to understand the course material.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	**63**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**4**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	**37**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**4**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**100**		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	**2**	**10% (10)**	**7 and 14**	**LO #2 and #5**
	Assignments	**4**	**10% (10)**	**11 and 13**	**LO #4 and #5**
	homework	**1**	**10%(10)**	**14**	
	Report	**2**	**10%(10)**	**14**	
Summative	**Midterm Exam**	**2 hr**	**10% (10)**	**15**	**LO #1 - #3**

assessment	**Final Exam**	**3 hr**	**50 % (40)**	**16**	**All**
Total assessment			**100% (100 Marks)**		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction to fluid flow , Physical properties of fluids
Week 2	Kinematic viscosity, Newton's , law of viscosity
Week 3	surface tension and capillarity, bulk modulus of Elasticity, Pressure
Week 4	Tutorial
Week 5	Dimensional Analysis Fundamental dimensions, dimensions, Dimensional homogeneity, methods of dimensional analysis, Rayleigh's method (power series)
Week 6	Buckingham's Π method / Theorem Dimensionless numbers
Week 7	Tutorial
Week 8	**Midterm one**
Week 9	Fluid Statics and its applications
Week 10	Buoyancy Measurement of pressure: (Piezometer, Manometers, types)
Week 11	Tutorial
Week 12	Fluid kinematics Types of fluid flow (steady and unsteady flows, uniform and non-uniform flows, one, two, and three dimensional flows, ,
Week 13	Continuity equation
Week 14	Newtonian's Fluid (Incompressible flow in Pipe and Channels) Reynolds experiment
Week 15	Velocity distribution for laminar and turbulent flow
Week 16	**Final Exam**

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	**Available in the Library?**
Required Texts	1 R. W. Fox and A. T. McDonald, "Introduction to fluid mechanics", 5th. Ed., John Wiley & Sons, 1998. 2.R. M. Holland, "Fluid Flow", John Wiley & Sons, 1982.	Yes

Recommended Texts	W. L. McCabe, J. Smith and P. Harriot, "Unit Operations of Chemical Engineering", 6th Ed., McGraw – Hill, International Edition, 2001	yes
Websites	http://www.efluids.com/	

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note:

NB Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Higher Education and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	**Physical Chemistry**	**Module Delivery**	
Module Type	**Core**	**Theory** **Lecture** **Lab** **Tutorial** **Seminar**	
Module Code	**CHE 203**		
ECTS Credits	**5**		
SWL (hr/sem)	**125**		

Module Level	1	**Semester of Delivery**	1
Administering Department	Chemical Engineering	**College**	Engineering
Module Leader	Nabaa Burhan Ali	**e-mail**	nabaa_burhan_eng@uodiyala.edu.iq
Module Leader's Acad. Title	Assistant Lecturer	**Module Leader's Qualification**	Msc
Module Tutor	None	**e-mail**	
Peer Reviewer Name	None	**e-mail**	
Scientific Committee Approval Date		**Version Number**	

Relation with other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	1.During the semester, the student learns an idea about the branches of physical chemistry and necessary facts, concepts, principles and theories of physical chemistry.

	2.Learn and understand the principles of thermodynamics 3.Learn and understand types of thermodynamic processes 4.Learn and understand Gibbs free energy and Helmholtz energy 5.Identify the types of Phase Equilibrium 6. Learn about Henry's law and Raoult's Law 7. Learn and understand Electromotive force (EMF) of a cell 8.Learn and understand the application of chemical kinetics, and Effect of temperature on reaction rate.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Understanding and teaching students the branches of physical chemistry. 2.Enabling students to obtain knowledge and understanding Fundamentals of thermodynamics. 3.Enabling students to obtain knowledge and understanding of Thermochemistry. 4.Enable the student to obtain knowledge and understanding of Kinetic chemistry. 5. Enabling students to obtain knowledge and understanding of Electrochemistry.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: Principles of thermodynamics (heat, work, types of systems, Zeroth, first law of thermodynamics, Thermochemistry , Effect of temperature on the reaction enthalpy) (4h) Types of thermodynamic processes(isothermal process, adiabatic process)(4h) Second and Third laws of thermodynamics (Heat engines) (4h) Entropy (Calculation of entropy, Gibbs free energy and Helmholtz energy, effect of pressure on the Gibbs energy) (4h) Chemical Equilibrium(Relation between Kc and Kp, Relation between Kp and Kx, Effect of inert gas on equilibrium) (4h) Phase Equilibrium (Phase rule, phase diagram of one component system, Phase diagram of two components system, Equilibrium between two phases, Clausius-Clapeyron equation) (6h) Henry's law, Raoult's Law (Applications of osmosis, calculating Molar Mass from Colligative Properties) (6h) Applications of phase rule(Types of solutions, ideal and non- ideal solutions, intermolecular forces, Solubility of gases in liquids) (6h) Electrochemical cells Electromotive force (EMF) of a cell (The polarity of electrodes, Electrode potential, The cell reaction and reversible cells) (6h) Types of half EMF, Standard electrode potentials (Thermodynamic data from cell E.M.F.S, Oxidation reduction cells, Determination of pH, Concentration cells, the temperature dependence of the EMF) (6h) Kinetic reaction (Application of chemical kinetics, The rate of chemical reactions, order of reaction, theories of chemical reactions) (4h) Rate constant (zero first, second and third order rate equations, Determination of the reactions order, Effect of temperature on reaction rate, Activation energy and Arrhenius equation) (6h)
Course Description	This course provides students an idea the branches of physical chemistry and practical applications in physical chemistry The program has been arranged in a way that covers all areas of physical chemistry, where the kinetic theory of gases, the foundations of thermodynamics, thermochemistry, chemical equilibrium, phase equilibrium, the movement of chemical reactions, and electrochemistry were identified.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1.Use different sources to obtain information. 2.Work within a team and a group for the purpose of completing some reports and solutions to duties. 3.Gain experience in finding solutions to some industrial problems. 4.Calculating the rank of chemical reactions and finding the chemical reaction constant. 5.Calculation of the temperature of chemical reactions. Calculation of electrochemical cell potential

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 43 **In class tests** **2** **Tutorial** **15** **Lab** **30** **Final Exam** **4**	**94**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6.3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل الحمل الدراسي غير المنتظم للطالب خلال الفصل **Libraray, dorm, home, memorize** 18 **Preparation for tests** 8 **Homework** **5**	**31**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	4	20% (20)	3, 6,10 and 13	LO #1, 2, 4, 5, 8, 9, 11 and 12
	Assignments	4	10% (10)	2, 5, 9 and 12	LO #1, 4, 10 and 11
	Projects / Lab.	15	10% (10)	Continuous	All
	Seminars				
Summative	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7

assessment	**Final Exam**	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Principles of thermodynamics, heat, work, types of systems, Zeroth, first law of thermodynamics, Thermochemistry , Effect of temperature on the reaction enthalpy,
Week 2	Types of thermodynamic processes, isothermal process, adiabatic process
Week 3	Second and Third laws of thermodynamics, Heat engines
Week 4	Entropy, Calculation of entropy, Gibbs free energy and Helmholtz energy, effect of pressure on the Gibbs energy
Week 5	Chemical Equilibrium, Relation between Kc and Kp,
Week 6	Relation between Kp and Kx, Effect of inert gas on equilibrium
Week 7	Mid-term Exam -
Week 8	Phase Equilibrium, Phase rule, phase diagram of one component system, Phase diagram of two components system, Equilibrium between two phases, Clausius-Clapeyron equation.
Week 9	Henry's law, Raoult's Law , Applications of osmosis, calculating Molar Mass from Colligative Properties
Week 10	Applications of phase rule, Types of solutions, ideal and non- ideal solutions, intermolecular forces, Solubility of gases in liquids
Week 11	Electrochemical cells Electromotive force (EMF) of a cell, The polarity of electrodes, Electrode potential, The cell reaction and reversible cells,
Week 12	Types of half EMF, Standard electrode potentials,Thermodynamic data from cell E.M.F.S.,
Week 13	Oxidation reduction cells, Determination of pH, Concentration cells, the temperature dependence of the EMF
Week 14	Kinetic reaction, Application of chemical kinetics, The rate of chemical reactions, order of reaction, theories of chemical reactions
Week 15	Rate constant zero, first, second and third order rate equations, Determination of the reactions order, Effect of temperature on reaction rate, Activation energy and Arrhenius equation
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Determine the density of a liquid by pyknometry
Week 2	Distribution of acetic acid between toluene and water
Week 3	The solubility of solids in liquids
Week 4	Determine the viscosity of a pure liquid(nitrobenzene) and its variation with temperature
Week 5	Determine the surface tension of a liquid by the double capillary method at different temperatures

Week 6	Adsorption of acetic acid with activated carbon particles
Week 7	Find the solubility between phenol and water
Week 8	Calculate the molecular weights of the freezing point depression
Week 9	Study the variation of the vapour pressure of a pure liquid with temperature
Week10	Determine of the relative molecular mass of chloroform by Victor Meyer's method
Week11	Determine the solubility of benzoic acid over a range of temperatures and hence calculate its heat of solution
Week12	Determine the adsorption isotherm of acetic acid from aqueous solution by charcoal
Week13	Study the Kinetics of the hydrolysis of methyl acetate catalyzed by hydrochloric acid
Week14	Determine the rate constant of the hydrolysis of ethyl acetate by sodium hydroxide
Week15	Determine the rate constant and the energy of activation of the reaction between hydrogen peroxide and hydrogen iodide

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1.Robert A. Alberty "Physical Chemistry " seven edition	Yes
Recommended Texts	1.K.K. Sharma " Physical Chemistry " 2.Arun Bahl , B.S.Bahl ,G.D.Tuli "Essentials of Physical Chemistry "S.Chand and Company ltd 2008	Yes
Websites		

Ministry of Higher Education and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Petroleum and Natural gas			Module Delivery	
Module Type	Core			Theory Lecture Tutorial Lab	
Module Code	CHE 205				
ECTS Credits	5				
SWL (hr/sem)	79				
Module Level	2		Semester (s) offered	3	
Administering Department	Chemical Engineering		College	Engineering	
Module Leader	Dr. Ahmed Abbas Fadhil		e-mail	Ahmed.a.fadhil@uodiyala.edu.iq	
Module Leader's Acad. Title	Lecturer		Module Leader's Qualification	Ph.D.	
Module Tutor	None		e-mail		
Peer Reviewer Name	None		e-mail		
Review Committee Approval			Version Number		

Relation with Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module		Semester	1
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	*Petroleum* 1. *Understanding Petroleum:* - Define petroleum and explain its origins. - Identify and describe the chemical composition of crude oil. - Classify different types of crude oil based on their properties and composition.

	2. *Preparation of Crude Oil for Refining/Distillation: * - Explain the processes involved in crude oil degassing and stabilization. - Discuss methods for sulfur recovery from petroleum gases. - Describe techniques for treating emulsions and dehydration in crude oil. - Explain the desalting process in crude oil preparation. 3. *Refining/Distillation of Crude Oil: * - Understand the operation of simple fractional distillation columns. - Describe the process and importance of atmospheric complex fractional distillation. - Explain vacuum complex fractional distillation and its applications. - Introduce azeotropic distillation and its significance in refining. 4. *Petroleum Products: * - Identify various petroleum products including LPG, gasoline, kerosene, gas oil, lubricating oils, wax, and asphalt. - Discuss the uses and applications of different petroleum products. 5. *Physical Properties of Petroleum Products: * - Understand mechanical properties such as density, specific gravity, viscosity and viscosity index, and surface tension. - Study thermal properties including cloud point, pour point, freezing point, and melting point. - Examine optical properties like boiling point, flash point, fire point, auto-ignition point, octane number, aniline point, diesel index, specific heat, volatility, and refractive index. *Natural Gas* 1. *Understanding Natural Gas: * - Define natural gas and describe its chemical composition. - Discuss the various uses of natural gas. - Differentiate between types of gas reservoirs and classify associated and non-associated gases. - Study the properties of natural gas. 2. *Natural Gas Processing: * - Explain the methods for condensate and water removal. - Describe acid gas removal processes and the sweetening of sour natural gas. - Discuss sulfur recovery using the Claus process. - Understand dehydration (moisture removal) and mercury removal techniques. - Explain nitrogen rejection, NGL recovery, and fractionation of natural gas liquids (NGL). 3. *Natural Gas Transmission: * - Discuss the principles and practices of liquefied natural gas (LNG) and compressed natural gas (CNG) transmission. - Explain the concept and importance of the heating value (HV) of fuel in natural gas transmission.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Petroleum 1. *Definition and Origin of Petroleum* - Understand and define petroleum and its origins. - Explain the chemical composition and classification of crude oil. 2. *Preparation of Crude Oil for Refining/Distillation* - Describe the processes involved in crude oil degassing and stabilization. - Explain the techniques for sulfur recovery from petroleum gases.

	- Understand emulsion treatment, dehydration, and desalting processes in crude oil preparation. 3. *Refining/Distillation of Crude Oil* - Describe the operation of a simple fractional distillation column. - Explain the functions and processes within an atmospheric complex fractional distillation column. - Understand the principles of vacuum complex fractional distillation and azeotropic distillation. 4. *Petroleum Products and Their Uses* - Identify various petroleum products including LPG, gasoline, kerosene, gas oil, lubricating oils, wax, and asphalt. - Explain the various uses of crude oil and its products. 5. *Physical Properties of Petroleum Products* - Define and measure the mechanical properties such as density, specific gravity, viscosity and viscosity index, and surface tension. - Explain the thermal properties including cloud point, pour point, freezing point, and melting point. - Understand the optical properties like boiling point, flash point, fire point, auto-ignition point, octane number, aniline point, diesel index, specific heat, volatility, and refractive index. #### Natural Gas 1. *Introduction to Natural Gas* - Define natural gas and explain its chemical composition. - Understand the various uses of natural gas and differentiate between types of gas reservoirs. - Explain the differences between associated and non-associated gases. 2. *Natural Gas Properties* - Understand the physical and chemical properties of natural gas. 3. *Natural Gas Processing* - Explain the processes involved in condensate and water removal. - Understand acid gas removal (sweetening of sour natural gas) and sulfur recovery using the Claus process. - Describe the methods for dehydration (moisture removal), mercury removal, and nitrogen rejection. - Understand NGL recovery and the fractionation of natural gas liquids. 4. *Natural Gas Transmission* - Describe the processes and techniques involved in the transmission of natural gas. - Understand the differences and uses of liquefied natural gas (LNG) and compressed natural gas (CNG). • - Explain the heating value (HV) of fuel and its importance in natural gas applications.
Indicative Contents المحتويات الإرشادية	Petroleum 1. *Introduction to Petroleum* - Definition of petroleum - Origin and formation of petroleum - Chemical composition of crude oil - Classification of crude oil (paraffinic, naphthenic, aromatic, and mixed-base) 2. *Preparation of Crude Oil for Refining/Distillation*

	- Crude oil degassing: methods and importance - Crude oil stabilization: principles and techniques - Sulfur recovery from petroleum gases: processes (Claus process, etc.) - Emulsion treatment and dehydration: methods (chemical, electrical, and thermal) - Desalting of crude oil: single-stage and multi-stage desalting processes 3. *Refining/Distillation of Crude Oil* - Simple fractional distillation: principles, equipment, and operation - Atmospheric complex fractional distillation: design and operation - Vacuum complex fractional distillation: purpose, equipment, and processes - Azeotropic distillation: principles, applications, and examples 4. *Petroleum Products and Their Uses* - LPG: production, properties, and uses - Gasoline: composition, properties, and uses - Kerosene: properties and uses - Gas oil (diesel): production, properties, and applications - Lubricating oils: types, properties, and uses - Wax: production, properties, and uses - Asphalt: production, properties, and applications 5. *Physical Properties of Petroleum Products* - Mechanical properties: density, specific gravity, viscosity, viscosity index, surface tension - Thermal properties: cloud point, pour point, freezing point, melting point - Optical properties: boiling point, flash point, fire point, auto-ignition point, octane number, aniline point, diesel index, specific heat, volatility, refractive index #### Natural Gas 1. *Introduction to Natural Gas* - Definition and formation of natural gas - Chemical composition of natural gas - Uses of natural gas in various industries - Types of gas reservoirs: conventional, unconventional - Associated vs. non-associated gases: definitions and examples 2. *Properties of Natural Gas* - Physical properties: phase behavior, density, viscosity - Chemical properties: methane content, impurities 3. *Natural Gas Processing* - Condensate and water removal: methods and equipment - Acid gas removal: techniques (amine gas treating, membrane separation) - Sulfur recovery: Claus process, SuperClaus process, and other methods - Dehydration: methods (glycol dehydration, molecular sieves) - Mercury removal: techniques and importance - Nitrogen rejection: cryogenic distillation, adsorption methods - NGL recovery: processes and equipment - Fractionation of natural gas liquids: distillation columns, separation techniques 4. *Natural Gas Transmission* - Liquefied Natural Gas (LNG): production, transportation, and storage - Compressed Natural Gas (CNG): production, transportation, and applications - Heating value (HV) of fuel: definition, measurement, and significance
Course Description	This course provides an in-depth exploration of the petroleum and natural gas industries, focusing on their origins, compositions, processing methods, and

	applications. Students will begin by understanding the definition and formation of petroleum and natural gas, followed by a detailed study of the chemical composition and classification of crude oil and natural gas. The course delves into the preparation of crude oil for refining and distillation, covering essential processes such as degassing, stabilization, sulfur recovery, emulsion treatment, dehydration, and desalting. Students will learn about various refining and distillation techniques, including simple and complex fractional distillation, vacuum distillation, and azeotropic distillation. An examination of petroleum products such as LPG, gasoline, kerosene, gas oil, lubricating oils, wax, and asphalt will be conducted, along with their specific uses and applications. The course will also cover the physical properties of these petroleum products, including mechanical, thermal, and optical properties. In the natural gas section, students will study the types of gas reservoirs, associated and non-associated gases, and the various physical and chemical properties of natural gas. The course will cover natural gas processing techniques such as condensate and water removal, acid gas removal, sulfur recovery, dehydration, mercury removal, nitrogen rejection, NGL recovery, and fractionation.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1. *Lectures and Interactive Sessions* - *Overview: * Deliver structured lectures to introduce key concepts, theories, and processes. - *Interactive Component: * Incorporate Q&A sessions, real-time polling, and discussion prompts to encourage student participation and engagement. 2. *Hands-On Laboratory Exercises* - *Overview: * Provide practical experience with laboratory equipment and simulations related to petroleum and natural gas processing. - *Activities: * Perform experiments on crude oil stabilization, distillation processes, and natural gas sweetening, and measure physical properties of petroleum products. 3. *Case Studies and Industry Examples* - *Overview: * Utilize real-world case studies to illustrate the application of theoretical concepts in industry settings. - *Application: * Analyze successful and challenging projects in petroleum and natural gas industries, examining methods used and lessons learned. 4. *Field Trips and Industry Visits* - *Overview: * Arrange visits to refineries, natural gas processing plants, and research facilities. - *Exposure: * Provide students with firsthand observation of industrial processes and the opportunity to interact with professionals in the field. 5. *Guest Lectures and Expert Panels* - *Overview: * Invite industry experts and researchers to share their experiences and insights. - *Integration: * Schedule guest lectures on specialized topics and organize panel discussions to address current trends and challenges in the industry. 6. *Group Projects and Presentations* - *Overview: * Encourage collaborative learning through group projects focused on specific aspects of petroleum and natural gas processing. - *Deliverables: * Have student groups present their findings and recommendations, fostering teamwork and communication skills.

	7. *Problem-Based Learning (PBL)* - *Overview: * Engage students in solving real-world problems related to petroleum and natural gas industries. - *Method: * Present scenarios and challenges for students to analyze and develop solutions, promoting critical thinking and application of knowledge. 8. *Simulation Software and Digital Tools* - *Overview:* Integrate the use of simulation software to model petroleum refining and natural gas processing. - *Tools:* Use software like Aspen HYSYS, ChemCAD, or similar tools to simulate processes, enhancing understanding through virtual experimentation.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل In class lectures 45 In class tests 4 Lab 30 Final Exam 3	79	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل Library, dorm, home memorizing 30 Preparation for tests 30 Homework 12	72	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	151		

Module Evaluation
تقييم المادة الدراسية

		Time/ Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	3 and 6	LO #1, 2, 6, and 7
	Semen	1	10% (10)	2 and 14	LO # 1,2,3,5 and 6
	Projects / Lab.	1	10% (10)	Continuous	All
	Home work	2	10% (10)	3 and 10	LO # 4-9
Summative assessment	Midterm Exam	1	10% (10)	7	LO # 1-5
	Final Exam	1	50% (50)	16	All
Total assessment			100% (100Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

Material Covered
Week Delivery Plan (Weekly Syllabus for 3 Hours per Week) Week 1: Introduction to Petroleum and Natural Gas - *Topics: *

- Definition and origin of petroleum and natural gas
- Chemical composition of crude oil and natural gas
- Classification of crude oil
- *Activities: *
- Lecture and introductory discussion (1.5 hours)
- Overview of course structure and expectations (30 minutes)
- Reading assignment: Introductory chapters on petroleum and natural gas (1 hour)

Week 2: Chemical Composition and Classification of Crude Oil
- *Topics: *
- Detailed chemical composition of crude oil
- Classification of crude oil: paraffinic, naphthenic, aromatic, mixed-base
- *Activities: *
- Lecture and discussion (1.5 hours)
- Group activity: Classifying samples of crude oil (1.5 hours)

Week 3: Crude Oil Degassing and Stabilization
- *Topics: *
- Crude oil degassing: methods and importance
- Crude oil stabilization: principles and techniques
- *Activities: *
- Lecture and demonstration (1.5 hours)
- Lab exercise: Degassing and stabilization techniques (1.5 hours)

Week 4: Sulfur Recovery and Emulsion Treatment
- *Topics: *
- Sulfur recovery from petroleum gases: Claus process
- Emulsion treatment and dehydration methods
- *Activities: *
- Lecture and discussion (1.5 hours)
- Lab exercise: Emulsion breaking techniques (1.5 hours)

Week 5: Desalting of Crude Oil
- *Topics: *
- Desalting processes: single-stage and multi-stage desalting
- *Activities: *
- Lecture and demonstration (1.5 hours)
- Lab exercise: Desalting process simulation (1.5 hours)

Week 6: Simple Fractional Distillation
- *Topics:*
- Principles of simple fractional distillation
- Equipment and operation
- *Activities: *
- Lecture and demonstration (1.5 hours)
- Lab exercise: Simple distillation process (1.5 hours)

Week 7: Atmospheric and Vacuum Distillation
- *Topics: *
- Atmospheric complex fractional distillation
- Vacuum complex fractional distillation
- *Activities: *
- Lecture and discussion (1.5 hours)
- Lab exercise: Atmospheric and vacuum distillation simulation (1.5 hours)

Week 8: Mid-term Exam and Review
- *Activities: *
- Mid-term exam covering Weeks 1-7 content (1.5 hours)
- Review session to discuss exam results and key concepts (1.5 hours)

Week 9: Azeotropic Distillation
- *Topics: *
  - Principles and applications of azeotropic distillation
- *Activities: *
  - Lecture and demonstration (1.5 hours)
  - Lab exercise: Azeotropic distillation process (1.5 hours)

Week 10: Petroleum Products and Their Uses
- *Topics: *
  - LPG, gasoline, kerosene, gas oil, lubricating oils, wax, asphalt
  - Uses and applications of petroleum products
- *Activities: *
  - Lecture and discussion (1.5 hours)
  - Group activity: Research and presentation on petroleum products (1.5 hours)

Week 11: Physical Properties of Petroleum Products (Part 1)
- *Topics: *
  - Mechanical properties: density, specific gravity, viscosity, viscosity index, surface tension
- *Activities: *
  - Lecture and demonstration (1.5 hours)
  - Lab exercise: Measuring mechanical properties (1.5 hours)

Week 12: Physical Properties of Petroleum Products (Part 2)
- *Topics: *
  - Thermal properties: cloud point, pour point, freezing point, melting point
  - Optical properties: boiling point, flash point, fire point, auto-ignition point, octane number, aniline point, diesel index, specific heat, volatility, refractive index
- *Activities: *
  - Lecture and demonstration (1.5 hours)
  - Lab exercise: Measuring thermal and optical properties (1.5 hours)

Week 13: Natural Gas Properties and Processing
- *Topics: *
  - Physical and chemical properties of natural gas
  - Condensate and water removal, acid gas removal
- *Activities: *
  - Lecture and discussion (1.5 hours)
  - Lab exercise: Natural gas processing techniques (1.5 hours)

Week 14: Sulfur Recovery, Dehydration, and Mercury Removal
- *Topics: *
  - Sulfur recovery: Claus process
  - Dehydration methods: glycol dehydration, molecular sieves
  - Mercury removal techniques
- *Activities: *
  - Lecture and discussion (1.5 hours)
  - Lab exercise: Sulfur recovery and dehydration techniques (1.5 hours)

Week 15: Nitrogen Rejection, NGL Recovery, and Fractionation / Natural Gas Transmission and Capstone Project Presentation
- *Topics: *
  - Nitrogen rejection: cryogenic distillation, adsorption methods
  - NGL recovery and fractionation processes
  - LNG and CNG production, transportation, and storage
  - Heating value (HV) of fuel
- *Activities: *
  - Lecture and discussion (1.5 hours)
  - Capstone project presentations by student groups (1.5 hours)

Week 16
  - Final exam

This 15-week syllabus with 3 hours per week ensures a comprehensive understanding of the petroleum and natural gas, blending theoretical knowledge with practical skills insights.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	1. W.L Nelson, Petroleum Refinery Engineering, 4th edition, 1985. 2. William D. McCain, The Properties of Petroleum Fluids, 1990.	Yes
Recommended Texts	- 1. Saeid Mokhatab, William A.Poe and James G.Speight. "Hand book of Natural Gas Transmission and Processing" 2006. 2. Arthur J. Kidnay & William R. Parrish “Fundamentals of Natural Gas Processing” 2006. 3. Xiuli Wang XGAS “Advanced Natural Gas Engineering” 2009.	No
Websites	Nil	

Ministry of Higher Education and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	**Computer Programming I**	**Module Delivery**	
Module Type	**Core**	**Theory** ✓ **Lecture** ✓ **Lab** **Tutorial** ✓ **Seminar**	
Module Code	**CHE 206**		
ECTS Credits	**4**		
SWL (hr/sem)	**100**		

Module Level	**2**	**Semester of Delivery**	**1**
Administering Department	Chemical Engineering	**College**	Engineering
Module Leader	Sura Fahmy Yousif	**e-mail**	Sura.fahmy@uodiyala.edu.iq
Module Leader's Acad. Title	Assistant Prof.	**Module Leader's Qualification**	MSc
Module Tutor	None	**e-mail**	-
Peer Reviewer Name	None	**e-mail**	-
Scientific Committee Approval Date		**Version Number**	1.0

Relation with other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	**Semester**	-
Co-requisites module	None	**Semester**	-

Module Aims, Learning Outcomes and Indicative Contents
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	1. Teaching the student during the semester about MATLAB program specifications, algorithm design and development, coding, and testing using a modern software

	development environment. 2. Teaching the student how to write programs in a high-level object-oriented programming language including algorithms, diagrams, problem solving, programming concepts, methods, control structures, arrays, and strings. 3. Providing the students with problem-solving skills and their application to solve computer problems. 4. Developing the student's mind and enabling him to write any program in the MATLAB language through the application of different programs in all fields. 5. Clarifying the importance of computer science for students at present and in the future, and keeping pace with the development of this science in various disciplines.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Enabling the student to know the concepts of information technology by learning the basics of MATLAB language. 2. Enabling the student to know MATLAB instructions and how to use each instruction inside the program. 3. Enabling the student how to write functions and use them repeatedly within each program. 4. Enabling the student how to use MATLAB language to draw diagrams and models. 5. Enabling the student how to write programs in MATLAB language for any required mathematical equation or diagram. 6. Enabling the student to think about the importance of programming using the MATLAB language in facilitating contemporary life. 7. Enabling the student to think about the importance of the impact of the MATLAB language on the development of scientific research methods. 8. Enabling the student to think and follow the rapid development of the MATLAB language.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: • A brief history importance of MATLAB [4 hrs]. • Explaining the MATLAB language using simplified programs [8 hrs]. • Types of data, variables, arithmetic functions, numbers, and operations in MATLAB using subprograms [8 hrs]. • Solving differential equations, derivative, and integration in MATLAB [12 hrs]. • Plot functions using applied examples in MATLAB [8 hrs]. • Arrays, matrices, and their arithmetic operations in MATLAB [12 hrs]. • Basic control and conditional functions with examples in MATLAB [12 hrs].
Course Description	This course provides students an idea of fundamental principles and applications of programming using MATLAB language. Types of data, constants, variables, characters, numbers, operations, instructions and mathematical functions in MATLAB. Solving algebraic equations, differential equations, differentiation, limited integration, unlimited integration, and limits in MATLAB. Control flow, relational, logical operators, and loops in MATLAB. Basic plotting including 2D and 3D drawing, adding titles, axis labels, annotations, specifying line styles and colors of the graph, subplots in MATLAB. Generation of arrays and matrices and their arithmetic operations, solving linear equations using matrices in MATLAB language.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1. The teacher prepares lectures on the subject in paper and electronic form and presents them to the students. 2. The teacher explains the theoretical and practical lectures using modern teaching and presentation methods. 3. The teacher explains lectures in detail. 4. The teacher requests periodic reports and homework assignments on the basic topics of the subject. 5. The teacher encourages students to participate in discussions to clear up any misconceptions. 6. The teacher asks questions and gives exercises that require analysis and conclusions related to lectures. 7. The teacher uses different examples to connect the theoretical and practical sides. 8. The teacher encourages students to do the practical part and work in groups.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures 13** **In class tests 4** **Lab 43** **Final Exam 4**	**64**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**4.2**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Libraray, dorm, home, memorize 14** **Preparation for tests 14** **Homework 8**	**36**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**2.4**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**100**		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	4	10% (10)	3, 6, 9 and 12	LO #1, 2, 3, 4, 5, 7, 8, 9, 10 and 11
	Assignments	6	10% (10)	3, 5, 8, 11, 12 and 13	LO #1, 4, 10 and 11

	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #3, #4 and #6
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #8
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	A brief history importance of MATLAB
Week 2	Explains the MATLAB program using simplified programs
Week 3	Explains the MATLAB program using subprograms
Week 4	Types of data, variables, arithmetic functions, numbers, and operations in MATLAB
Week 5	Write and solve algebraic equations in MATLAB
Week 6	Write and solve differential equations in MATLAB
Week 7	Write and solve differentiation in MATLAB
Week 8	Write and solve limited integration, unlimited integration, and limits in MATLAB
Week 9	Plots 2D functions using applied examples in MATLAB
Week 10	Plots 3D functions using applied examples in MATLAB
Week 11	Adding titles, axis labels, annotations, specifying line styles and colors of the graph, subplots in MATLAB
Week 12	Arrays and their arithmetic operations in MATLAB
Week 13	Matrices and their arithmetic operations in MATLAB
Week 14	Basic programs about control functions in MATLAB
Week 15	Basic programs about conditional functions in MATLAB
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Introduction to the lab and get started with use of MATLAB program on the computer
Week 2	Explains the MATLAB program using simplified programs
Week 3	Explains the MATLAB program using subprograms
Week 4	Types of data, variables, arithmetic functions, numbers, and operations in MATLAB
Week 5	Write and solve algebraic equations in MATLAB
Week 6	Write and solve differential equations in MATLAB

Week 7	Write and solve differentiation in MATLAB
Week 8	Write and solve limited integration, unlimited integration, and limits in MATLAB
Week 9	Plots 2D functions using applied examples in MATLAB
Week10	Plots 3D functions using applied examples in MATLAB
Week11	Adding titles, axis labels, annotations, specifying line styles and colors of the graph, subplots in MATLAB
Week12	Arrays and their arithmetic operations in MATLAB
Week13	Matrices and their arithmetic operations in MATLAB
Week14	Basic programs about control functions in MATLAB
Week15	Basic programs about conditional functions in MATLAB

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	• Chemical Engineering Computation with MATLAB®, 1st Edition, and Professor Yeong Koo Yeo teaches chemical engineering at the College of Engineering of Hanyang University, Seoul, South Korea. • Essential MATLAB for Engineers and Scientists, Fourth Edition, Brian H. Hahn, Daniel T. Valentine • Essential MATLAB for Engineers and Scientists, Fifth Edition, Brian H. Hahn, Daniel T. Valentine	-
Recommended Texts	All solid scientific magazines and periodicals related to programming in the MATLAB language.	-
Websites	1. http://www.cprogramming.com/ 2. http://www.mathworks.com/	

Ministry of Higher Education and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	جرائم نظام البعث في العراق (Extinct Ba'ath Party Crimes)	**Module Delivery**	
Module Type	Basic learning activities	☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **L Tutorial** ☐ **Practical** ☒ **Seminar**	
Module Code	UD05		
ECTS Credits	2		
SWL (hr/sem)	50		
Module Level	2	**Semester of Delivery**	
Administering Department	جميع اقسام الكلية	**College**	College of
Module Leader		**e-mail**	
Module Leader's Acad. Title		**Module Leader's Qualification**	MSc.
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	
Scientific Committee Approval Date	9/09/2024	**Version Number**	1.0

Relation with other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	1. التعرف على ماهية الجريمة لغة واصطلاحاً وماهية أقسام الجرائم. 2. التعرف على جرائم نظام البعث وفق قانون المحكمة الجنائية العراقية العليا عام 2005م. 3. تنمية وعي الطلب بجرائم نظام البعث وفق توثيق قانون المحكمة الجنائية العراقية العليا لسنة 2005م.

	4. دراسة الجرائم التي ارتكبها نظام البعث على مدى سنوات طويلة واثارها النفسية والاجتماعية . 5. التعرف على صور انتهاكات حقوق الانسان وجرائم السلطة والتعرف على الجرائم البيئية لنظام البعث في العراق. 6. تعزيز الوعي بحقيقة ما جرى من مآسي المقابر الجماعية المرتكبة من النظام البعثي في العراق.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. تمكين الطالب من معرفة المفاهيم النظرية للجرائم وأركان الجرئم . 2. تمكين الطالب من معرفة أقسام الجرائم . 3. تمكين الطالب من معرفة قانون المحكمة الجنائية العراقية العليا لسنة 2005. 4. فهم تشكيل المحكمة الجنائية العراقية العليا لسنة 2005 والتعرف على تشكيل المحكمة أجراءات التقاضي امام المحكمة. 5. يتعلم الطالب أنواع الجرائم الدولية على وفق النظام الاساسي للمحكمة الجنائية الدولية. 6. معرفة الطالب بألاثار النفسية والاجتماعية لجرائم نظام البعث. 7. يتمكن الطالب من فهم موقف النظام البعثي من الدين من خلال فهم عقيدة النظام السياسي سبيلاً لفهم موقف النظام من الدين. 8. يتمكن الطالب من التعرف على صور أنتهاكات القوانين العراقية وأنتهاكات حقوق الانسان وجرائم السلطة. 9. تمكين الطالب من التعرف على بعض قرارات الانتهاكات السياسية والعسكرية لنظام البعث. 10- يتعرف الطالب على أماكن السجون والاحتجاز لنظام البعث. 11- معرفة الطالب بالجرائم البيئية وبأثار الجرائم البيئية لنظام البعث، ويتعرف جرائم المقابر الجماعية.
Indicative Contents المحتويات الإرشادية	**<u>الجزء الاول</u> : جرائم نظام البعث وفق قانون المحكمة الجنائية العراقية العليا لعام 2005م، والجرائم النفسية والاجتماعية وآثارها وابرز انتهاكات النظام البعثي في العراق:** التعريف بالجريمة لغة وأصطلاحاً، اركان واقسام الجريمة (2 ساعة). جرائم نظام البعث وفق قانون المحكمة الجنائية العراقية العليا عام 2005م : أنواع الجرائم الدولية، القرارات الصادرة من المحكمة الجنائية العليا (2 ساعة). وابرز القضايا التي نظرت فيها المحكمة (2 ساعة).الجرائم النفسية والاجتماعية وآثارها وابرز انتهاكات النظام البعثي في العراق: الجرائم النفسية، اليات الجرائم النفسية (2 ساعة). اثار الجرائم النفسية ، الجرائم الاجتماعية (2 ساعة) . عسكرة المجتمع، موقف النظام البعثي من الدين (2 ساعة) . أنتهاكات القوانين العراقية، صور أنتهاكات حقوق الانسان (2 ساعة) . جرائم السلطة، بعض قرارات الانتهاكات السياسية والعسكرية لنظام البعث، أماكن السجون والاحتجاز لنظام البعث (2 ساعة). **<u>الجزء الثاني : الجرائم البيئية لنظام البعث في العراق، جرائم المقابر الجماعية :</u>** الجرائم البيئية لنظام البعث في العراق: التلوث الحربي والاشعاعي – أستعمال الاسلحة المحرمة دولياً ومخاطر الالغام. (2 ساعة). التلوث بالمواد المشعة، أثار أستخدام الاسلحة المحرمة دولياً (2 ساعة). تدمير المدن والقرى (سياسة الارض المحروقة): قصف المدن، قصف العتبات المقدسة والمساجد والحسينيات، معركة نهر جاسم ، حرق آبار النفط (2 ساعة). تجفيف الاهوارو أثارها البيئية والاجتماعية والاقتصادية (2 ساعة). ، تجريف بساتين النخيل والاشجار والمزروعات (2 ساعة). جرائم المقابر الجماعية وموقف الامم المتحدة منها (2 ساعة). احداث المقابر الجماعية المرتكبة من النظام البعثي في العراق، التصنيف الزمني لمقابر ابادة الجماعية في العراق للمدة 1963- 2003 (2 ساعة).
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1- زيادة وعي الطالب بالجرائم التي ارتكبها نظام البعث في العراق وحقيقة ما جرى من مآسي وويلات بحق الشعب العراقي. 2- اكتساب الطالب ثقافة عامة بماهية الجرائم واركانها واقسامها وموقف المشرع العراقي منها. 3- زيادة وعي الطالب بموقف القانون الدولي والمحاكم الجنائية الدولية من الجرائم والانتهاكات التي ترتكبها الانظمة السلطوية.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ أسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	**33**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	2.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	**17**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	1.1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**50**		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	2	10% (10)	5, 10	LO #1, 2, 10 and 11
	Assignments	2	10% (10)	2, 12	LO # 3, 4, 6 and 7
	Projects / tutorial.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	**Midterm Exam**	1 hr	10% (10)	7	LO # 1-7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	محاضرة تعريفية عن المادة واهميتها.
Week 2	التعريف بالجريمة لغة واصطلاحا، أقسام الجريمة، جرائم نظام البعث وفق قانون المحكمة الجنائية العراقية العليا عام 2005م ، أنواع الجرائم الدولية.
Week 3	القرارات الصادرة من المحكمة الجنائية العليا، وأبرز القضايا التي نظرت فيها المحكمة.
Week 4	الجرائم النفسية، اليات الجرائم النفسية.
Week5	اثار الجرائم النفسية، الجرائم الاجتماعية
Week 6	عسكرة المجتمع، موقف النظام البعثي من الدين.
Week 7	انتهاكات القوانين العراقية، صور انتهاكات حقوق الانسان، جرائم السلطة.
Week 8	بعض قرارات الانتهاكات السياسية والعسكرية لنظام البعث، أماكن السجون والاحتجاز لنظام البعث.
Week 9	الجرائم البيئية لنظام البعث في العراق: التلوث الحربي والاشعاعي – استعمال الاسلحة المحرمة دولياً ومخاطر الالغام.
Week 10	التلوث بالمواد المشعة، أثار أستخدام الاسلحة المحرمة دولياً
Week 11	تدمير المدن والقرى (سياسة الارض المحروقة).
Week 12	تجفيف الأهوار أثارها البيئية والاجتماعية والاقتصادية .

Week 13	تجريف بساتين النخيل والاشجار والمزروعات.
Week 14	جرائم المقابر الجماعية، أحداث المقابر الجماعية المرتكبة من النظام البعثي في العراق.
Week 15	التصنيف الزمني لمقابرالابادة الجماعية في العراق للمدة 1963- .2003
Week 16	الامتحان النهائي

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	المنهج المقر الدراسي للجامعات الحكومية و الأهلية كافة كتاب وزارة التعليم والبحث العلمي ذي العدد (ت م 3/ 7588 في 2023/10/19)	نعم
Recommended Texts		لا
Websites		

YEAR 2
(SEMESTER 2)

Ministry of Higher Education and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	Engineering Mathematics II	**Module Delivery**	
Module Type	Core	☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Practical** ☐ **Seminar**	
Module Code	CHE 207		
ECTS Credits	4		
SWL (hr/sem)	100		
Module Level	UGII	**Semester of Delivery**	Three
Administering Department	Chemical engineering	**College**	College of Engineering
Module Leader	Ali I. Abdalla	**e-mail**	alialnuaimmy@uodiyala.edu.iq
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	MSc.
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	
Scientific Committee Approval Date		**Version Number**	1.0

Relation with other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	CHE 201	**Semester**	Two
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	1-Provide a Strong Foundation in Mathematical Concepts • Introduce fundamentals of calculus, linear algebra, and other core mathematical tools • Develop logical understanding and mathematical skills to solve engineering problems 2- Develop Problem-Solving Skills • Equip students with techniques to interpret objectives, mathematize, solve, and communicate results • Cultivate critical thinking and creativity in applying mathematics to engineering problems 3- Facilitate Active Learning • Use a mix of lectures, tutorials, discussions, and hands-on exercises for active learning • Provide guided practice with relevant engineering problems 4- Teach Applications to Engineering Fields • Relate mathematical concepts to real-world engineering scenarios and applications • Integrate engineering examples and case studies throughout the curriculum • Demonstrate the importance and symbiosis between mathematics and engineering The overall goal is to develop students' mathematical maturity and ability to apply advanced concepts to solve complex engineering problems. This requires a combination of solid foundational knowledge, practice with relevant applications, and explicit connections between theory and practice.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	**Module Learning Outcomes** 1. Demonstrate an understanding the Double integral, changing double integral from Cartesian to polar form. 2. Finding the area using double integral, area using polar coordinates, moments and center of mass 3. Demonstrate an understanding the triple integral, volume using triple integral 4. Demonstrate an understanding of infinite sequence and series, geometric series, alternating series, tests of infinite series. 5-Representing function as series, Taylor series, McLaurin series, power series, Taylor`s theorem with remainder 6- Types of matrix, matrix algebra, Inverse of matrix, Grammar's rule, Gaussian elimination method. 7- Understanding and finding Eigen value and Eigen vector of a matrix
Course Description	**Course Description** Engineering Mathematics I is a foundational course that introduces students to the key mathematical concepts and techniques essential for success in various engineering disciplines. The course typically covers the following topics: 1- Multiple Integration Calculus • Double integral, changing double integral from Cartesian to polar form • Applications of double integration (Area, Volume, mass, center of mass,

	average value, etc.) • Triple integration and its applications 2-Linear Algebra • Systems of linear equations • Gaussian elimination • Matrix algebra • Transpose • Determinants and Cramer's Rule • Inverse matrices • Eigen value and Eigen vector of matrix 3- Sequence and Series • Convergence and Divergence of Series (Tests for convergence: ratio test, root test, integral test, comparison test, etc.) • Geometric series, Harmonic series, Alternating series, Power series, Taylor Series, Fourier series. • Radius and interval of convergence • Approximation of functions The course is typically delivered through a combination of lectures, tutorials, classwork, and homework. Assessment includes a final exam worth 50%, mid-term exam worth 10% and other coursework such as homework assignments, classwork and tests worth 40%.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1- Integrate Lectures and Tutorials for Active Learning • Mix direct instruction in lectures with guided practice in tutorials for active learning • Include a variety of learning activities like problem-solving, discussions, and hands-on exercises 2- Use Relevant Examples and Applications • Use examples and problems with engineering contexts embedded throughout the course • Include some engineering guest lectures to explain real-world applications of the mathematical concepts • Relate the mathematics to specific engineering disciplines like fluid mechanics, structures, etc 3- Establish High Expectations and Develop Critical Thinking • Establish high expectations for students' mathematical understanding • Develop critical thinking and problem-solving skills • Cultivate creativity in applying mathematics to engineering problems The overall goal is to help students develop a strong conceptual understanding of the mathematics that is directly applicable to their engineering studies. This requires a combination of solid foundational knowledge, practice with relevant

	problems, and explicit connections to engineering applications. Both students and instructors play an active role in employing effective learning and teaching strategies to achieve this goal.

Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 41 **In class tests** 4 **Tutorial** 15 **Final Exam** 3	**63**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**4.2**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing** 12 **Preparation for tests** 13 **Homework** 12	**37**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**2.47**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**100**		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	20% (20)	3 and 10	LO #1, 2, 3, 4 ,5 and 7
	Assignments	4	10% (10)	5 and 11	LO #1, 2, 3, 4 ,5 and 7
	homework	4	10%(10)	4 and 12	LO #1, 2, 3, 4 ,5 and 7
Summative assessment	Midterm Exam	2 hr	10% (10)	8	LO #1 - #4
	Final Exam	3 hr	50 % (40)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Double integral, changing double integral from Cartesian to polar form
Week 2	Area using double integral, area using polar coordinates
Week 3	Moments and center of mass

Week 4	Triple integral, volume using triple integral
Week 5	Introduction, infinite series, geometric series
Week 6	Tests of infinite series (Integral test, comparison test, ratio test, root test)
Week 7	Alternating series, tests of alternating series
Week 8	**Midterm Exam**
Week 9	Taylor series, McLaurin series
Week 10	power series
Week 11	Taylor`s theorem with remainder
Week 12	introduction, types of matrix, matrix addition, subtraction and multiplication
Week 13	Determinant, Grammar's rule
Week 14	Inverse of matrix, solution of system of linear equations by matrix
Week 15	Eigen value and Eigen vector
Week 16	**Final Exam**

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	3. George B. Thomas and Ross L. Finney, "Calculus and Analytic Geometry, Addison- Wesley, ISBN:0201531747. 4. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley	Yes
Recommended Texts	George F. Simmons, "Calculus with Analytic Geometry", McGraw-Hill, ISBN: 0070576424	yes
Websites	https://www.geogebra.org/calculator https://www.desmos.com/calculator https://www.symbolab.com/solver/integral-calculator	

	Ministry of Higher Education and Scientific Research - Iraq University of Diyala College of Engineering Department of Chemical Engineering	

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information

معلومات المادة الدراسية

Module Title	Fluid Flow II	**Module Delivery**	
Module Type	Core	☒ **Theory** ☒ **Lecture** ☒ **Lab** ☐ **Practical** ☐ **Seminar**	
Module Code	CHE 208		
ECTS Credits	5		
SWL (hr/sem)	125		
Module Level	2	**Semester of Delivery**	2
Administering Department	Chemical engineering	**College**	College of Engineering
Module Leader	Walaa abid mahmood	**e-mail**	Whalaa_alkhaisi76@uodiyala.edu.iq
Module Leader's Acad. Title	Assistant Lecturer	**Module Leader's Qualification**	MSc.
Module Tutor		**e-mail**	
Peer Reviewer Name		**e-mail**	
Scientific Committee Approval Date		**Version Number**	1.0

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	• This semester is a continuation of the first semester, where the student understands the applications of the Bernoulli and Venturi equations in the

	operation of pumps • As well as learning about the types of Newtonian fluids and how to deal with them, and also learning about the devices for the flow meter. • Compressed fluids and their applications are also studied.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	• The student must be able to work with an integrated team and be able to use the skills he has acquired and apply them in the field of work. • The student should be able to apply Bernoulli's equation in his practical reality to control the flow under the conditions imposed on him • Student distinguish between Newtonians fluid and Non-Newtonians fluid • The student should distinguish between the different methods of dealing with fluids. Acquiring the skill of studying the types of flow by studying compressible and non-compressive fluids. •
Indicative Contents المحتويات الإرشادية	➢ Introducing the student to the basic properties of fluids and the phenomena related to them ➢ The nature and behavior of fluids at rest ➢ The nature of fluids in the state of flow of all types and the forces exchanged between them and the surfaces containing them ➢ Designing pipe connection systems, starting from the process of pumping with pumps and connecting to pipes and their connectors, to connecting to various places. ➢ Introducing the student to the basic principles of compressive flow to enable him to design nozzles and their types ➢ Familiarize the student with the basics of mixing fluids to enable him to know the properties of the mixture.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	• Daily discussion to determine the extent of students' understanding of the material and to evaluate the daily contributions. • Daily exams with various short scientific questions to understand the extent of their understanding of the material. • Giving part of each chapter's grade to homework assignments. • Daily exams (quizzes) and monthly exams for the curriculum and the final exam.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	**125**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**4**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	**121**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**5.4**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**125**		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	**2**	**10% (10)**	**7 and 9**	**LO #2 and #5**
	Assignments	**2**	**20% (20)**	**11 and 13**	**LO #4 and #5**
	Projects / Lab.	**1**	**10% (10)**		
	Report				
Summative assessment	**Midterm Exam**	**2 hr**	**10% (10)**	**7and 9**	**LO #1 - #3**
	Final Exam	**3 hr**	**50% (50)**	**16**	**All**
Total assessment			**100% (100 Marks)**		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Flow Measurement (Practical Application of Bernoulli's Equation) Pitot tubes, orifice meter,
Week 2	Venturi meter with its applications
Week 3	Nozzle meter, Rotameters other types of flow meters, Flow in open channels and weirs.
Week 4	Tutorial, Midterm one
Week 5	Pumping of Liquids Total heads, NPSH, Horse Power and cost consumption, Pumping Efficiencies,
Week 6	Types of the pumps, Selection of Pumps, Centrifugal pump relations, homologous centrifugal pump Characteristics curves, Centrifugal pumps in series and in parallel.
Week 7	Tutorial +Quiz
Week 8	Non-Newtonian Fluids in Pipes Definition, types of fluid depended on time,
Week 9	Calculation of friction and pressure drop for general time independent in laminar and turbulent flow. +Quiz
Week 10	Flow of Compressible Fluid General equation, equation of state, sonic velocity in fluids, , Converging-diverging nozzle for gas flow,.
Week 11	Isothermal, Non-isothermal and Adiabatic flow of an ideal gas in horizontal pipe
Week 12	Type of Compressor, Gas compression and compressors work and efficiency. Two Phase Flow, Flow regime, Pressure Momentum, and Energy relations
Week 13	Liquid Mixing Stirring and mixing, Stirred vessels (power consumption, power curve, scaledup), equipment. Motion of Particles in a Fluid Drag force on a particle, terminal falling velocities ,
Week 14	Sedimentation of fine and coarse Particles. Flow of Fluid through Granular Bed
Week 15	Midterm Exam.

Week 16	Preparatory week before the final Exam.

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Experiment #1: OSBORNE REYNOLDS' DEMONSTRATION
Week 2	EXPERIMENT #2: BERNOULLI'S THEOREM DEMONSTRATION
Week 3	Experiment #3: Orifice experiment
Week 4	Experiment #4 Venturi meter
Week 5	Daily Exam and discussion students
Week 6	E EXPERIMENT #5: ENERGY LOSS IN PIPE FITTINGS
Week 7	EXPERIMENT #6: HYDROSTATIC PRESSURE
Week 8	Preparing lab project
Week 9	Experiment #7:Calibration
Week 10	Experiment #8: IMPACT OF A JET
Week 11	EXPERIMENT #9: ENERGY LOSS IN PIPES
Week 12	Daily Exam and dissection students
Week 13	Experiment #10: FLOW OVER WEIRS
Week 14	EXPERIMENT #11: PUMPS
Week 15	lab. Projects.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	R. W. Fox and A. T. McDonald, "Introduction to fluid mechanics", 5th. Ed.,	Yes
Recommended Texts	John Wiley & Sons, 1998. 2. R. M. Holland, "Fluid Flow", John Wiley & Sons, 1982. W. L. McCabe, J. Smith and P. Harriot, "Unit Operations of Chemical Engineering", 6th Ed., McGraw – Hill, International Edition, 2001	yes
Websites	http://www.efluids.com	

Ministry of Higher Education and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	**Pollution and Industrial Safety**		**Module Delivery**	
Module Type	**Core**		**Theory** **Lecture** **Tutorial** **Practical** **Seminar**	
Module Code	CHE 209			
ECTS Credits	**5**			
SWL (hr/sem)	**125**			
Module Level	2	**Semester (s) offered**	2	
Administering Department	Chemical Engineering	**College**	Engineering	
Module Leader	Yaser I. Jasem	**e-mail**	Yaser_ij@uodiyala.edu.iq	
Module Leader's Acad. Title	Assist. Proff.	**Module Leader's Qualification**	MS.c.	
Module Tutor	None	**e-mail**		
Peer Reviewer Name	None	**e-mail**		
Review Committee Approval		**Version Number**	1.0	

Relation With Other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	**Semester**	-
Co-requisites module	None	**Semester**	-

Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر

Module Aims أهداف المادة الدراسية	a) Introducing pollutants in general, whether they are air, water, or solid pollutants, especially those resulting from various industries. b) Introducing the harms resulting from these pollutants and their negative impact on human life and the surrounding soil, air, water, and all living organisms.

	c) Thus, finding the best appropriate methods (taking into account Cost factor) to reduce these pollutants or reduce their impact through designing the necessary equipment to reduce these pollutants or through the correct management of various wastes in a way that ensures the best environment with the least amount of pollutants possible to preserve life. d) Introducing food fortification technology and fortification requirements. e) Ensuring the necessary protection for all production teams and reducing risk factors, especially with regard to the human factor. f) Reducing the incidence of occupational diseases such as poisoning and others. g) Reducing the possibility of injuries and accidents at work. h) Preventing and extinguishing fires and searching for preventive factors.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	At the end of this course the students will be able to: 1- Knowledge of environmental phenomena that have a global impact, such as global warming and the erosion of the ozone layer. 2- Knowing how to classify different pollutants, whether they are air, water, or solid materials. 3- Designing various equipment to reduce pollutants in all their forms. 4- Optimal management of solid waste, ensuring the reduction of waste of raw materials and reducing damage to the minimum possible extent. 5- Taking care of the environment of which we are a part and spreading environmental awareness. 6- Enables the student to ensure the safety of workers and the facility in the event of an accident or fire. 7- Reduce the factors causing accidents and achieve the highest level of safety A person in the establishment, 8- As well as limiting the consequences of fires as much as possible and minimizing losses.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Identifying global environmental phenomena, their effects and management. [4 hrs] • Types of Hazards. [6 hrs] • Air pollution, air pollution classification. [9 hrs] • The risks of pressure, heat, radiation, fire and explosion. [6 hrs] • Water and wastewater treatment. [9 hrs] • Working at heights and maintenance. [6 hrs] • Sold waste management. [4 hrs] • Management of drilling and cutting fluids for wells. [4 hrs]
Course Description	Identifying global environmental phenomena, their effects, and ways to reduce them and reduce their effects. Air pollution, air pollution classification, Gravitational settling chambers, Cyclone separators, Baghouses, Electrostatic precipitator, Wet scrubber and their calculations. Water and wastewater treatment, Primary and Secondary treatment. Tertiary treatment. Solid Waste Management. The safety training course trains the youth is various sectors such as construction, infrastructure, fire, industrial hazards, and various risk assessment safety measures. This provides a detailed overview and empowers the youth into a skilled individual helping them meet the demands of a career in the following field.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Begin to establish a strong conceptual understanding of the environmental issues and Safety training. Use the reality of work examples to help students relate

	abstract concepts to environmental issues. Encourage discussions and questions to clear up any misconceptions. In addition, provide students with the tool to deal with environmental issues and Safety problems. Encourage active participation and group discussions to enhance critical thinking and problem-solving skills. Guide students through the problem-solving process and provide constructive feedback.

Student Workload (SWL)
الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 38 **Tutorial** 2 **In class tests** 4 **Final Exam** 4	48	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing** 50 **Preparation for tests** 14 **Homework** 13	77	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5.1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	4	15% (15)	2, 5, 8 and 11	LO #1, 2, 3,7,8 and LO# 4,5,6,9,10
	Assignments	4	5% (5)	3, 6, 9 and 12	LO # 7, 8 and LO# 9,10
	Homework	2	20% (20)	Continuous	
Summative assessment	**Midterm Exam**	2	10% (10)	7	LO #1, 2, 3,4,7,8 and LO# 4,5,6,9,10
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Identifying global environmental phenomena, their effects, and ways to reduce them and reduce their effects.
Week 2&3	Air pollution, air pollution classification (primary, secondary and air borne particulate), Gravitational settling chambers.

Week 4	Air pollution, cyclones, wet scrubbers.
Week 5	Water and wastewater treatment, types of pollutant their sources and effect, primary treatment.
Week 6	Water and wastewater treatment, secondary treatment.
Week 7	Water and wastewater treatment, tertiary treatment.
Week 8	Solids waste management.
Week 9	**Types of Hazards** • Definitions of Hazards • Visible, Hidden and Developed Hazards with Examples • Hazard Awareness
Week 10	**Understanding Hazardous Energy** • Forms of Energy: Sources and Developments • How Energy Becomes Hazardous • Controlling Hazardous Energy: Procedures Personal Protective Equipment (PPE): Eye and Face Protection (Common Eye and Face Hazards), Head Protection (Hard Hats: Types and Quality), Foot and Leg Protection, Hand Protection, Body Protection, Hearing Protection (Permissible Noise Exposures), Respiratory Protective Equipment (RPE), and Fall Protection (Training and Requirements)
Week 11	**General Fire and Explosion Considerations** • Fire Triangle: Diagram • Elements of Fire: Energy, Oxygen and Fuel • Critical Risk Factors: Chemical and Physical Factors • Control for Elements of Fire: Energy, Oxygen and Fuel • Risk Assessment: Conditions, Level of Risk, and Procedures of Treatment Required • Fire and Explosion Prevention • Supervisor Roles: Training, Preparing Hazard ID and Controls, Reporting and Evaluating Unsafe Works • Worker Roles • Training Requirements • Fire Classes • Safety Measures • Types of Fire Tenders • Basic Precautions for Fire Prevention • Oil & Gas Well Drilling Risks • Hot Work, Fire, and Explosive Hazards: Possible Solutions
Week 12	**Pressure, Temperature and Radiation Hazards** • Examples of Pressure Hazards Includes • Using Compressed Air for Cleaning Tools • Temperature Hazards • Radiation Hazards: Types of Radiation • Norm in Oil Industry • Norm Regulations
Week 13	**Maintenance** • Definitions and Descriptions • Maintenance Hazards • Basic Rules for Safe Maintenance
Week 14	Working area and height hazard.
Week 15	**Health, Safety, Environment and Waste Management of Drilling Fluids**

Week 16	Final Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1. C.S.Rao , "Environmental Pollution Control Engineering", 2nd eddition , New Age International(P) Limited, Published, 2006, Reprint 2007. 2. M. Grawford, "Air Pollution Control Theory", McGraw-Hill, New York, 1976. 3. M. M. Gilbert, "Introduction To Environmental Engineering And Science ", 2nd edition, Hall, Inc, New Jersey, 1998. 4. Introduction to Industrial and Systems Engineering (Prentice-Hall International Series in Industrial and Systems) 2nd Edition by Wayne C. Turner (Author) 5. Prentice Hall International Series in Industrial & Systems Engineering: Systems Engineering and Analysis, Benjamin Blanchard	Yes
Recommended Texts	1. R. K. Sinnott, Chemical Engineering Design, Vol. 6. 4th edition, Chemical Engineering Design, 2005, pp. 450-457.	Yes
Websites		

Ministry of Higher Education and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Engineering Statistic**			**Module Delivery**	
Module Type	**Basic**			✓ **Theory** ✓ **Lecture** **Lab** ✓ **Tutorial** **Seminar**	
Module Code	**CHE 210**				
ECTS Credits	**3**				
SWL (hr/sem)	**75**				
Module Level	**2**		**Semester of Delivery**	**2**	
Administering Department	Chemical Engineering		**College**	Engineering	
Module Leader	Sura Fahmy Yousif		**e-mail**	Sura.fahmy@uodiyala.edu.iq	
Module Leader's Acad. Title	Assistant Prof.		**Module Leader's Qualification**	MSc	
Module Tutor	None		**e-mail**	-	
Peer Reviewer Name	None		**e-mail**	-	
Scientific Committee Approval Date			**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	-
Co-requisites module	None	**Semester**	-

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives	6. Giving the student an overview of the principles and concepts of statistics

أهداف المادة الدراسية	and probability. 7. Make the student able to represent data in the form of tables and graphics. 8. Teach the student to differentiate between quantitative and qualitative data and how they are represented. 9. Knowing the types of descriptive measures such as arithmetic mean, frequency, range, amount of change and standard deviation. 10. Knowledge of the principles of probability and its types and the laws of multiplication, addition and continuity in addition to the use of the laws of permutations and combinations in finding probability. 11. Make the student able to know the types of random variables. 12. Make the student able to know the probability distribution and types of discrete random variable. 13. Make the student able to know the probability distribution and types of continuous random variable. 14. Make the student able to know the difference between population proportion and sample proportion. 15. Teach the student the properties and conditions of central limit theorem.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	9. Enabling the student to differentiate between quantitative and qualitative data. 10. Enabling the student to differentiate between the methods of representing quantitative and qualitative data, whether in the form of tables or graphics. 11. Enabling the student of finding the types of descriptive metrics. 12. Enabling the student of finding the probability for each random variable. 13. Enabling the student of finding the types of distribution for the discrete and continuous random variables. 14. Enabling the student of finding the population proportion and sample proportion. 15. Enabling the student of finding the shape of the sampling distribution of the sample mean and the central limit theorem. 16. Enabling the student of knowing the methods of curve fitting and its applications.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: • Principles of statistics, quantitative and qualitative data (Types of quantitative and qualitative data and the way to represent them numerically and graphically) [7 hrs]. • Descriptive metrics (Descriptive measures such as mean, frequency, median value, amount of change, standard deviation, and range) [7]. • Probability (Introduction to probability and its types and the laws of multiplication and addition using Venn forms) [7]. • Permutations and combinations (Use permutations and combinations theorems to find probability values) [4]. • Types of probability distribution (Introduction to the types of probability distribution such as normal distribution, Poisson distribution, Binomial distribution, Standard distribution) [4]. • Central limit theorem and Curve fitting methods [4].
Course Description	This course provides students an idea of basic principles of statistic and probability, types of data, represent qualitative and quantitative data in tables

	and graphs, descriptive measures for grouped and ungrouped data, mean, median, mode, range, variance, standard deviation, percentiles, quartiles, deciles. Experiment, outcomes, sample space, types of events, tree diagram, types of probability, how to use permutations and combinations in probability problems. Types and probability distribution of discrete and continuous random variables. Sampling distribution of sample mean, sampling distribution of the population proportion, sampling distribution of the sample proportion, central limit theorem and ways of curve fitting.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	9. Explaining the theoretical lectures by subject teachers using modern teaching and presentation methods. 10. Explaining the philosophy of statistical laws and the purpose of their use. 11. Practical application of solving statistical problems using applied examples and solving them. 12. Encouraging students by collecting statistical data and preparing individual and group reports, as well as preparing presentations. 13. Encouraging students to contribute in discussions and questions to correct misconceptions. 14. Giving exercises that require analysis and conclusions related to subject lectures. 15. Proper assessment and evaluative feedback. 16. Summarizing and reviewing of lectures.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** **25** **In class tests** **5** **Final Exam** **3**	**33**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**2.2**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Libraray, dorm, home, memorize** **20** **Preparation for tests** **14** **Homework** **8**	**42**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**2.8**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**75**		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	4	20% (20)	3, 6, 9 and 12	LO #1, 2, 3, 4, 5, 7, 8, 9, 10 and 11
	Assignments	6	10% (10)	3, 5, 8, 11, 12 and 13	LO #1, 4, 10 and 11
	Report	1	10% (10)	13	LO #3, #4 and #6
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #8
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to statistics
Week 2	Types of quantitative data and the way to represent them numerically and graphically
Week 3	Types of qualitative data and the way to represent them numerically and graphically
Week 4	Descriptive measures such as mean, frequency, and median value
Week 5	Descriptive measures such as amount of change, standard deviation, and range
Week 6	Introduction to probability and its types
Week 7	Introduction to probability and its laws of multiplication and addition using Venn forms
Week 8	Permutations and combinations
Week 9	Use permutations and combinations theorems to find probability values
Week 10	Introduction to the types of probability distribution such as Binomial distribution
Week 11	Introduction to the types of probability distribution such Poisson distribution
Week 12	Introduction to the types of probability distribution such as uniform distribution
Week 13	Introduction to the types of probability distribution such as normal distribution
Week 14	Introduction to the types of probability distribution such as standard normal distribution
Week 15	central limit theorem and curve fitting methods
Week 16	Final Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Douglus C. Montgomery, G. C. Runger, Applied Statistics and Probability for Engineers, John Wiley and Sons, 2003.	Yes
Recommended Texts	P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Statistical Theory, Houghton Miffin, 1971.	Yes
Websites		

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note:				
NB Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.				

Ministry of Higher Education and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Computer Programming II**			**Module Delivery**	
Module Type	**Core**			**Theory** ✓ **Lecture** ✓ **Lab** **Tutorial** ✓ **Seminar**	
Module Code	**CHE 206**				
ECTS Credits	**4**				
SWL (hr/sem)	**100**				
Module Level	**2**		**Semester of Delivery**	**2**	
Administering Department	Chemical Engineering		**College**	Engineering	
Module Leader	Sura Fahmy Yousif		**e-mail**	Sura.fahmy@uodiyala.edu.iq	
Module Leader's Acad. Title	Assistant Prof.		**Module Leader's Qualification**	MSc	
Module Tutor	None		**e-mail**	-	
Peer Reviewer Name	None		**e-mail**	-	
Scientific Committee Approval Date			**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	-
Co-requisites module	None	**Semester**	-

Module Aims, Learning Outcomes and Indicative Contents
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	16. Teaching the student during the semester about Simulink in MATLAB program specifications, algorithm design and development, and testing using a modern software development environment. 17. Teaching the student how to design models in a high-level object-oriented programming language including algorithms, diagrams, problem solving, programming concepts, methods, control structures, arrays, and strings. 18. Providing the students with problem-solving skills and their application to solve computer problems using MATLAB Simulink models. 19. Developing the student's mind and enabling him to design any model in the MATLAB Simulink through the application of different programs in all fields. 20. Teaching the student about Python program specifications to solve challenging problems of chemical engineering applications. 21. Providing the students with modeling concepts and techniques from different disciplines to solve computer problems using Python language. 22. Teaching the student how to incorporate AI-based modeling with first-principles-based models using Python language. 23. Combine the traditional symbolic AI with the more recent data-driven AI using Python language. 24. Teaching the students how to incorporate AI-based modeling in combination with first-principles-based models derived from the understanding of the physics and chemistry (and biology) of our products, processes, and systems.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	17. Enabling the student to know the concepts of information technology by learning the basics of Simulink in MATLAB language. 18. Enabling the student to know MATLAB Simulink blocks and how to use each block inside the model. 19. Enabling the student how to use MATLAB Simulink language to design diagrams and models. 20. Enabling the student to think about the importance of the impact of the MATLAB Simulink language on the development of scientific research methods. 21. Enabling the student to know the concepts of information technology by learning the basics of Python programming language. 22. Enabling the student to solve particular problem in a scientific manner and present it clearly and correctly using Python programming language. 23. Enabling the student to think about the importance of programming using the Python language in facilitating contemporary life. 24. Enabling the student to think and follow the rapid development of the Python language.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: • A brief history importance of Simulink in MATLAB, explaining the Simulink in MATLAB language using simplified programs [4 hrs]. • Solving differential equations, derivative, integration, types of relational and logical operator's examples in MATLAB Simulink [8 hrs]. • Plot functions using applied examples in MATLAB Simulink [4 hrs]. • Arrays, matrices, and their arithmetic operations in MATLAB Simulink [8 hrs]. • A brief history importance of Python language including basic principles like variables, arithmetic operations, strings, conditional statements, recursive phrases, functions, database design, and graphical interfaces [14 hrs]. • Chemical engineering modeling approaches, knowledge representation, symbolic reasoning and inference, knowledge-based systems, and statistical data analysis [14 hrs]. • Machine learning methods such as clustering, neural networks, random forests, Bayesian networks, and directed evolution [12 hrs].
Course Description	This course provides students an idea of fundamental principles and applications of designing using MATLAB Simulink language. Types of blocks in MATLAB Simulink. Solving algebraic equations, evaluating polynomials, differentiation, limited integration, and unlimited integration in MATLAB Simulink. Relational and logical operators in MATLAB Simulink. Basic plotting including 2D and 3D drawing, adding titles, axis labels, annotations, specifying line styles and colors of the graph, subplots in MATLAB Simulink. Generation of arrays and matrices and their

	arithmetic operations, solving linear equations using matrices in MATLAB Simulink language. Also, this course provides students an idea of fundamental principles and applications of Python language. Types of variables, numbers, arithmetic operations, strings, arrays, data objects, conditional statements, recursive phrases, Built-in functions, basic math functions, trigonometric functions, polynomials, database design, and graphical interfaces. For and while loops, visual studio code, subplots, write data to a file, read data from a file, and logging data to file. Chemical engineering applications, modeling approaches, machine learning methods, clustering, neural networks, random forests, and directed evolution in Python language.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	17. The teacher prepares lectures on the subject in paper and electronic form and presents them to the students. 18. The teacher explains the theoretical and practical lectures using modern teaching and presentation methods. 19. The teacher explains lectures in detail. 20. The teacher requests periodic reports and homework assignments on the basic topics of the subject. 21. The teacher encourages students to participate in discussions to clear up any misconceptions. 22. The teacher asks questions and gives exercises that require analysis and conclusions related to lectures. 23. The teacher uses different examples to connect the theoretical and practical sides. 24. The teacher encourages students to do the practical part and work in groups.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** **13** **In class tests** **4** **Lab** **43** **Final Exam** **4**	**64**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**4.2**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Libraray, dorm, home, memorize** **14** **Preparation for tests** **14** **Homework** **8**	**36**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**2.4**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**100**		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	4	10% (10)	3, 6, 9 and 12	LO #1, 2, 3, 4, 5, 7, 8, 9, 10 and 11
	Assignments	6	10% (10)	3, 5, 8, 11, 12 and 13	LO #1, 4, 10 and 11
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #3, #4 and #6
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #8
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	A brief history importance of Simulink in MATLAB, types of blocks in MATLAB Simulink
Week 2	Explaining the Simulink in MATLAB language using simplified programs
Week 3	Solve algebraic equations, evaluate polynomials in MATLAB Simulink
Week 4	Solve differentiation, limited integration, unlimited integration, relational and logical operators in MATLAB Simulink
Week 5	Plots 2D functions, plots 3D functions using applied examples, adding titles, axis labels, annotations, specifying line styles and colors of the graph, subplots in MATLAB Simulink
Week 6	Arrays, matrices and their arithmetic operations, solve linear equations using matrices in MATLAB Simulink
Week 7	A brief history importance of Python language including basic principles like variables, arithmetic operations, strings, conditional statements, recursive phrases, functions, database design, and graphical interfaces
Week 8	For and while loops, visual studio code, subplots, write data to a file, read data from a file, and logging data to file in Python language
Week 9	Chemical engineering modeling approaches, knowledge representation in Python language
Week 10	Symbolic reasoning and inference, knowledge-based systems in Python language
Week 11	Statistical data analysis, machine learning methods: clustering in Python language
Week 12	Machine learning methods: neural networks in Python language
Week 13	Machine learning methods: random forests in Python language
Week 14	Machine learning methods: Bayesian networks in Python language
Week 15	Machine learning methods: directed evolution in Python language
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	A brief history importance of Simulink in MATLAB, types of blocks in MATLAB Simulink
Week 2	Explaining the Simulink in MATLAB language using simplified programs
Week 3	Solve algebraic equations, evaluate polynomials in MATLAB Simulink
Week 4	Solve differentiation, limited integration, unlimited integration, relational and logical operators in MATLAB Simulink
Week 5	Plots 2D functions, plots 3D functions using applied examples, adding titles, axis labels, annotations, specifying line styles and colors of the graph, subplots in MATLAB Simulink
Week 6	Arrays, matrices and their arithmetic operations, solve linear equations using matrices in MATLAB Simulink
Week 7	A brief history importance of Python language including basic principles like variables, arithmetic operations, strings, conditional statements, recursive phrases, functions, database design, and graphical interfaces
Week 8	For and while loops, visual studio code, subplots, write data to a file, read data from a file, and logging data to file in Python language
Week 9	Chemical engineering modeling approaches, knowledge representation in Python language
Week10	Symbolic reasoning and inference, knowledge-based systems in Python language
Week11	Statistical data analysis, machine learning methods: clustering in Python language
Week12	Machine learning methods: neural networks in Python language
Week13	Machine learning methods: random forests in Python language
Week14	Machine learning methods: Bayesian networks in Python language
Week15	Machine learning methods: directed evolution in Python language

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	• Chemical Engineering Computation with MATLAB®, 1st Edition, and Professor Yeong Koo Yeo teaches chemical engineering at the College of Engineering of Hanyang University, Seoul, South Korea. • Essential MATLAB for Engineers and Scientists, Fourth Edition, Brian H. Hahn, Daniel T. Valentine. • Essential MATLAB for Engineers and Scientists, Fifth Edition, Brian H. Hahn, Daniel T. Valentine. • Venkatasubramanian, V., Artificial Intelligence in Process Engineering: Experiences from a Graduate Course. Chem. Eng. Educ., Fall Issue, 188–192, 1986. • Venkatasubramanian, V., The promise of artificial intelligence in chemical engineering: Is it here, finally?. AIChE J., 65: 466-478, 2019.	-
Recommended Texts	All solid scientific magazines and periodicals related to programming in the MATLAB Simulink and Python languages.	-
Websites	3. http://www.cprogramming.com/ 4. http://www.mathworks.com/	

Ministry of Higher Education and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	**Materials Engineering**	**Module Delivery**	
Module Type	**Core**	**Theory** **Lecture** **Lab** **Tutorial** **Seminar**	
Module Code	**CHE 212**		
ECTS Credits	**5**		
SWL (hr/sem)	**125**		
Module Level	2	**Semester of Delivery**	2
Administering Department	Chemical Engineering	**College**	Engineering
Module Leader	Khalid Al Dolaimy	**e-mail**	khalideng@uodiyala.edu.iq
Module Leader's Acad. Title	Lecturer	**Module Leader's Qualification**	MSc
Module Tutor	None	**e-mail**	
Peer Reviewer Name	None	**e-mail**	
Scientific Committee Approval Date		**Version Number**	1.0

Relation with other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	This course aims to teach the students to learn and recognize the engineering materials and its properties. The student learns an idea about the followings; 1. Learn and understand Structure of materials-Various types of bonds, Crystalline Structure of Solids- concepts of unit cell and space lattice, and packing factor

	2. Learn and understand the X-ray diffraction for determining crystal structure; 3. Learn and understand Mechanical properties: Strength, hardness, toughness, ductility, brittleness of Engineering Materials; Elastic, an-elastic and visco-elastic behavior of materials; 4. Learn and understand the Inorganic & organic amorphous materials and their structural & property characteristics; 5. Learn and understand Optical fibers. 6. Learn and understand Crystals structure, phase diagrams, 7. Learn about copper, aluminum and iron alloys, 8. Learn and understand the plastic materials and polymers, properties and uses of poly ethylene, 9. Learn and understand the Classification of materials and properties, metallurgical aspects of materials, Significance of microstructural features, 10. Learn and understand the effect of cooling and heating rates and ageing materials for mechanical load bearing applications, 11. Learn and understand the corrosion resistant materials, 12 Learn about the Electrical, Electronic, Optical & Optoelectronic, civil, biomedical material and its applications.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1.Understanding and teaching students the concepts of Materials Engineering. 2.Enabling students to obtain knowledge and understanding about the properties of the materials and its applications.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: • The Structure of materials-Various types of bonds [3 hrs] • Crystalline Structure of Solids- concepts of unit cell [3 hrs] • Space lattice and packing factor and X-ray diffraction for determining crystal structure [3 hrs] • Mechanical properties: Strength, hardness, toughness, ductility, brittleness of Engineering Materials; Elastic, an-elastic and visco-elastic behavior of materials [3 hrs] • Crystals structure and phase diagrams [3 hrs] • Metallurgical aspects of materials and significance of microstructural features [3 hrs] • Classification of materials and properties [3 hrs] • Copper, aluminum and iron alloys [3 hrs] • Effect of cooling and heating rates and ageing materials for mechanical load bearing applications [3 hrs] • Plastic materials and polymers, properties and uses of poly ethylene • Ceramic materials [3 hrs] • Optical fibers, optical & optoelectronic properties of material • Inorganic & organic amorphous materials and their structural & property characteristics [3 hrs] • Civil, biomedical material and its applications [3 hrs] • Corrosion resistant, electrical and electronic, materials and its applications [3 hrs]
Course Description	This course provides students an idea about the engineering materials, its properties and applications.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1. Explain of Materials Engineering and topics by subject specialists. 2. Present the topics which are related to Materials Engineering properties. 3. Present the calculation of equilibrium diagram.

	4. Explain and clarify some applications of the engineering materials.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** **45** **Tutorial** **15** **Lab** **30** **Final Exam** **4**	94	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل الحمل الدراسي غير المنتظم للطالب خلال الفصل **Libraray, dorm, home, memorize** **11** **Preparation for tests** **10** **Homework** **10**	31	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**125**		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	2, 5, 9 and 12	LO #1-14
	Assignments	2	10% (10)	3, 6, 10 and 13	LO # 1-14
	Projects / Lab.	1	10% (10)	Continuous	All
	Seminars	1	10% (10)	14	LO # 1 – 14
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - 7
	Final Exam	4hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Structure of materials-Various types of bonds
Week 2	Crystalline Structure of Solids- concepts of unit cell
Week 3	Space lattice and packing factor and X-ray diffraction for determining crystal structure

Week 4	Mechanical properties: Strength, hardness, toughness, ductility, brittleness of Engineering Materials; Elastic, an-elastic and visco-elastic behavior of materials
Week5	Crystals structure and phase diagrams
Week 6	Metallurgical aspects of materials and significance of microstructural features,
Week 7	Mid-term Exam, Classification of materials and properties
Week 8	Copper, aluminum and iron alloys
Week 9	Effect of cooling and heating rates and ageing materials for mechanical load bearing applications
Week 10	Plastic materials and polymers, properties and uses of poly ethylene
Week 11	Ceramic materials
Week 12	Optical fibers, optical & optoelectronic properties of material
Week 13	Inorganic & organic amorphous materials and their structural & property characteristics
Week 14	Civil, biomedical material and its applications.
Week 15	Corrosion resistant, electrical and electronic, materials and its applications
Week 16	Final Exam
Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Experiment of preparing a specimen to examine the microscopic structure of the metal
Week 2	Lab 2: Experiment of preparing a specimen to examine the microscopic structure of the metal
Week 3	Lab 3: Experiment of preparing a specimen to examine the microscopic structure of the metal
Week 4	Lab 4: Experiment of preparing Microscopy sample support
Week 5	Lab 5: Experiment of preparing Microscopy sample support
Week 6	Lab 6: Experiment of preparing Microscopy sample support
Week 7	Lab 7: Mid-term Exam
Week 8	Lab 8: Hardness test experiment
Week 9	Lab 9: Hardness test experiment
Week 10	Lab 10: Hardness test experiment
Week 11	Lab 11: Tensile test for metals experiment
Week 12	Lab 12: Tensile test for metals experiment
Week 13	Lab 13: Compression test for metals experiment
Week 14	Lab 14: Compression test for metals experiment
Week 15	Lab 15: Final test

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	w.Bolton "Engineering Material Technology" 3ed Butterwoth-Heinemann, Oxford (1998)	Yes
Recommended Boxs	Brian S. Mitchell An Introduction To Material Engineering and Science For Chemical and Materials Engineers A. John Wiley & Sons Inc. Publication	Yes
Websites	http://www.kutub.info/library	

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note:				

NB Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Higher Education and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	English Language 2			**Module Delivery**	
Module Type	Basic learning activities			☒**Theory** ☐**Lecture** ☐**Lab** ☐**Tutorial** ☐**Practical** ☐**Seminar**	
Module Code	UD21				
ECTS Credits	**2**				
SWL (hr/sem)	**50**				
Module Level		UGII	**Semester of Delivery**		
Administering Department		All	**College**	All	
Module Leader			**e-mail**		
Module Leader's Acad. Title			**Module Leader's Qualification**		
Module Tutor	Name(if available)		**e-mail**	E-mail	
Peer Reviewer Name		Name	**e-mail**	E-mail	
Scientific Committee Approval Date		3/11/2024	**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	The module aims at enabling students to learn and understand the written and spoken form of English. It also aims at teaching functional English to learners and honing their reading, writing and listening skills>
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Read and understand simple texts in English. 2. Answer simple comprehension questions and match sentences about texts. 3. Reconstruct texts by reordering sentences. 4. Understand the main idea of a text. 5. Identify specific information in a text. Writing and paraphrasing paragraphs.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. i) Grammar has a core place in language teaching and learning. ii) A wide variety of practice tasks in all the four skills are essential to language learning. iii) Everyday expressions, particularly of spoken English, also need a place in the syllabus. These can be functional, social, situational or idiomatic.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Headway's trusted methodology combines solid grammar and practice, vocabulary development, and integrated skills with communicative role-plays and personalization. Authentic material from a variety of sources enables students to see new language in context, and a range of comprehension tasks, language and vocabulary exercises, and extension activities practice the four skills. 'Everyday English' and 'Spoken grammar' sections practice real-world speaking skills, and a writing section for each unit at the back of the book provides models for students to analyze and imitate.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	33	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	2.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	17	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	1.1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**50**		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	20% (5)	3 , 6,8,11	LO #1...#3, #4...#6, #7&#8, #9... #11
	Assignments	2	10% (5)	5 and 12	LO #3, #4 and #6, #7
	Projects /				
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	Midterm Exam	1hr	10% (10)	7	LO #1 - #7
	Final Exam	2hr	50% (50)	15	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Course Introduction (Course material and objectives, learning outcomes, lessons and assessment discussed with the learners).
Week 2	**Unit 1. Getting to know you** **Reading:** People, the great communicators' - the many ways we communicate **Listening**: Neighbours - Steve and Mrs Snell talk about each other as neighbours **Speaking**: Information gap - Joy Darling **Writing**: Informal letters - A letter to a pen friend **Gramma**r: Tenses: present, past and future
Week 3	**Unit 2. The way we live** **Reading:** 'Living in the USA' - three people talk about their experiences **Listening**: You drive me mad (but I love you)!' - what annoys you about the people in your life? **Speaking**: Information gap - people's Lifestyles. Exchanging information about immigrants to the USA **Writing**: Linking words, but, however. Describing a person **Gramma**r: Present tense , present continuous
Week 4	**Unit 3. It all went wrong** **Reading:** 'The burglars' friend'. Newspaper stories. A short story - 'The perfect crime **Listening**: A radio drama - 'The perfect crime **Speaking**: Information gap - Zoe's party. Telling stories **Writing**: Linking words: while, during, and for. Writing a story **Gramma**r: Past tenses: Past Simple and past continuous
Week 5	**Unit 4. Let's go shopping!** **Reading:** 'The best shopping street in the world' **Listening**: 'My uncle's a shopkeeper' , Buying things **Speaking**: Town survey - the good things and bad things about living in your town, Discussion - attitudes to shopping p **Writing**: Filling in forms **Gramma**r: Quantity , Articles
Week 6	**Assessment Test 1. Feedback and Remedial Work**

Week 7	**Unit 5. What do you want to do?** **Reading:** 'Hollywood kids - growing up in Los Angeles ain't easy **Listening:** A song - You've got a friend **Speaking:** What are your plans and ambitions? Being a teenager **Writing:** Writing a postcard **Grammar:** Verb patterns 1, future intentions
Week 8	**Unit 6. Tell me! What's it like?** **Reading:** A tale of two millionaires' - one was mean and one was generous **Listening:** Living in another country — an interview with a girl who went to live in Sweden **Speaking:** Information gap – comparing cities **Writing:** Relative clauses 1 who/that/which/where. Describing a place **Grammar:** Comparative and superlative adjectives big, bigger, biggest, good, better, best
Week 9	**Unit 7. Famous couples** **Reading:** Celebrity interview from Hi! Magazine with the pop star and the footballer who are in love **Listening**: An interview with the band Style **Speaking:** Mingle - Find someone who ... Role play - interviewing a band **Writing:** Relative clauses 2 who/ which/ that as the object. Writing a biography **Grammar:** Present Perfect and Past Simple
Week 10	**Unit 8. Do's and don'ts** **Reading:** Problems and suggestions **Listening:** Holidays in January - three people's advice on what to do in their country in January **Speaking:** Jobs - a game. Discussion - house rules, Asking questions about place **Writing:** Writing letters- Formal letters **Grammar:** have (got) to, should, must
Week 11	**Assessment Test 2. Feedback and Remedial Work**
Week 12	**Unit 9. Going places** **Reading:** The world's first megalopolis - a city of 40 million people **Listening:** Life in 2050 - an interview with Michio Kaku, Professor of Theoretical Physics **Speaking:** What will you do? Discussion - what will life be like in the 21st century? **Writing:** Linking words 2, Advantages and disadvantages **Grammar:** Time and conditional clauses
Week 13	**Unit 10. Scared to death** **Reading:** 'Don't look down' - walking on a dangerous footpath, 'Into the wild' **Listening:** When I was young p80 It was just a joke - a boy called Jamie kidnapped his friend **Speaking:** 'When I was young' - talking about your childhood **Writing:** Writing letters Formal and informal letters 1 **Grammar:** Verb patterns 2 manage to do, used to do, go walking, Infinitives, Purpose
Week 14	**Unit 11. Things that changed the world** **Reading:** Three plants that changed the world - tobacco, sugar and cotton **Listening:** The world's most common habit: chewing gum **Speaking:** Exchanging information about three plants **Writing:** Writing a review of a book or film **Grammar:** Passive
Week 15	**Unit 12. Dreams and reality** **Reading:** The vicar who's a ghostbuster **Listening:** An interview with a woman who heard voices **Speaking:** Giving advice - If I were you, I'd….. **Writing:** Writing letters Expressions in different kinds of letters **Grammar:** Second conditional

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	New Headway Pre-Intermediate by:John and Liz Soars. Oxford University Press	Yes
Recommended Texts	None	
Websites	https://apoyanblog.wordpress.com/wp-content/uploads/2016/09/new-headway-pre-intermediate-students-book.pdf	

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note:

NB Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**اللغة العربية 2**			**Module Delivery**	
Module Type	**Basic learning activities**			☒**Theory** ☐**Lecture** ☐**Lab** ☐**Tutorial** ☐**Practical** ☐**Seminar**	
Module Code	**UD22**				
ECTS Credits	**2**				
SWL (hr/sem)	**50**				
Module Level	UGII		**Semester of Delivery**		
Administering Department	All		**College**	All	
Module Leader			**e-mail**		
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Name(if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	3/11/2024		**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	الهدف الأساس في تدريس اللغة العربية للأقسام العلمية : • اخذ الطالب الى روعة بيان القران الكريم ، وادراكه يقينا ان التعبير القراني تعبير فني مقصود ، كل لفظة ، وكل حرف وضع وضعا فنياً مقصوداً • تقويم اللسان العربي . واعتماد العربية الفصحى في الحديث والكتابة ، ولزيادة رصيد الطالب من ادب وتراث ، على تناول النصوص المختارة من العصور الأدبية المختلفة ، لزيادة رصيد ادب لتراث والادب المعاصر . • التأكيد على دور الطالب في المتابعة واثراء المعرفة باللغة العربية وفنونها بجهد خاص ، ذا ما وضعنا مفاتيح المنهاج الدراسي لتقع على الطالب بعد ذلك مهمة فتح الأبواب والنوافذ الى مصادر المعرفة الواسعة . في جعل العربية الفصيحة تحتل موضع الصدارة وتجاوز العامية ، خدمة الى لغتنا العربية المقدسة. وحفاظا على قوتها وجمالها . • ومن نافلة القول في اهداف تدريس اللغة العربية : هي الجانب المحقق للوحدة وتلزمنا دوافع الوفاء بالحرص عليها والمحافظة على جوهرها .
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	يمكن ايجاز مخرجات العلم لمادة اللغة العربية العامة لاقسام غير الاختصاص بالنسبة لمرحلة الدراسة الأولى بالاتي :- * علمه اليقين بان القران الكريم قد اعطى للغة قيمة عليا ، ومنزلة رفيعة . واجبه الحفاظ عليها وصيانتها من اللحن والخطا ، ومن كل ما يشوبها . * تمكين الطالب من قراءة النص القراني بنفسه وتمكنه من معرفة ما في الايات الكريمة من امور لغوية وبلاغية ومعنوية ، وتمكنه من فحصها فحصاً دقيقاً . * سيتمكن الطالب من معرفة ما في لغته العربية من دقة في التعبير واحكام في الفن والعلو في الصنعة . * إظهار القواعد العلمية ، والأسس الفنية ، التي يقوم عليها العمل الأدبي في جزئياته وكلياته . لبيان الروح الجمالية والإبداعية التي تتجلى في النص الأدبي. * فهم طبيعة اللغة من حيث اعرابها (علم النحو) ، من الفعل والفاعل الذي يقع عليه فعل الفاعل ، والحال والتمييز والاوجه الاعرابية لما بعد التمييز . * تمكين الطالب من التفريق بين الافعال الثلاثية والرباعية والخماسية ، وتمكينه من التمييز بين الافعال ومصادر الافعال ، فالفعل : لفظ يدل على حدث الى جانب دلالته على الزمن ، مصدره لا يدل على زمنه أي زمن فعله. * التعريف بالمفهوم الزمني الفني : للحداثة والمعاصرة في الأدب ، وإعطاء صورة لتطور أدب وصولا إلى أدب العصر الحديث . * معرفة الطالب لمفهوم النثر العربي , وكيفية تطور النثر من القديم وكيفية تطور من القديم الى العصر الحديث من: المقالة والقصة والمسرحية ، ومعرفة اهم خصائصه الفنية ، وتطور المصطلح من النثر الى مفهوم السرد في العصر الحديث . * تعريف الطالب بمفهوم الشعر الحر او " شعر التفعيلة " ورواد مدرسة الشعر الحر ، نازك الملائكة وبدر شاكر السياب ، وكيف تفجرت حركة الشعر كلون من الوان الاحتجاج على الواقع الفني العربي .
Indicative Contents المحتويات الإرشادية	1- الاهتمام بالكلام ، ومحاولة التعمق في دراسة قواعده واصوله وتاريخه . 2- الاهتمام بقواعد اللغة تاصيلا وتقعيدا ، وتاريخ ادبها تسجيلا وتدوينا ، ونقد نصوصها تفسيرا وتاويلا .

3- الفهم الدقيق لاصوات اللغة العربية ، ومعرفة مخارج الاصوات ، ومعرفة مخرج كل صوت من اصوات العربية بطريقة مبسطة .وعلاقة الدال بالمدلول . 4- البحث في نشاة اللغة ، وعلاقتها بغيرها ، وخصائص اصواتها ، وابنية مفرداتها وتراكيبها . 5- البحث في عناصر لهجاتها وتطور دلالالتها ، والعوامل التي اثرت فيها ، والقوانين التي تحكم الصلة بين الفاظها . 6- الاهتمام بالكلام ومحاولة التعمق في دراسة قواعده واصوله وتاريخه . 7- - توليد القدرة على تذوق النصوص ، وفتح نافذة القدرة على التحليل والتاويل ، ومعرفة ما يريد ان يقوله النص الادبي . 8- دراسة اساسيات النحو العربي وقواعد الجملة العربية . 9- التعرف على تراكيب الجملة الفعلية والاسمية والمركبة .	

Learning and Teaching Strategies استراتيجيات التعلم و التعليم	
Strategies	ليحقق التدريسي اهداف ونواتج التعلم المستهدفة لا بد من تحقيق الاتي : ١_ التركيز على استراتيجيات تقود الى التعلم النشط ، والتأكيد على دور المتعلم واثارة اهتمامه ودفعه الى المشاركة الايجابية ٢_ الاكثار من النصوص العربية العالية ٣_ وان تعد بعض القطع للقراءة يمتزج فيها درس القواعد بدرس الادب؛ فان ذلك ادعى لتنمية ذوق الطالب في الفهم والحس والكلمات والاساليب واستعمالها . ٤_ منح التدريسي حرية اختيار قطع للقراءة من كتب الادب والنصوص ومن ادب المناسبات الذي ينشر في الصحف والمجلات ، لتصحيح النطق عند الطالب ، وتعويده على القراءة الصحيحة الخالية من اللحن . ٥_ تقع على عاتق التدريسي مهنة اساسية وهي التشويق والتقويم والتصويب في تدريسه اللغة_ العربية العامة لأقسام غير اختصاص . ٦_ تنشيط عنصر الاعتزاز باللغة العربية لدى طالب العلم وتأصيله والعمل على زرع محبته للغة العربية بوصفها اللغة الام لغة القران الكريم لغة الاعجاز والبيان . من خلال عرضه لقصص تراثية تتعلق بحرص العربي على لغته والاعتزاز بها .

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1- التعبير ألقراني – الدكتور : فاضل السامرئي 2- شرح ابن عقيل على الفية ابن مالك – لابن عقيل 3- علم اساليب البيان – غازي يموت. 4- اللغة العربية لاقسام غير الاختصاص مجموعة من اساتذة اللغة العربية .	
Recommended Texts		
Websites		

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note:

NB Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

YEAR 3
(SEMESTER 1)

	Ministry of Higher Education and Scientific Research - Iraq University of Diyala College of Engineering Department of Chemical Engineering	

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Polymer technology**			**Module Delivery**	
Module Type	**elective**			☒**Theory** ☒**Lecture** ☐**Lab** ☐**Practical** ☐**Seminar**	
Module Code	**CHE 313**				
ECTS Credits	**4**				
SWL (hr/sem)	**100**				
Module Level	3		**Semester of Delivery**	6	
Administering Department	Chemical Engineering		**College**	College of Engineering	
Module Leader	Mohanad Ali Sultan		**e-mail**	maalazzawi85@uodiyala.edu.iq	
Module Leader's Acad. Title	Master		**Module Leader's Qualification**		
Module Tutor	None		**e-mail**		
Peer Reviewer Name	None		**e-mail**		
Scientific Committee Approval Date			**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	A historical overview of polymers and their development stages. Naming polymers and sources of polymers. Methods of preparing polymers and polymerization mechanisms. The conditions of the polymerization process and what is the difference between addition polymerization and condensation polymerization. The molecular weight of polymers and methods for its determination. The technology of polymer manufacturing and some types of plastics, as well as knowledge of the types of reactors used.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Students who successfully finish this course will be eligible to: 1. Understand the fundamental concepts of polymer science, including polymerization mechanisms, polymer structure, and classification of polymers. 2. Identify and describe various polymerization techniques such as bulk, solution, suspension, and emulsion polymerization, and analyze the kinetics of polymerization reactions. 3. Determine the molecular weight and molecular weight distribution of polymers and understand their effect on physical and mechanical properties. 4. Analyze the thermal and mechanical behavior of polymers using techniques like DSC, TGA, and DMA, and interpret their implications for polymer processing and applications. 5. Compute and evaluate the rheological properties of polymer melts and solutions and understand their significance in extrusion, molding, and film formation. 6. Explain polymer degradation mechanisms and stabilization methods, including thermal, oxidative, and UV degradation processes. 7. Understand the role of additives in polymer compounding and their impact on the final properties of plastic materials. 8. Select appropriate processing techniques for different polymeric materials

	based on their structure-property relationships and end-use requirements.
Description of course	This course will focus on the fundamental principles of polymer science and engineering. The types of polymerization processes; step-growth and chain-growth mechanisms involved in polymer production will be outlined and the governing reaction kinetics derived. This course provides the fundamentals of polymer synthesis, characterization, and classification. This course covers details on the structure-property relationships and the influence of molecular weight on polymer behavior. Also, focus on polymer thermal, mechanical, and rheological properties with emphasis on their role in processing techniques such as extrusion, molding, and fiber spinning. Also, this course focuses on the fundamental aspects of polymer additives and degradation mechanisms.
Indicative Contents المحتويات الارشادية	The following is indicative content: 1. Basic principles of polymer science, classification of polymers, structure-property relationships, and overview of natural and synthetic polymers. (6 hours) 2. Polymerization techniques: step-growth and chain-growth polymerization, including bulk, solution, suspension, and emulsion methods. (10 hours) 3. Kinetics of polymerization reactions and molecular weight determination: number-average and weight-average molecular weights and polydispersity index. (6 hours) 4. Characterization techniques: thermal analysis (DSC, TGA), spectroscopy (FTIR, NMR), and mechanical testing of polymers. (6 hours) 5. Rheological behavior of polymers in melt and solution forms and their significance in polymer processing. (6 hours) 6. Polymer processing methods: extrusion, injection molding, blow molding, film casting, and fiber spinning. (8 hours) 7. Polymer additives: plasticizers, stabilizers, fillers, flame retardants, and their impact on material properties. (4 hours) 8. Polymer degradation mechanisms: thermal, oxidative, UV, and biological degradation and stabilization techniques. (4 hours)

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, homework's and examples. Practical examples help students to understand the course material.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 34 **In class tests** 3 **Tutorial** 12 **Final Exam** 3	**52**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**5.3**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **home, memorize, paper** 20 **Preparation for tests** 10 **Homework** 18	**48**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**7.7**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**100**		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	16% (16)	3, 7, 11 and 14	LO #3, LO #4, LO #6 and LO #8
	Assignments	2	4%(4)	5 and 12	LO #3 and #10
	Homework	2	10%(10)	6 and 13	LO #4 and #8
	Report	1	10%(10)	14	Lo#8
Summative assessment	Midterm Exam	2 hr	10% (10)	8	LO #1 - #7
	Final Exam	3 hr	50 % (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction to polymer science, classification of polymers, and overview of polymer applications.
Week 2	Fundamentals of polymer structure, molecular weight concepts, and chain configurations.
Week 3	Step-growth and chain-growth polymerization mechanisms.
Week 4	Bulk and solution polymerization: principles, advantages, and limitations.
Week 5	suspension and emulsion polymerization: process overview and industrial relevance.
Week 6	Kinetics of polymerization and calculation of molecular weight averages.
Week 7	Thermal characterization techniques: DSC and TGA.
Week 8	Midterm One
Week 9	Mechanical and spectroscopic characterization: tensile testing, FTIR, and NMR.

Week 10	Tutorial and problem solving in polymer analysis and structure-property relationships.
Week 11	**Rheological behavior of polymers and its influence on processing.**
Week 12	Polymer processing techniques: extrusion, injection molding, blow molding.
Week 13	Advanced processing methods: film casting, fiber spinning, and thermoforming.
Week 14	Polymer additives: plasticizers, fillers, and stabilizers.
Week 1	Degradation of polymers and stabilization methods (thermal, UV, oxidative).
Week 16	Final Exam

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Tim A.Osswald, material science of polymers for engineers, Osswald, menges	online
Recommended Texts	Robert O.Ebewele , polymer science technology Ebewele R., 2000. 2-Mustaf Akay.introduction to polymer science and technology, Akay M, 2012	online
Websites		

Ministry of Higher Education and
Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Corrosion Engineering**			**Module Delivery**	
Module Type	CORE			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Practical** ☐ **Seminar**	
Module Code	CHE -312				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	3		**Semester (s) offered**	6	
Administering Department	Chemical Engineering		**College**	Engineering	
Module Leader	Asst. prof. Dr. Adiba A. Mahmmod		**e-mail**	alnuimiadiba@uodiyala.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	PHD.	
Module Tutor	None		**e-mail**		
Peer Reviewer Name	None		**e-mail**		
Review Committee Approval			**Version Number**		

<table>
<tr><th colspan="4">Relation With Other Modules
العلاقة مع المواد الدراسية الأخرى</th></tr>
<tr><td>Prerequisite module</td><td>Corrosion Engineering</td><td>Semester</td><td>2</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><th colspan="4">Module Aims, Learning Outcomes, Indicative Contents and Brief Description
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشاديةمع وصف مختصر</th></tr>
<tr><td>Module Aims
أهداف المادة الدراسية</td><td colspan="3">The main objective of studying engineering corrosion is to develop students' understanding of the fundamentals of corrosion science, distinguish between chemical corrosion and electrochemical corrosion, identify the harmful effects of corrosion and methods for preventing or reducing the corrosion process. Students will also gain knowledge of most methods for calculating the corrosion rate and determining the operational life of equipment.</td></tr>
<tr><td>Module Learning Outcomes
مخرجات التعلم للمادة الدراسية</td><td colspan="3">Knowledge and Understanding
Students who successfully complete this course will be qualified to gain knowledge in corrosion engineering science and its practical applications, including methods for reducing corrosion:
1. Enabling students to gain knowledge in the concept of corrosion and the distinction between chemical and electrochemical corrosion.
2. Enabling students to gain knowledge about the damage caused by corrosion and types of cells, including dry cells.
3. Enable the student to obtain knowledge in the processes of using inhibitors as organic , inorganic & green .
4. Enable the student to obtain knowledge in the concept of Gibbs free energy & reference electrodes.
5. To enable students to gain knowledge on how to calculate weight loss and polarization and then provide a detailed explanation of each method separately.
6. Enabling students to gain knowledge of the Impedance method, and Tafel diagram.
7. Enable the student to obtain knowledge in the process of Cathodic protection in all detail .
8. Enabling students to the study effect of temperature , inhibitor concentration & dissolved oxygen on corrosion process .
9. To enable students to gain knowledge of the fuel cells description .
10. Enabling students to obtain knowledge of the electroplating process & Operations Management .</td></tr>
<tr><td>Course Description</td><td colspan="3">Giving the student an overview of the principles and concepts of corrosion</td></tr>
</table>

	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.
Indicative Contents المحتويات الإرشادية	➢ Definition of corrosion , corrosion damage and corrosion cells (**8 hour**) ➢ Anode & Cathode , control processes on corrosion & Examples in addition of reference electrode (**6 hour**) ➢ Gibbs free energy , Nernst equation (**5 hour**) ➢ Corrosion potential , polarization definition (**4 hour**) ➢ Polarization type , Corrosion rates & methods of measuring corrosion rates (**6 hour**) ➢ Learn about the concept of effect of temperature on corrosion rate (**4 hour**) ➢ Effect of immersion time in corrosive media on metal corrosion (**2 hour**) ➢ Effect of concentration of inhibitor on corrosion rate (**3 hour**) ➢ Cathodic protection & effect of oxygen dissolved (**4 hour**) Introduction Fuel cell & Electroplating (**3 hour**)
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	• Daily discussion to determine the extent of students' understanding of the material and to evaluate the daily contributions. • Daily exams with various short scientific questions to understand the extent of their understanding of the material. • Giving part of each chapter's grade to homework assignments. • Daily exams (quizzes) and monthly exams for the curriculum and the final exam .

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** **30** **In class tests** \	48	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4

Tutorial 15 **Final Exam 3**			
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing 10** **Preparation for tests10** **Homework 17**	52	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation
تقييم المادة الدراسية

		Time/ Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	4	16% (16)	2,4, 9 and 13	LO #1, 2, 6, and 10
	Report	1	10% (10)	5	LO # 6
	Home work	2	10% (10)	14	LO # 8
	Class work	2	4% (4)	5 and 10	LO # 7 and 9
Summative assessment	**Midterm Exam**	1	10% (10)	7	LO # 1-6
	Final Exam	1	50% (50)	16	All
Total assessment			100% (100Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Basic principles of Definition of corrosion , corrosion cells and corrosion damage .
Week 2	Description of the Anode & Cathode and . control processes on corrosion in addition Examples
Week 3	Fundamentals of the Corrosion Dynamic , Gibbs Free Energy & Nernst Equation
Week 4	Describe the concept of Corrosion Potential & Examples
Week 5	Description of the Polarization definition & types
Week 6	Corrosion Rates & Methods of measuring corrosion rates
Week 7	Midterm one
Week 8	Fundamentals of the PASSIVITY & Introduction .Effect of temperature
Week 9	Describe the effect of inhibitor concentration & Examples

Week 10	Effect of immersion time in corrosive media on metal corrosion
Week 11	Fundamentals of the Cathodic protection
Week 12	Describe the effect of dissolved oxygen
Week 13	Corrosion in the oil industry and introduction Corrosion by H_2S & CO_2
Week 14	Describe the Electro plating process & Examples
Week 15	Introduction of Fuel cells & Examples of applications
Week 16	**Final Exam**

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	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	Yes
Recommended Texts	1. 1 Nathan, C.C., *Corrosion Inhibitors*, NACE (1973). 2. West, J.M., *Electrodeposition and Corrosion Processes*, V.N.R. Co. (1971).	No
Websites	http://www.corrosion-doctors.org/	

Ministry of Higher Education
and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Engineering Analysis**			**Module Delivery**	
Module Type	**Core**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Practical** ☐ **Seminar**	
Module Code	**CHE-301**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level	3		**Semester of Delivery**	5	
Administering Department	Chemical Engineering		**College**	College of Engineering	
Module Leader	Dr. Mohammed F. Mohammed AL-Kharkhi		**e-mail**	muhammed_faiq_eng@uodiyala.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor	None		**e-mail**		
Peer Reviewer Name	None		**e-mail**		
Scientific Committee Approval Date			**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	CHE 207	**Semester**	Five
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	The module's main objectives expose the following subjects in engineering analysis. The introduction and general review of differential equations lead students to learn how to solve them and how they are applied to find other subjects, such as modelling in chemical engineering. Solving of differential equations using power series: the Frobenius method and the Bessel equation is given as a modified learning. The module includes Taylor's and McLaurin series expansions. Then, students can know how the Fourier Series: Fourier Transforms - Complex form of the Fourier series - sine and cosine transformations are applied in the field of chemical engineering. Furthermore, students through this module learns what the Laplace transform is and how it can be applied in industries such as control systems to find transfer functions. As part of the module, the partial differential equations, including the difference equations: Wave equation, heat equation, Laplace's equation, 2D steady state heat flow equation, are explained, and how they are useful to solve the different complex study cases in the chemical engineering field. Also, students can know about the analytic function, what it is, and how it is used. Additionally, complex integration is explained to enhance the knowledge of students about mysteries and the ways of thinking about and solving them. Besides the previous subjects, mathematical modelling can enable students to be able to design and implement processes digitally before use in the industries. Finally, functions of definite integrals: Error, Gamma, and Beta functions are useful to make students to use them in the steps of solutions for other subjects when they are needed.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Students who successfully finish this course will be eligible to: 1. Be aware of the mathematical background for the different applied methods introduced in the course. 2. Explain and derive the different methods to solve the algebraic equations and to solve system of linear and nonlinear equations. 3. Analyze and solve the different methods for interpolation, differentiation, integration and solving set of ordinary and partial differential equations. 4. Describe how utilized methods afford a mean to generate solutions for simple and complex cases in the field of chemical engineering industries. 5. Use and find new strategies for solving problems, cases, and mysteries in different scientific fields as first steps. 6. Be able to gain the knowledge about the mathematical modelling and how it could be developed with advanced manner and how to connect between the reality of chemical engineering industries and their related theoretical. 7. Be able to know how the mathematics can manage the solution for continuous functions and discrete functions using their related methods

	(Laplace Transform, Fourier Transform, … etc.) with a gorgeous way that can be useful to solve mysterious cases in different sciences. 8. Be able to use his mind with a beautiful manner to thinking and analyzing about how to control industrial processes. 9. Applying the definitions or givens (Boundary conditions) to simplify the solutions then develops his skills to know how to write such conditions for different cases in his specialty when they are not given. Be able to authorize the mathematical expression for cases. 10. Briefly, the program provides opportunities for students to develop and demonstrate knowledge, understanding, qualities, skills and other characteristics in the following areas: A) Knowledge and understanding: Necessary facts, concepts, principles and theories of chemical engineering, and an understanding of the constraints facing the engineer in making the right decision. Basic mathematics, science and technology, management ideas and concepts. B) Cultural capabilities: Solving industrial problems that may be determined by known or unknown conditions. Analyze and discuss available data or conduct specific experiments to obtain more data. Design units and processes and make the necessary improvements. Ability to apply new technologies. Have a holistic view of industrial engineering problems and take into account cost and quality. C) Transferable skills: - Apply mathematical skills in practical problems. Control of time and resources. To be creative, especially in designs.
Description of course	This course will focus on demonstrating the mathematical methods for solving different problems with the style of mass transfer, heat transfer, and momentum or fluid flow. Furthermore, other industrial processes could be applied to solve their case studies. Each method has its own procedure in the solution of the aforementioned cases, with its evaluations of rightness and accuracy. This module describes the linearization methods. Followed by solving differential equations using various methods, such as the application of series methods for solving differential equations. Also, the principles of transform will be applied to solve the discrete and continuous functions using Laplace and Fourier Transforms. However, the partial differential equations, like heat, mass, wave, and electric equations, are solved. Modelling has its role in this module through the writing and solving of some chemical engineering models. Complexity has been involved to support the complex principles in the department's scientific fields. Such complexity is the application of complex integration in the solutions. Definite integrals and using their functions, such as error, Gamma, and Beta functions, will be applied.

Indicative Contents المحتويات الارشادية	1) Linear and nonlinear cases including the linearization methods. (3 hr) 2) Solving differential equations by different methods. (6 hr) 3) Apply the series methods in the solutions of differential equations. (6 hr) 4) Apply the principles of transform in the solution of discrete and continuous functions using Laplace and Fourier Transforms. (9 hr) 5) Solving partial differential equations such as heat, mass, wave, and electric equations. (6 hr) 6) Solving and writing the mathematical modelling. (3 hr) 7) Analyzing cases and solutions. (3 hr) 8) Using complex principles in the solution of complex cases. (3 hr) 9) Applying complex integration in the solutions. (3 hr) 10) Applying the definite integrals and using their functions such as error, Gama and Beta functions. (3 hr)

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy that will be adopted in delivering this module is to help students to participate in the exercises. Besides the theoretical lectures with the use of illustrations, they are able to develop their critical thinking skills. Also, the practical application of concepts taught theoretically can enhance such skills. All these points are achieved through solving problems, discuss them, and assign students some homework and reports during the class platform. Identifying the types of equipment and the differences between them will help students to understand the course materials.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 50 **Tutorial** 10 **Exam** 2 **Final Exam** 3	**63**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**4.2**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **home, memorize, paper** 32 **Preparation for tests** 15 **Homework** 15	**62**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**4.1**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**125**		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	15% (15)	4, 8, 12 and 13	LO #3, LO #6, LO #8 and LO #10
	Assignments	2	10% (10)	6 and 13	LO #6 and #14
	Classwork	1	5% (5)	5 and 11	LO #6 and #11
	Homework	3	10%(10)	6 and 13	LO #6 and #14
Summative assessment	Midterm Exam	2 hr	10% (10)	8	LO #1 - #7
	Final Exam	3 hr	50 % (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction and general review of differential equations. First order differential equation. Separation of variables. Homogeneous equation.
Week 2	Exact equations. Linear equations. Bernoulli equations.
Week 3	Second order differential equations. Non-Linear equations.
Week 4	Equations where the dependent variable (y) is missing. Equations where the independent variable (x) is missing. Homogeneous equations.
Week 5	Linear second order differential equation with constant coefficients. Complementary function. Unequal roots to auxiliary equation. Equal roots to auxiliary equation. Complex roots to auxiliary equation.
Week 6	Non- homogeneous function (Particular solution). The method of undetermined coefficients. The method of inverse operators: Properties and applications. The method of variation of parameters.

Week 7	Functions of definite integrals. Error function. Gamma function. Beta function.
Week 8	Power series The general power series form: Exponential series. Logarithmic series. Trigonometric series. Hyperbolic series. Taylor series and Maclaurin series. Analytic and non-analytic function.
Week 9	Frobineous method: Roots of indicial equation different, but not by an integer. Roots of indicial equation equal. Roots of indicial equation differing by an integer. Case I. Roots of indicial equation differing by an integer. Case II.
Week 10	Special functions: Bessel's equation and Bessel's function.
Week 11	The Bessel's function of the first kind of order zero. The Bessel's function of the first kind of order one. The second solution of the Bessel's equation. 2k is not an integer or zero. k = 0. 2k is an integer. Modified Bessel's Equation: Properties.
Week 12	Partial differential equations. Separation of variables. Boundary conditions.
Week 13	Fourier series.
Week 14	Laplace transformation. Laplace transforms of some functions. Basic properties of Laplace transform. The inverse Laplace transformation. Laplace transforms of derivatives. First order derivative. Second order derivative. Third order derivative. nth order derivative. Differentiation of the transform with respect to the operator S. The Laplace transform of the integral of a function. Method of convolution integral. Some useful signals and control models. The step function. The unit impulse function. The staircase function. Application to control and signal systems. The second shift theorem.

Week 15	The mathematical modeling of the problem.
Week 16	A week between the end semester and the final exam (Preparation week for exam)

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	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.	Most of books are available online
Recommended Texts	1. Mathematical Methods in Chemical Engineering', Seinfeld and Lapidus, Prentice Hall,1974. 2. 'Process Modeling, simulation and Control for Chemical Engineers', W. L. Luyben, 1990.	Most of books are available online
Websites	/	

Grading Scheme
مخطط الدرجات

Group	Grade	التقدير	Marks %	Definition
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C – Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

	Ministry of Higher Education and Scientific Research - Iraq University of Diyala College of Engineering Department of Chemical Engineering	

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Heat Transfer I**			**Module Delivery**	
Module Type	**Core**			**Theory** **Lecture** **Lab** **Tutorial** **Seminar**	
Module Code	**CHE-304**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level	3		**Semester of Delivery**	1	
Administering Department	Chemical Engineering		**College**	Engineering	
Module Leader	Mustafa Sabah Mahdi		**e-mail**	mustafa.sabah@uodiyala.edu.iq	
Module Leader's Acad. Title	Assistant prof.		**Module Leader's Qualification**	MSc	
Module Tutor	None		**e-mail**		
Peer Reviewer Name	None		**e-mail**		
Scientific Committee Approval Date			**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	Throughout this semester, students will learn the fundamental concepts of heat transfer and develop an understanding of conduction heat transfer mechanisms, enhancing their understanding of energy transfer processes. The course will explore the applications of conduction in various engineering fields while also focusing on the limitations and assumptions of conduction models and the formulation of the general differential heat conduction equation. Furthermore, students will analyze heat transfer in extended surfaces (fins), study transient heat conduction phenomena, and ultimately develop essential problem-solving skills in heat transfer analysis.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Derive the general heat conduction equation in Cartesian, cylindrical, and spherical coordinates. 2. Analyze heat transfer in composite systems 3. Solve transient conduction problems using analytical methods. 4. Apply boundary conditions and initial conditions to heat transfer problems. 5. Understand the significance of parameters like Biot number and Fourier number in transient conduction. 6. Analyze heat transfer in various fin geometries 7. Evaluate the performance of fins for different applications. 8. Use software tools to solve complex heat transfer problems. 9. Interpret and present heat transfer results effectively. 10. Apply heat transfer principles to real-world engineering applications.
Course Description	This course provides a comprehensive understanding of the fundamental principles and applications of heat transfer by conduction. It covers the derivation and application of the general heat conduction equation in various coordinate systems, with an emphasis on steady-state and transient analyses. Topics include one-dimensional and multidimensional conduction, the analysis and design of extended surfaces (fins) to enhance heat transfer, and analytical and numerical techniques for solving transient conduction problems. Students will develop the ability to formulate and solve practical engineering problems involving heat transfer by conduction in diverse applications.

Indicative Contents المحتويات الإرشادية	1. **Derivation of the General Heat Conduction Equation:** Conservation of energy, Fourier's Law in three dimensions, derivation in Cartesian coordinates. (10 hours) 2. **General Heat Conduction Equation in Different Coordinate Systems:** Transformation to cylindrical and spherical coordinates, understanding the terms. (10 hours) 3. **Boundary Conditions and Initial Conditions:** Types of boundary conditions (Dirichlet, Neumann, Robin), initial conditions for transient problems. (10 hours) 4. **Steady-State Heat Conduction in Fins:** Analysis of different fin profiles (rectangular, triangular, parabolic), fin equation, boundary conditions for fins. (10 hours) 5. **Fin Performance Parameters:** Fin efficiency, fin effectiveness, overall surface efficiency, design considerations for finned surfaces. (10 hours) 6. **Transient Heat Conduction: Lumped Capacitance Analysis:** Derivation and application of the lumped capacitance method, Biot number and its significance. (10 hours) 7. **Transient Heat Conduction in Semi-Infinite Solids:** Analytical solutions, error function, applications to sudden surface temperature changes and constant heat flux. (10 hours) 8. **Transient Heat Conduction in Finite Geometries:** Product solutions for slabs, cylinders, and spheres, using Heisler charts and approximate analytical solutions. (10 hours) 9. **Applications of Transient Conduction and Fins:** Heat treatment, cooling of electronic components, thermal energy storage, design of heat sinks. (10 hours)

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1. Interactive lectures with real-world examples and discussions. 2. Problem-based learning using realistic engineering challenges. 3. Worked examples and tutorials for guided problem-solving practice. 4. Hands-on laboratory experiments to reinforce theory and develop skills. 5. Numerical simulations and software tools for complex analyses. 6. Individual and group assignments for practice and application. 7. Assessments through quizzes, exams, and potentially online resources.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** **42** **In class tests** **4** **Tutorial** **14** **Lab** **30** **Final Exam** **4**	94	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home, memorize** **16** **Preparation for tests** **10** **Homework** **5**	31	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**150**		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	4	16% (16)	3, 6,10 and 13	LO #1, 5, 8 and 10
	classwork	4	8% (8)	2, 5, 9 and 12	LO #1, 4, 7 and 10
	Lab.	1	10% (10)	Continuous	All
	Seminars	1	6% (6)	13	LO # 10
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to Heat Transfer
Week 2	Importance of heat transfer in chemical engineering, Applications of heat transfer in industry
Week 3	Basic Concepts of Thermodynamics
Week 4	Fourier's law of heat conduction, Thermal conductivity
Week 5	Steady-state conduction in one and composite
Week 6	Thermal resistance
Week 7	Mid-term Exam,
Week 8	Series and parallel thermal resistances
Week 9	Heat generation
Week 10	Heat transfer through cylindrical walls
Week 11	Heat transfer through spherical walls
Week 12	Fins. Types of fins
Week 13	Heat transfer from fins
Week 14	Fin efficiency and effectiveness
Week 15	Unsteady-State Conduction, Lumped capacitance method,
Week 16	Biot and Fourier numbers, Temperature distribution in solids

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: 1. Thermal Conductivity Measurement-1
Week 2	Lab 2: Heat Transfer through Fins-1
Week 3	Lab 3: Transient Heat Conduction in a Solid-1
Week 4	Lab 4: Heat Transfer in Composite Materials
Week 5	Lab 5: Thermal Conductivity Measurement-2
Week 6	Lab 6: Heat Transfer through Fins-2
Week 7	Lab 7: Phase Change Heat Transfer
Week 8	Lab 8: Heat Transfer in Building Materials
Week 9	Lab 9: Heat Exchanger Performance
Week10	Lab 10: Thermal Contact Resistance

Week11	Lab 11: Convection Heat Transfer
Week12	Lab 12: Heat Transfer in a Spherical Shell
Week13	Lab 13: Transient Heat Conduction in a Semi-Infinite Solid
Week14	Lab 14: Drop-wise vs. Film-wise Condensation
Week15	Lab 15: Transient Heat Conduction in a Solid-2

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Heat Transfer (McGraw-Hill) 10th Edition by Jack Holman	Yes
Recommended Texts	Heat and Mass Transfer: A Practical Approach (McGraw-Hill) 2007 by Yunus A. Cengel	Yes
Websites	International Journal of Heat and Mass Transfer | ScienceDirect.com by Elsevier	

Grading Scheme مخطط الدرجات				
Group	**Grade**	التقدير	**Marks %**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 – 100	Outstanding Performance
	B - Very Good	جيد جدا	80 – 89	Above average with some errors
	C – Good	جيد	70 – 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 – 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 – 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Higher Education and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTORM
وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Industrial management and economic**			**Module Delivery**	
Module Type	CORE			**Theory** **Lecture** **Tutorial**	
Module Code	CHE 308				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	3		**Semester (s) offered**	5	
Administering Department	Chemical Engineering		**College**	Engineering	
Module Leader	Asst. teacher walaa abid		**e-mail**	Whalaa_alkhaisi76@uodiyala.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Msc	
Module Tutor	None		**e-mail**		
Peer Reviewer Name	None		**e-mail**		
Review Committee Approval			**Version Number**		

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	**Industrial management and economic**	**Semester**	1
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر	
Module Aims أهداف المادة الدراسية	The main objective of studying Chemical and Petrochemical Industries is to develop students' understanding of the fundamentals of petrochemicals, including olefins and aromatics, and their manufacturing methods. Students will also gain knowledge of most chemical industries and their manufacturing mechanisms, such as glass, sulfuric acid, ceramics, cement, etc. Additionally, students will gain knowledge of the separation processes for most petrochemical products.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	**Knowledge and Understanding** Students who successfully finish this course will be eligible to gains knowledge of chemical & petrochemical industries science and its practical applications, including manufacturing methods **:** 1. Enable the student to obtain knowledge in the Production of the basic materials for the petrochemical industry (olefins and aromatics) & Production of Ethylene in all detail . 2. Empowering student with the basics and types of petrochemicals **,** including derivatives of methane, ethylene, propylene, thermoplastics, and thermosets. 3. Enable the student to obtain knowledge in the concepts of synthetic fibers and rubber and provide a sufficient explanation of them. 4. Enabling students to obtain knowledge and understanding of industries of Ceramic , glass & nitric acid . 5. Enable the student to obtain knowledge in the Production of the (Paper**,** cement & Fertilizers) industries . 6. To make the student understand the basics of Carbon Industrial & Sulphuric Acid . 7. Enable the student to obtain knowledge and understanding in the subject of Gases (carbon dioxide, ammonia) & manufacturing of ammonia . 8. Enable the student to obtain knowledge and understanding in the subject of Nitrogen **,** helium and oxygen . 9. Empowering student the concept of pharmaceutical industries . 10. Enabling students to obtain knowledge in the manufacture of vegetable oils **,** Soap & Detergents and Sugar .
Indicative Contents المحتويات الإرشادية	➢ A detailed study of the definition of petrochemicals, in addition to

	studying their components in a way that enables the student to understand these components correctly, the most important of which are olefins and aromatics. (**8 hour**) ➢ Production of Ethylene and Petrochemicals from methane& Ethylene (**9hour**) ➢ Propylene derivatives Thermoplastic& Thermoset (**12 hour**) ➢ Ceramic , glass, nitric acid pharmaceutical industries (**10 hour**) ➢ Paper, cement & Fertilizers (**12 hour**) ➢ Industrial of carbon & Sulphuric Acid (**8 hour**) ➢ Gases(carbon dioxide, ammonia) (**7 hour**) ➢ Nitrogen, helium & oxygen , Soap &Detergents and Sugar (**9 hour**) ➢
Course Description	During the semester , the student a general overview of the principles and concepts of petrochemicals & chemical industries 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.
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	• Daily discussion to determine the extent of students' understanding of the material and to evaluate the daily contributions. • Daily exams with various short scientific questions to understand the extent of their understanding of the material. • Giving part of each chapter's grade to homework assignments. • Daily exams (quizzes) and monthly exams for the curriculum and the final exam.

Student Workload (SWL) الحمل الدراسي للطالب				
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل		63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
In class lectures	**42**			
In class tests	**3**			
Tutorial	**15**			
Final Exam	**3**			

Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing 10** **Preparation for tests 10** **Homework 17**	37	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation
تقييم المادة الدراسية

		Time/ Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	4	16% (16)	4,6,9and 13	LO #1, 3, 6, and 7
	Assignments	1	10%(10)	5	LO # 4
	Home work	1	10% (10)	3	LO#2
	project	2	4% (4)	8 and 12	LO #5 and 10
Summative assessment	**Midterm Exam**	1	10% (10)	7	LO # 1-5
	Final Exam	1	50% (50)	16	All
Total assessment			100% (100Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Management theory and practice
Week 2	Functions of management
Week 3	Production and types of it
Week 4	Productivity and work study,
Week 5	Introduction to Total Quality
Week 6	Total Quality control
Week 7	Industrial and type of it
Week 8	Mid term
Week 9	Management and ISO 9000
Week 10	Learn about the concept of economics and how it is classified
Week 11	Capital investment, Cost index, Profit and cost of invest
Week 12	Heat transfer equipment cost
Week 13	Application of heat equipment cost

Week 14	Depreciation and it types
Week 15	Project of management
Week 16	**Final Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Lectures by the subject teacher and any book from the library related to industrial management	Yes
Recommended Texts	PROCESS ENGINEERING CONOMICS James R. CoupUniversity of Arkansas Fayetteville, Arkansas, US. A	No
Websites	• Any other materials available on the web. • http://www.dekker.com	

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	مقبول بقرار	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note:

NB Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Higher Education and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical

MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Module Information
معلومات المادة الدراسية

Module Title	**Mass Transfer I**	**Module Delivery**	
Module Type	**Core**	☒**Theory** ☒**Lecture** ☐**Lab** ☐**Practical** ☐**Seminar**	
Module Code	**CHE 302**		
ECTS Credits	**6**		
SWL (hr/sem)	**150**		

Module Level	3	**Semester of Delivery**	5
Administering Department	Chemical engineering	**College**	College of Engineering
Module Leader	Prof. Dr. Ahmed Daham Wiheeb	**e-mail**	ahmed_chem76@uodiyala.edu.iq
Module Leader's Acad. Title	Professor	**Module Leader's Qualification**	PhD.
Module Tutor	None	**e-mail**	
Peer Reviewer Name	None	**e-mail**	
Scientific Committee Approval Date		**Version Number**	1.0

Relation with other Modules
العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	The primary purpose of the study of mass transfer is to develop the ability of students to know the basics knowledge about fundamentals of mass transfer to predict the application of mass transfer in industries. And also, be able to analyzing how mass transfer occurs and to solve problems related to the mass transfer process. To impart the knowledge of separation processes like absorption, and extraction.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Students who successfully finish this course will be eligible to: 1. Compare and contrast mass transfer by molecular diffusion and convection. 2. Use Fick's Law of diffusion in a mass balance for a simple geometric configuration in order to estimate mass transport rates in a binary system at steady state. 3. Explain the difference between diffusion modes (equimolar counter diffusion, unimolecular counter and stagnant). 4. Calculate values for binary diffusion coefficients in gas and liquid phases at specified conditions using standard models and correlations. 5. Explain the concept of mass transfer theories. 6. Explain the difference between individual phase (i.e.; a gas phase or liquid phase) and overall mass transfer coefficients. 7. Use a one-dimensional material balance on an elemental volume to derive an equation for the steady mass transfer rate in a packed bed absorption column. 8. Explain the height of transfer unit (HTU) and number of transfer units (NTU) concepts as applied to packed tower absorption process. 9. Providing education compatible to liquid –liquid extraction, principles, calculations. 10. Design multistage completely and partially immiscible solvents for co-current and current -current flow of linear and non-linear equilibrium.
Description of course	This course will focus on the demonstrating the basic concepts of mass transfer. The modes of diffusion; steady-state and unsteady-state diffusion involved in mass transfer will be outlined and governing equations derived. This course provides the concept and use of mass transfer coefficients and the use of dimensionless numbers. This course covers details of the absorption process such as gas-liquid equilibrium and types of absorption columns used. Also focus on the extraction process and the types of extraction and the mathematical models used to calculate the number of stages in co-current and counter current extraction units.

Indicative Contents المحتويات الارشادية	The following is indicative content. 1. Basic principles of diffusion, flick's law of mass transfer and the fundamentals of the modes of diffusion, Maxwell's Law for multicomponent mass transfer and the effective diffusivity of (A) in the mixture. (12 hours) 2. Diffusion through a varying cross-section area and the mole flux through a spherical body, Diffusivities of gases and vapors. (8 hours) 3. Mass transfer theories and mass transfer coefficient. (4 hours) 4. Fundamentals of the absorption of gas into liquid and the equilibrium relation of gas and liquid compute; Describe the absorption process, compute the number of transfer units, height of transfer units and the packed tower height for linear and non-linear equilibrium relation (8 hours) 5. Compute the number of trays and the tower height for linear and non-linear equilibrium relation, absorption problems (8 hours) 6. Compute the diameter of packed and tray towers, Fundamentals of the extraction of liquid into liquid, the equilibrium relation of liquid and liquid and the height of the differential extraction (8 hours) 7. The number of the stages for immiscible and co-current and current -current flow of linear and non-linear equilibrium, The number of the stages for party miscible and co-current flow of linear and non-linear equilibrium compute (8 hours) 8. The number of the stages for party miscible and counter-current flow of linear and non-linear equilibrium compute (4 hours)

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, homework's and examples. Practical examples help students to understand the course material.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا				
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 41 **In class tests** 4 **Tutorial** 15 **Final Exam** 3	**63**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**4.2**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **home, memorize, paper** 50 **Preparation for tests** 15 **Homework** 22	**87**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**5.8**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**150**		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	16% (16)	3, 7, 11 and 14	LO #3, LO #6, LO #8 and LO #10
	Classwork	2	10% (10)	5 and 12	LO #5 and #10
	Homework	2	10%(10)	6 and 13	LO #6 and #10
	Report	1	4%(4)	14	Lo#10
Summative assessment	Midterm Exam	2 hr	10% (10)	8	LO #1 - #7
	Final Exam	3 hr	50 % (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Basic principles of diffusion, flick's law of mass transfer and the fundamentals of the modes of diffusion.
Week 2	Maxwell's Law for multicomponent mass transfer and the effective diffusivity of (A) in the mixture.
Week 3	Diffusion through a varying cross-section area and the mole flux through a spherical body.
Week 4	Diffusivities of gases and vapors.
Week 5	Mass transfer theories and mass transfer coefficient
Week 6	Fundamentals of the absorption of gas into liquid and the equilibrium relation of gas and liquid compute.
Week 7	Describe the absorption process, compute the number of transfer units, height of transfer units and the packed tower height for linear and non-linear equilibrium relation.
Week 8	**Midterm one**
Week 9	Compute the number of trays and the tower height for linear and non-linear equilibrium relation.
Week 10	Tutorial in absorption problems
Week 11	Compute the diameter of packed and tray towers.
Week 12	Fundamentals of the extraction of liquid into liquid, the equilibrium relation of liquid and liquid and the height of the differential extraction.
Week 13	The number of the stages for immiscible and co-current and current -current flow of linear and non-linear equilibrium.
Week 14	The number of the stages for party miscible and co-current flow of linear and non-linear equilibrium compute.
Week 15	The number of the stages for party miscible and counter-current flow of linear and non-linear equilibrium compute.
Week 16	**Final Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	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.	Yes
Recommended Texts	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	Yes
Websites	https://www.chemengstudent.com/blog/?v=795237fd9d10	

Grading Scheme مخطط الدرجات				
Group	**Grade**	التقدير	**Marks %**	**Definition**
Success Group (50 - 100)	**A** – Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C – Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E – Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Higher Education
and Scientific Research - Iraq
University of Diyala
College of Engineering
Department of Chemical

YEAR 3
(SEMESTER 2)

Ministry of Higher Education and Scientific Research - Iraq University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Mass Transfer II**			**Module Delivery**	
Module Type	**Core**			☒**Theory** ☒**Lecture** ☐**Lab** ☐**Practical** ☐**Seminar**	
Module Code	**CHE 308**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	3		**Semester of Delivery**	6	
Administering Department	Chemical engineering		**College**	College of Engineering	
Module Leader	Prof. Dr. Ahmed Daham Wiheeb		**e-mail**	ahmed_chem76@uodiyala.edu.iq	
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	PhD.	
Module Tutor	None		**e-mail**		
Peer Reviewer Name	None		**e-mail**		
Scientific Committee Approval Date			**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Mass Transfer I (CHE 302)	**Semester**	5
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	The main purpose of the learning of mass transfer is to develop the ability of students to know the basics knowledge about fundamentals of mass transfer in leaching, distillation and cooling processes. And also, be able to design and solve problems related to the mass transfer in these applications. To impart the knowledge of separation processes like leaching, distillation and cooling towers.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Students who successfully finish this course will be eligible to: 1. Know the principles of Leaching process, mole flux through the leaching process and continuous leaching process through constant under flow and variable under flow. 2. Understand the types of distillation used in industrial and determine the vapor-liquid equilibrium. Calculate the height of differential distillation column. Also, calculate the composition and the quantity of the product in flash distillation column. 3. Separation of liquid feed by continuous (fractionation) distillation column, the operating lines equations. Compute the number of plates and reflux ratio using McCabe-Thiele methods. 3. Compute the number of trays for multi-feeds and side stream distillation and compute the composition of components on the trays and the number of trays for fractionation distillation column using Lewis- Sorial method. 4. Compute the composition of components on the distillation column trays and the number of trays using Ponchon-Savarit method for non-ideal system. 5. Determine the number of trays in batch distillation column with constant reflux ratio and constant distillate product. 6. Determine the number of plates and reflux ratio in multi-component feed in the distillation by Lewis and Matheson method. 7. Know the humidification and water-cooling process and to determine the cooling towers height.
Description of course	This course will focus on the demonstrating the mass transfer in leaching process. The types of distillation; vapor-liquid equilibrium involved distillation process will be outlined and governing equations derived. This course provides the fundamentals of differential, batch and continuous distillation. This course covers details on the operating lines equations and on the determination the number of plates and minimum reflux ratio in distillation column. Also focus on the multi-component mixture in distillation process. Also, this course focus on the fundamental of the humidification process and cooling towers calculations.

Indicative Contents المحتويات الارشادية	The following is indicative content. 1. Basic principles of Leaching process, mass transfer form solid to liquid solvent, mole flux through the leaching process, continuous leaching process through constant under flow and variable under flow for linear and nonlinear relation. (12 hours) 2. Define the distillation process and types of distillation used in industrial and determine the vapor-liquid equilibrium. Drive the equation used to calculate the height of differential distillation column, flash distillation column and drive the equations used to calculate the composition and the quantity of the product. (8 hours) 3. Fundamentals of mass transfer through the continuous (fractionation) distillation column and drive the operating lines equations. Compute the number of plates and reflux ratio in continuous distillation using McCabe-Thiele method. (8 hours) 4. Compute the number of trays for multi-feeds and side stream distillation and compute the composition of components on the trays and the number of trays for fractionation distillation column using Lewis- Sorial method. (8 hours) 5. Compute the composition of components on the distillation column trays and the number of trays using Ponchon-Savarit method. (6 hours) 6. Batch distillation column with constant reflux ratio and constant distillate product and determine the number of trays in batch distillation. multi-component distillation column and determine the number of plates and reflux ratio in multi-component distillation by Lewis and Matheson method. (10 hours) 7. Humidification and Water Cooling (4 hours) 8. Cooling towers, equilibrium relation and determine the height of the cooling tower (4 hours)

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, homework's and examples. Practical examples help students to understand the course material.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 41 **In class tests** 4 **Tutorial** 15 **Final Exam** 3	**63**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**4.2**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **home, memorize, paper** 50 **Preparation for tests** 15 **Homework** 22	**87**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**5.8**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**150**		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	16% (16)	3, 7, 11 and 14	LO #1, LO #3, LO #4 and LO #8
	Classwork	2	10% (10)	5 and 12	LO #3 and #7
	Homework	2	10%(10)	6 and 13	LO #4 and #8
	Report	1	4%(4)	14	Lo#8
Summative assessment	Midterm Exam	2 hr	10% (10)	8	LO #1 - #7
	Final Exam	3 hr	50 % (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Basic principles of Leaching process, describe the mass transfer form solid to liquid solvent. And recognize the fundamentals of the mole flux through the leaching process.
Week 2	Describe the continuous leaching process and drive the equation used to calculate the number of stages through constant under flow.
Week 3	Describe continuous leaching with variable under flow and drive the equations used to calculate the number of stages through variable under flow for linear and nonlinear relation.
Week 4	Define the distillation process and the types of distillation used in industrial and determine the vapor-liquid equilibrium.
Week 5	Drive the equation used to calculate the height of differential distillation column, Describe the mass transfer through flash distillation column and drive the equations used to calculate the composition and the quantity of the product.
Week 6	Fundamentals of mass transfer through the continuous (fractionation) distillation column and drive the operating lines equations.
Week 7	Compute the number of plates and reflux ratio in continuous distillation using McCabe-Thiele method.
Week 8	**Midterm one**
Week 9	Compute the number of trays for multi-feeds and side stream distillation and compute the composition of components on the trays and the number of trays for fractionation distillation column using Lewis- Sorial method.
Week 10	Tutorial in distillation problems
Week 11	Compute the composition of components on the distillation column trays and the number of trays using Ponchon-Savarit method.
Week 12	Fundamentals of the batch distillation column with constant reflux ratio and constant distillate product and determine the number of trays in batch distillation.
Week 13	Fundamentals of the mass transfer multi-component distillation column and determine the number of plates and reflux ratio in multi-component distillation by Lewis and Matheson method.
Week 14	Humidification and Water Cooling
Week 15	Cooling towers, equilibrium relation and determine the height of the cooling tower.
Week 16	**Final Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	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.	Yes
Recommended Texts	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	Yes
Websites	https://www.chemengstudent.com/blog/?v=795237fd9d10	

Grading Scheme مخطط الدرجات				
Group	**Grade**	التقدير	**Marks %**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C – Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Higher Education and Scientific Research - Iraq University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Numerical Methods**		**Module Delivery**		
Module Type	**Core**		☒**Theory** ☒**Lecture** ☒**Lab** ☐**Practical** ☐**Seminar**		
Module Code	**Ch.E.307**				
ECTS Credits	**4**				
SWL (hr/sem)	**100**				
Module Level	3		**Semester of Delivery**	6	
Administering Department	Chemical engineering		**College**	College of Engineering	
Module Leader	Yussur Dh. Abdulwahhab		**e-mail**	esar@uodiyala.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	MSc	
Module Tutor	None		**e-mail**		
Peer Reviewer Name	None		**e-mail**		
Scientific Committee Approval Date			**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	The module's objectives include introducing numerical methods with their definitions and procedures. The students were able to learn how to find the roots of a single nonlinear equation. By solving a system of linear and nonlinear equations. Then, they will acquire the skills to solve the ordinary differential equation. As a part of the module syllabus, the second and higher order differential equations are involved as the development requirements for their skills. The module comprises numerical integration to complete the picture of learning mathematics of numerical systems. Finally, the module leads students to use interpolation to provide a means of estimating the function at intermediate points. Interpolation describes some methods differing in such properties as accuracy, cost, number of data points needed, and smoothness of the resulting interpolant function.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Students who successfully finish this course will be eligible to: 1. Be aware of the mathematical background for the different numerical methods introduced in the course. 2. Explain and derive the different numerical methods to solve algebraic equations and to solve systems of linear and nonlinear equations. 3. Analyse and solve the different numerical methods for interpolation, differentiation, integration, and solving a set of ordinary differential equations. 4. Determine how numerical methods afford means to generate solutions in a manner that can be implemented on digital computers. 5. Use and create functions in MATLAB and EXCEL for solving numerical engineering problems.
Description of course	This course will focus on demonstrating the numerical methods for solving different problems with the style of mass transfer, heat transfer, and momentum or fluid flow. Furthermore, other industrial processes could be applied to solve their case studies. Each method has its own procedure in the solution of the aforementioned cases, with its evaluations of rightness and accuracy. This module describes the numerical methods in three chapters. First chapter involves the error analysis, finding the roots of nonlinear algebraic equations, followed by the solution of linear and transcendental simultaneous equations, and ending with the matrix and vector manipulation. Second chapter deals with Curve fitting and interpolation. The third chapter displays the numerical integration and differentiation, solution of ordinary and partial differential equations.

Indicative Contents المحتويات الارشادية	**Chapter one** The numerical methods include error analysis, roots of nonlinear algebraic equations, solution of linear and transcendental simultaneous equations, matrix and vector manipulation [20 hrs] **Chapter Two** Curve fitting and interpolation [10 hrs] **Chapter Three** Numerical integration and differentiation, solution of ordinary and partial differential equations [15 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
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.

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1-2	Lab 1: Introduction to the MATLAB interface
Week 3-4	Lab 2: Introduction to MATLAB programming language
Week 5-6	Lab 3: Drawing using MATLAB
Week 7-8	Lab 4: Solve the equation of falling under the influence of gravity
Week 9-10	Lab 5: Finding the square root of a given number
Week 11-12	Lab 6: Sort specific numbers according to a specific condition
Week 13-14	Lab 7: Solve linear algebraic equations
Week 15-16	Lab 8: Solving differential equations

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 30 **Lab** 30 **Exam** 4 **Final Exam** 3	**64**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**4.3**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **home, memorize, paper** 15 **Preparation for tests** 12 **Homework** 9	**36**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**2.4**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**100**		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	14% (14)	3, 7 and 14	LO #3, LO #8 and LO #10
	Classwork	2	10% (10)	4 and 10	LO #6 and #12
	Lab	1	10% (10)	Continuous	All
	Homework	2	6% (6)	6 and 13	LO #6 and #14
Summative assessment	Midterm Exam	2 hr	10% (10)	8	LO #1 - #7
	Final Exam	3 hr	50 % (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction, General concepts of numerical method, General definition of the types of numerical error
Week 2	General definition of the types of numerical error
Week 3	Finding the roots, define some useful methods, describe how to treat roots and find it
Week 4	Introduce the remain methods of finding roots and some applied examples
Week 5	Complete the subject of roots and how to apply it, and the linking of roots with other subjects , define the matrix and its types and applications
Week 6	Explain what is the system of linear equations
Week 7	Determine the applicable methods to solve the system of linear equations
Week 8	Continue of solving system of linear equations
Week 9	Explain the curve fitting, the procedure and uses, Explain the polynomial interpolation, the procedure and uses
Week 10	Continue of the polynomial interpolation, the procedure and uses
Week 11	Continue of the polynomial interpolation, the procedure and uses
Week 12	Continue of the polynomial interpolation, the procedure and uses
Week 13	Explain the methods of Integration and differentiation by numerical behaviour
Week 14	Continue of the Differentiation and Ordinary differential equation by numerical behaviour
Week 15	Continue of the Ordinary differential equation by numerical behaviour
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	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.	Yes
Recommended Texts	1. Mathematical Methods in Chemical Engineering', Seinfeld and Lapidus, Prentice Hall,1974. 2. 'Process Modeling, simulation and Control for Chemical Engineers', W. L. Luyben, 1990.	Yes
Websites	/	

Grading Scheme مخطط الدرجات				
Group	**Grade**	التقدير	**Marks %**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C – Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Ministry of Higher Education and Scientific Research - Iraq University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Reactor Design I**			**Module Delivery**	
Module Type	**Core**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Practical** ☐ **Seminar**	
Module Code	**CHE- 311**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	3		**Semester of Delivery**	6	
Administering Department	Chemical engineering			College of Engineering	
Module Leader	Assist Prof. Dr. Salah N. Farhan		**e-mail**	drsalahchem@uodiyala.edu.iq	
Module Leader's Acad. Title	Assistance Professor		**Module Leader's Qualification**	PhD.	
Module Tutor	None		**e-mail**		
Peer Reviewer Name	None		**e-mail**		
Scientific Committee Approval Date			**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	The primary objective of Reactor Design course is to equip students with ability to develop foundational skills in reaction kinetics, ideal reactor design (Batch/CSTR/PFR), and performance analysis. Learn to calculate conversions, interpret Levenspiel plots, and address pressure drop effects. And apply numerical methods for reactor sizing and compare liquid/gas-phase systems to analyze, design, and optimize chemical reactors for industrial and laboratory applications.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of the course, students should be able to: 1. Derive rate laws from reaction mechanisms and experimental data using differential/integral methods. 2. Calculate reaction rates accounting for temperature effects via the Arrhenius equation. 3. Design ideal reactors (Batch, CSTR, PFR) by solving material balance equations for given conversions. 4. Compare reactor performance using Levenspiel plots to select optimal configurations (series/parallel). 5. Predict pressure drops in packed-bed reactors using the Ergun equation and assess impact on conversion. 6. Analyze non-ideal flow using residence time distribution (RTD) data and tank-in-series models. 7. Distinguish liquid/gas-phase reactor design considerations (e.g., variable volume, ε factor). 8. Evaluate economic trade-offs in reactor sizing (capital vs. operating costs). 9. Model simple catalytic systems using Langmuir-Hinshelwood kinetics. 10. Solve CRE problems numerically using Python/Excel for ODE.
Description of course	This course introduces fundamental principles of chemical reaction engineering, covering reaction kinetics, reactor design, and analysis. Students learn to derive rate laws, analyze reaction mechanisms, and design ideal reactors (batch, CSTR, PFR). Topics include conversion calculations, Levenspiel plots, pressure drop effects, and residence time distribution. The course compares reactor performance for liquid- and gas-phase systems and introduces catalytic reactions. Practical applications are emphasized through problem-solving and case studies. By course end, students can select and

	size reactors for given kinetics, optimize reactor sequences, and evaluate non-ideal flow effects. Prerequisites: thermodynamics and transport phenomena. Tools include numerical methods and basic process simulation.
Indicative Contents المحتويات الارشادية	**Chemical Reaction Engineering I (CRE I) – Indicative Content:** **1. Introduction to Chemical Reaction Engineering (6 hours)** **2. Ideal Reactor Types (12 hours)** **3. Pressure Drop in Reactors (6 hours)** **4. Algorithms for Reactor Design (6 hours)** • **Numerical methods** ○ ODE solving (Euler, Runge-Kutta) for PFR/batch reactors. ○ Iterative methods for CSTR cascades. • **Software tools** ○ MATLAB/Python examples for reactor simulation. **5. Liquid-Phase Reactions (6 hours)** **6. Gas-Phase Reactions (6 hours)** **7. Levenspiel Plots (6 hours)** **8. Reactors in Series & Parallel (12 hours)**

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, homework's and examples. Practical examples help students to understand the course material.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا				
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 41 **In class tests** 4 **Tutorial** 15 **Final Exam** 3	**63**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**4.2**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **home, memorize, paper** 50 **Preparation for tests** 15 **Homework** 22	**87**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**5.8**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**150**		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	**4**	**16% (16)**	**3, 7, 11 and 14**	**LO #3, LO #6, LO #8 and LO #10**
	Class work	**2**	**10% (10)**	**6 and 13**	**LO #6 and #14**

	Homework	**2**	**10%(10)**	**6 and 13**	**LO #6 and #10**
	Report	**1**	**4%(4)**	**14**	**Lo#10**
Summative assessment	**Midterm Exam**	**2 hr**	**10% (10)**	**8**	**LO #1 - #7**
	Final Exam	**3 hr**	**50 % (50)**	**16**	**All**
Total assessment			**100% (100 Marks)**		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	**Introduction & Basic Concepts** • Course roadmap and industrial applications • Reaction classifications (homogeneous/heterogeneous, catalytic/non-catalytic) • Rate laws and stoichiometry (batch vs continuous)
Week 2	**Reaction Kinetics I** • Zero, first, second-order reactions • Determination of reaction order (differential/integral methods)
Week 3	**Reaction Kinetics II** • Arrhenius equation and activation energy • Complex reactions (parallel/series) • Introduction to reaction mechanisms
Week 4	**Reactor Fundamentals** • General mole balance equation • Space time, space velocity, conversion • Introduction to ideal reactor types
Week 5	**Batch Reactors** • Design equations and time calculations • Variable volume systems • Case study: Pharmaceutical batch processing

Week 6	**CSTR Design** • Material balance derivation • Residence time distribution • Multiple CSTRs in series
Week 7	**PFR Design** • Differential design equations • Comparison with CSTR performance • Numerical integration methods
Week 8	**Reactor Comparisons** • Levenspiel plots for reactor selection • Volume efficiency analysis
Week 9	**Pressure Drop Effects** • Ergun equation derivation in Packed bed reactor design • Variable density systems
Week 10	**Reactor Combinations** • Series and parallel configurations • Hybrid systems (CSTR-PFR combinations)
Week 11	**Liquid-Phase Reactions** • Solvent effects on kinetics • Mixing considerations • Case study: Polymerization reactors
Week 12	**Gas-Phase Reactions** • Expansion factor (ε) concept • Variable volume flow systems • Industrial example: Ammonia synthesis
Week 13	**Process Intensification** • Microreactors and novel designs • Safety considerations in reactor design • Green engineering principles
Week 14	**Comprehensive Case Study** • Full process design project • Integration of all course concepts

	• Final presentations and review
Week 15	**Introduction to Catalysis** • Basic concepts of catalytic reactions and difference between homogeneous/heterogeneous
Week 16	**Final Exam**

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	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.	Yes
Recommended Texts	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	Yes
Websites	https://www.chemengstudent.com/blog/?v=795237fd9d10	

Grading Scheme
مخطط الدرجات

Group	Grade	التقدير	Marks %	Definition
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C – Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Higher Education and Scientific Research - Iraq University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Thermodynamic I**			**Module Delivery**	
Module Type	**Core**			☒**Theory** ☒**Lecture** ☐**Lab** ☐**Practical** ☐**Seminar**	
Module Code	**CHE 303**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level	**3**		**Semester of Delivery**	**5**	
Administering Department	Chemical engineering		**College**	College of Engineering	
Module Leader	Dr. Ali Z. Al Hassn		**e-mail**	Alialhassn.uod@uodiyala.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	PhD.	
Module Tutor	None		**e-mail**		
Peer Reviewer Name	None		**e-mail**		
Scientific Committee Approval Date			**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	CHE 204	**Semester**	3
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	The course provides an introductory treatment of thermodynamics from a chemical-engineering point of view. In addition, it provides 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 also provide students with good skills and ability to solve the thermodynamic problems related to chemical engineering units. Besides, it provides a better understanding of the thermodynamic fundamentals themselves.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	After finishing this module successfully, students will: 1. Explain the basic definition of thermodynamic quantities and the fundamental physical quantities relating heat and work. 2. Describe Joule's experiments, the 1st law of thermodynamic, and its application to open and closed systems. 3. Describe thermodynamic State and State Functions, Enthalpy, Heat capacity, internal energy, and reversible/irreversible processes. 4. Analyze the PVT Behavior of Pure Substances via the Virial Equation and the ideal gas behavior (isochoric, isothermal, & adiabatic). 5. Use the equations of state EoS to determine the characteristics of ideal and non-ideal gases. 6. Be able to solve the problems and make calculations for the heat effects accompanied phase change, chemical reaction (heat of reaction, formation, and combustion). 7. Explain the 2nd law of thermodynamics and entropy change via heat engine principle. 8. Be able to solve the problems of the entropy change of an ideal gas 9. Analyze the relations between thermodynamic quantities for a homogenous phase of constant composition and Maxwell's equations 10. Analyze the residual properties, and quality of vapor of two-phase system. 11. Assess the enthalpy change in a system of flow in pipe and throttling process
Description of course	The module begins by outlining the fundamental definitions and evolution of the first law of thermodynamics. The first law is then applied to practical situations early on by treating the pressure/volume/temperature (PVT) behavior of fluids and heat effects related to temperature change, phase change, and chemical reaction. After that, the second law discussed, and its most fundamental uses are presented. The module concludes with an enlarged analysis of flow processes and a thorough discussion of the thermodynamic properties of pure fluids, which permits the universal application of the first and second laws.

Indicative Contents المحتويات الارشادية	The following is indicative content. 1. Basic definitions, Fundamental physical quantities, Heat and work. (3 hours) 2. Joule's Experiments, Internal Energy, Formulation of the First Law of Thermodynamics, The Thermodynamic State and State Functions, Enthalpy, Heat capacity, Reversible process, The Phase Rule. (6 hours). 3. The PVT Behavior of Pure Substances, The Virial Equation, The Ideal Gas (isochoric, isothermal, & adiabatic), Cubic Equations of State, Generalized Correlations for Gases and liquids. (6 hours) 4. Sensible Heat Effects, Heat Effects Accompanying Phase Changes of Pure Substances, The Standard Heat of (Reaction, Formation, and Combustion). (6 hours) 5. Effect of Temperature on the Standard Heat of Reaction, Heat Effects of Industrial Reactions. (3 hours) 6. The Heat Engine principle, Carnot Cycle for an Ideal Gas, Entropy, Entropy Changes of an Ideal Gas. (6 hours) 7. Mathematical Statement of the Second Law (3 hours) 8. Relations for a homogenous phase of constant composition, Maxwell's equations, Residual Properties. (6 hours) 9. Two-Phase Systems, Quality of vapor (3 hours) 10. Flow in pipe and Throttling process (3 hours)

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	✓ Make sure students understand how the first and second laws of thermodynamics relate to chemical processes by reinforcing them. ✓ Focus on the concepts of enthalpy, internal energy, entropy, heat and work. ✓ Use examples from actual chemical engineering situations to demonstrate thermodynamic concepts. ✓ Encouraging Students to solve the thermodynamic problems in groups by using problem-solving strategies. ✓ Using animations, 3D models, and images to illustrate thermodynamic ideas. ✓ Incorporate hands-on activities and group discussions to reinforce theoretical knowledge.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا				
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 28 **In class tests** 4 **Tutorial** 13 **Final Exam** 3	**48**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**3.2**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **home, memorize, paper** 42 **Preparation for tests** 15 **Homework** 20	**77**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**5.1**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**125**		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	**4**	**16% (10)**	**6 and 14**	**LO #3, LO #4, LO #8 and LO #10**
	Assignments	**2**	**10% (10)**	**7 and 12**	**LO #5 and #9**
	Homework	**2**	**10%(10)**	**3 and 13**	**LO #2 and #11**
	Report	**1**	**4%(4)**	**5**	**LO#5**
Summative assessment	**Midterm Exam**	**2 hr**	**10% (10)**	**8**	**LO #1 - #6**
	Final Exam	**3 hr**	**50 % (50)**	**16**	**All**
Total assessment			**100% (100 Marks)**		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to thermodynamics: Basic definitions, Fundamental physical quantities Heat and work
Week 2	1st law of thermodynamics: Joule's Experiments, Internal Energy, Formulation of the First Law of Thermodynamics
Week 3	1st law of thermodynamics: The Thermodynamic State and State Functions, Enthalpy, Heat capacity, Reversible process, The Phase Rule.
Week 4	Volumetric Properties of Pure Fluids: The PVT Behavior of Pure Substances, The Virial Equation.
Week 5	Volumetric Properties of Pure Fluids: The Ideal Gas (isochoric, isothermal, & adiabatic), Cubic Equations of State, Generalized Correlations for Gases and liquids.
Week 6	Heat Effects: Sensible Heat Effects, Heat Effects Accompanying Phase Changes of Pure Substances, The Standard Heat of (Reaction, Formation, and Combustion).
Week 7	Heat Effects: Effect of Temperature on the Standard Heat of Reaction, Heat Effects of Industrial Reactions.
Week 8	**Midterm one**
Week 9	2nd law of thermodynamics: The Heat Engine principle, Carnot Cycle for an Ideal Gas.
Week 10	2nd law of thermodynamics: Entropy, Entropy Changes of an Ideal Gas.
Week 11	2nd law of thermodynamics: Mathematical Statement of the Second Law
Week 12	Thermodynamic Properties of Fluids: Relations for a homogenous phase of constant composition, Maxwell's equations
Week 13	Thermodynamic Properties of Fluids: Residual Properties.
Week 14	Thermodynamic Properties of Fluids: Two-Phase Systems, Quality of vapor.
Week 15	Thermodynamics of Flow Processes: Flow in pipe and Throttling process
Week 16	**Final Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1. Introduction to Chemical Engineering Thermodynamics: Smith, J.M., Van ness H.C. and Abbot, M.M., 7th ed. MGH., 2005. 2. A Text Book of Chemical Engineering Thermodynamics, Narayanan, PHI	Yes
Recommended Texts	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.	Yes
Websites	http://web.mit.edu/10.213/www/handouts.shtml	

Grading Scheme مخطط الدرجات				
Group	**Grade**	التقدير	**Marks %**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C – Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Ministry of Higher Education and Scientific Research - Iraq University of Diyala
College of Engineering
Department of Chemical Engineering

MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Thermodynamic II**			**Module Delivery**	
Module Type	**Core**			☒**Theory** ☒**Lecture** ☐**Lab** ☐**Practical** ☐**Seminar**	
Module Code	**CHE 309**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level	**3**		**Semester of Delivery**		**6**
Administering Department	Chemical engineering		**College**	College of Engineering	
Module Leader	Dr. Ali Z. Al Hassn		**e-mail**	alialhassn.uod@uodiyala.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**		PhD.
Module Tutor	None		**e-mail**		
Peer Reviewer Name	None		**e-mail**		
Scientific Committee Approval Date			**Version Number**		1.0

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	CHE 303	**Semester**	5
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	This course tackles thermodynamic cycles (Rankine, refrigeration, liquefaction), analyzing Thermodynamic Properties of Pure Substances & Mixtures. It also includes applications of fugacity, activity, and chemical potential concepts in thermodynamic systems. The student during the will also learn about non-ideal behavior (real gases, residual properties) and use Raoult's Law, Henry's Law, and activity coefficients for mixtures. In addition, the course will give application of Gibbs free energy to predict phase equilibria and VLE systems. The chemical reaction equilibrium will be covered, as well.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	After finishing this module successfully, students will: 1. Explain the basic definition of the Steam Power Plant, Carnot cycle, Practical power plant cycle, and other engines. 2. Describe the Carnot Refrigerator, The Vapor-Compression Cycle, and The Choice of Refrigerant. 3. Describe the Heat Pump, Liquefaction Processes. 4. Analyze the Nature of equilibrium, Raoult's law, Ideal gas mixture, and Flash calculation. 5. Recognize Fugacity, and Fugacity coefficient. 6. Define Duhem's Theorem, chemical potential and non-ideal gas mixture. 7. Solve and calculate the Dew-Point and Bubble-Point problems. 8. Explain Heat of mixing. 9. Assess and determine the Chemical-Reaction Equilibria and the reaction coordinate 10. Comprehend The Standard Gibbs energy change, the equilibrium constant, and the effect of temperature on the equilibrium constant. 11. Evaluate the equilibrium constant and find Relations between Equilibrium Constants and Composition.
Description of course	The first topics covered in this module are refrigeration and power generation. Topics in the special field of chemical engineering thermodynamics are covered in the remaining portion of the module, which deals with fluid mixtures. The module also presents the solution thermodynamics framework, which serves as the foundation for the applications in the areas mixing processes and the analysis of phase equilibria, primarily qualitatively. Other lectures cover vapor/liquid equilibrium in detail. Chemical-reaction equilibrium is discussed at the end of module.

Indicative Contents المحتويات الارشادية	The following is indicative content. 1. Basic definitions, The Steam Power Plant, Carnot cycle, Rankine cycle, Practical power plant cycle, and other engines. (6 hours) 2. The Carnot Refrigerator, the Vapor-Compression Cycle, the Choice of Refrigerant, the Heat Pump, Liquefaction Processes. (6 hours). 3. Nature of equilibrium, Raoult's law, Ideal gas mixture, (6 hours) 4. Flash calculation. (3 hours) 5. Fugacity, Fugacity coefficient. (3 hours) 6. Vapor-Liquid Equilibrium VLE: Duhem's Theorem Dew-Point and Bubble-Point Calculations. (6 hours) 7. Heat of mixing. (3 hours) 8. Reaction Coordinate, The Standard Gibbs energy change and the equilibrium constant (3 hours) 9. Effect of Temperature on the Equilibrium Constant, Evaluation of equilibrium constant. (6 hours) 10. Relations between Equilibrium Constants and Composition (3 hours)

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	✓ Make sure students understand the systems, e.g. power plant, refrigeration, works. ✓ Focus on the concepts, the definitions, and the derivation of the equations. ✓ Use examples from actual chemical engineering situations to demonstrate thermodynamic concepts. ✓ Encouraging Students to solve the thermodynamic problems in groups by using problem-solving strategies. ✓ Using animations, 3D models, and images to illustrate thermodynamic ideas. ✓ Incorporate hands-on activities and group discussions to reinforce theoretical knowledge.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا				
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** 28 **In class tests** 4 **Tutorial** 13 **Final Exam** 3	**48**	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	**3.2**
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **home, memorize, paper** 42 **Preparation for tests** 15 **Homework** 20	**77**	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	**5.1**
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**125**		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	16% (16)	4 and 15	LO #1,2,3 and LO #9,10,11
	Assignments	2	10% (10)	6 and 11	LO #5,6 and LO #7,8
	Homework	2	10% (10)	5 and 13	LO #4 and LO #11
	Report	1	4% (4)	3	LO #3
Summative assessment	Midterm Exam	2 hr	10% (10)	8	LO #1 - #5
	Final Exam	3 hr	50 % (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Conversion of Heat into Work by Power Cycles: Basic definitions, The Steam Power Plant, Carnot cycle.
Week 2	Conversion of Heat into Work by Power Cycles: Rankine cycle, Practical power plant cycle, Other engines.
Week 3	Refrigeration and Liquefaction: The Carnot Refrigerator,The Vapor-Compression Cycle, The Choice of Refrigerant.
Week 4	Refrigeration and Liquefaction: The Heat Pump, Liquefaction Processes.
Week 5	Phase equilibrium: Nature of equilibrium, Raoult's law.
Week 6	Phase equilibrium: Ideal gas mixture, Flash calculation.
Week 7	Phase equilibrium: Fugacity, Fugacity coefficient.
Week 8	**Midterm one**
Week 9	Vapor-Liquid Equilibrium VLE: Duhem's Theorem.
Week 10	Vapor-Liquid Equilibrium VLE: Dew-Point and Bubble-Point Calculations.
Week 11	Vapor-Liquid Equilibrium VLE: Chemical potential and non-ideal gas mixture.
Week 12	Heat of mixing.
Week 13	Chemical-Reaction Equilibria: Reaction Coordinate, The Standard Gibbs energy change and the equilibrium constant
Week 14	Chemical-Reaction Equilibria: Effect of Temperature on the Equilibrium Constant, Evaluation of equilibrium constant
Week 15	Chemical-Reaction Equilibria: Relations between Equilibrium Constants and Composition
Week 16	**Final Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1. Introduction to Chemical Engineering Thermodynamics: Smith, J.M., Van ness H.C. and Abbot, M.M., 7th ed. MGH., 2005. 2. A Text Book of Chemical Engineering Thermodynamics, Narayanan, PHI	Yes
Recommended Texts	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.	Yes
Websites	http://web.mit.edu/10.213/www/handouts.shtml	

Grading Scheme مخطط الدرجات				
Group	**Grade**	التقدير	**Marks %**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C – Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

	Ministry of Higher Education and Scientific Research - Iraq University of Diyala College of Engineering Department of Chemical Engineering	

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Heat Transfer II**			**Module Delivery**	
Module Type	**Core**			**Theory** **Lecture** **Tutorial** **Seminar**	
Module Code	**CHE-310**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level		3	**Semester of Delivery**		2
Administering Department		Chemical Engineering	**College**	Engineering	
Module Leader	Mustafa Sabah Mahdi		**e-mail**	mustafa.sabah@uodiyala.edu.iq	
Module Leader's Acad. Title		Assistant prof.	**Module Leader's Qualification**		MSc
Module Tutor	None		**e-mail**		
Peer Reviewer Name		None	**e-mail**		
Scientific Committee Approval Date			**Version Number**		1.0

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	This module aims to equip students with a comprehensive understanding of convective heat transfer, encompassing the fundamental mechanisms of forced and natural convection, and the ability to quantify this transfer through the application of Newton's Law of Cooling. Students will analyze the concepts of hydrodynamic and thermal boundary layers and learn to determine relevant dimensionless numbers such as Reynolds, Prandtl, and Nusselt, enabling them to utilize empirical correlations for predicting convective heat transfer coefficients in diverse flow geometries, including both internal and external flows. Furthermore, the module will cover the principles of natural convection and buoyancy-driven flows, provide an explanation of the boiling curve, and analyze heat transfer during condensation, differentiating between filmwise and dropwise mechanisms. Finally, students will understand the operational principles and classifications of heat exchangers, including parallel-flow and counter-flow types, and gain proficiency in applying the Log Mean Temperature Difference (LMTD) and Effectiveness-NTU methods for their analysis.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Explain the fundamental mechanisms of forced and natural convection. 2. Apply Newton's Law of Cooling to calculate convective heat transfer rates. 3. Describe the development and significance of hydrodynamic and thermal boundary layers. 4. Define and calculate key dimensionless numbers in convection and interpret their physical meaning. 5. Select and apply appropriate empirical correlations to determine convective heat transfer coefficients for various flow configurations. 6. Analyze heat transfer in internal flows, considering entrance effects and fully developed flow. 7. Analyze heat transfer in external flows over different geometries. 8. Describe the different regimes boiling curve. 9. Distinguish between filmwise and dropwise condensation and their impact on heat transfer rates. 10. Classify different types of heat exchangers based on flow arrangement and construction. 11. Apply the Log Mean Temperature Difference (LMTD) method to analyze the performance of heat exchangers.

Course Description	This course provides a comprehensive study of convective heat transfer, encompassing both forced and natural convection in various flow geometries. It delves into the fundamental principles governing boiling and condensation phenomena, including different regimes and their associated heat transfer characteristics. Furthermore, the course covers the analysis, performance evaluation, and basic design principles of various types of heat exchangers, utilizing the Log Mean Temperature Difference (LMTD) and Effectiveness-NTU methods. Students will develop a strong understanding of the underlying physics and the ability to apply relevant correlations and methodologies to solve practical engineering problems involving these modes of heat transfer and thermal devices.
Indicative Contents المحتويات الإرشادية	1. **Fundamentals of Convection:** Introduction to convection, Newton's Law of Cooling, forced vs. natural convection, velocity and thermal boundary layers, laminar and turbulent flow, dimensionless numbers (Re, Pr, Nu, Gr, Ra). (8 hours) 2. **Forced Convection:** External flow (flat plate, cylinder, sphere), internal flow (pipes and ducts), hydrodynamic and thermal entry lengths, correlations for laminar and turbulent flow in various geometries, constant surface temperature and constant heat flux conditions. (8 hours) 3. **Natural Convection:** Buoyancy forces, boundary layer analysis for vertical plates and horizontal cylinders, correlations for natural convection from various surfaces, Rayleigh number, applications of natural convection. (8 hours) 4. **Boiling Heat Transfer:** Pool boiling regimes (nucleate, transition, film boiling), boiling curve, critical heat flux, correlations for nucleate and film boiling, flow boiling, two-phase flow characteristics. (7 hours) 5. **Condensation Heat Transfer:** Film condensation on vertical and horizontal surfaces, Nusselt theory, dropwise condensation. 6. **Heat Exchanger Fundamentals:** Types of heat exchangers (parallel-flow, counter-flow, shell-and-tube, compact heat exchangers), overall heat transfer coefficient, fouling factor, heat exchanger analysis vs. design. (4 hours) 7. **Log Mean Temperature Difference (LMTD) Method:** Derivation of LMTD for parallel-flow and counter-flow heat exchangers, LMTD correction factors for multi-pass and cross-flow heat exchangers, analysis of heat exchanger performance using LMTD. (8 hours) 8. **Effectiveness-NTU Method:** Definition of heat exchanger effectiveness and Number of Transfer Units (NTU), effectiveness relations for different flow arrangements, analysis of heat exchanger performance using the Effectiveness-NTU method. (8 hours) 9. **Heat Exchanger Design Considerations:** Selection of heat exchanger type, pressure drop considerations, economic analysis, compact heat exchanger characteristics, heat exchanger networks. (8 hours)

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1. Interactive lectures with real-world examples and discussions. 2. Problem-based learning using realistic engineering challenges. 3. Worked examples and tutorials for guided problem-solving practice. 4. Hands-on laboratory experiments to reinforce theory and develop skills. 5. Numerical simulations and software tools for complex analyses. 6. Individual and group assignments for practice and application. 7. Assessments through quizzes, exams, and potentially online resources.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** **41** **In class tests** **4** **Tutorial** **15** **Final Exam** **3**	63	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, home, memorize** **40** **Preparation for tests** **10** **Homework** **12**	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**125**		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	4	20% (20)	3, 6,10 and 13	LO #1, 2, 4, 5, 8, 9 and 11
	Classwork	4	8% (8)	2, 5, 9 and 12	LO #1, 4 and 10
	Homework	2	8% (10)	6 and 13	LO #6 and 10
	Report	1	4% (4)	14	LO # 11
Summative	**Midterm**	2hr	10% (10)	8	LO #1 - #7

assessment	**Exam**				
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to convection, Newton's Law of Cooling, forced vs. natural convection, velocity and thermal boundary layers,
Week 2	laminar and turbulent flow, dimensionless numbers (Re, Pr, Nu, Gr, Ra).
Week 3	Introduction to force convection External flow (flat plate, cylinder, sphere), internal flow (pipes and ducts), hydrodynamic and thermal entry lengths,
Week 4	Correlations for laminar and turbulent flow in various geometries, constant surface temperature and constant heat flux conditions
Week 5	Introduction to natural convection Buoyancy forces, boundary layer analysis for vertical plates and horizontal cylinders,
Week 6	Correlations for natural convection from various surfaces, Rayleigh number, applications of natural convection.
Week 7	**Mid-term Exam,**
Week 8	Pool boiling regimes (nucleate, transition, film boiling), boiling curve, critical heat flux, correlations for nucleate and film boiling, flow boiling, two-phase flow characteristics
Week 9	Film condensation on vertical and horizontal surfaces, Nusselt theory, dropwise condensation.
Week 10	Correlations for boiling and condensation
Week 11	Types of heat exchangers (parallel-flow, counter-flow, shell-and-tube, compact heat exchangers),
Week 12	Overall heat transfer coefficient, fouling factor, heat exchanger analysis vs. design.
Week 13	Derivation of LMTD for parallel-flow and counter-flow heat exchangers
Week 14	LMTD correction factors for multi-pass and cross-flow heat exchangers, analysis of heat exchanger performance using LMTD
Week 15	Effectiveness-NTU Method: Definition of heat exchanger effectiveness and Number of Transfer Units (NTU), effectiveness relations for different flow arrangements, analysis of heat exchanger performance using the Effectiveness-NTU method
Week 16	Heat Exchanger Design Considerations: Selection of heat exchanger type, pressure drop considerations, economic analysis, compact heat exchanger characteristics, heat exchanger networks.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Heat Transfer (McGraw-Hill) 10th Edition by Jack Holman	Yes
Recommended Texts	Heat and Mass Transfer: A Practical Approach (McGraw-Hill) 2007 by Yunus A. Cengel	Yes
Websites	International Journal of Heat and Mass Transfer | ScienceDirect.com by Elsevier	

Grading Scheme مخطط الدرجات				
Group	**Grade**	التقدير	**Marks %**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 – 100	Outstanding Performance
	B - Very Good	جيد جدا	80 – 89	Above average with some errors
	C – Good	جيد	70 – 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 – 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 – 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

	Ministry of Higher Education and Scientific Research - Iraq University of Diyala College of Engineering Department of Chemical Engineering	

MODULE DESCRIPTORM
وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Chemical & Petrochemical Industries**			**Module Delivery**	
Module Type	CORE			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☐ **Practical** ☐ **Seminar**	
Module Code	CHE -305				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	3		**Semester (s) offered**	5	
Administering Department	Chemical Engineering		**College**	Engineering	
Module Leader	Asst. prof. Dr. Adiba A. Mahmmod		**e-mail**	alnuimiadiba@uodiyala.edu.iq	
Module Leader's Acad. Title	Asst. prof.		**Module Leader's Qualification**	PHD	
Module Tutor	None		**e-mail**		
Peer Reviewer Name	None		**e-mail**		
Review Committee Approval			**Version Number**	1.0	

Relation With Other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	
Module Aims, Learning Outcomes, Indicative Contents and Brief Description أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية مع وصف مختصر			
Module Aims أهداف المادة الدراسية	The main objective of studying Chemical and Petrochemical Industries is to develop students' understanding of the fundamentals of petrochemicals, including olefins and aromatics, and their manufacturing methods. Students will also gain knowledge of most chemical industries and their manufacturing mechanisms, such as glass, sulfuric acid, ceramics, cement, etc. Additionally, students will gain knowledge of the separation processes for most petrochemical products.		
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	**Knowledge and Understanding** Students who successfully finish this course will be eligible to gains knowledge of chemical & petrochemical industries science and its practical applications, including manufacturing methods **:** 1. Enable the student to obtain knowledge in the Production of the basic materials for the petrochemical industry (olefins and aromatics) & Production of Ethylene in all detail . 2. Empowering student with the basics and types of petrochemicals **,** including derivatives of methane, ethylene, propylene, thermoplastics, and thermosets. 3. Enable the student to obtain knowledge in the concepts of synthetic fibers and rubber and provide a sufficient explanation of them. 4. Enabling students to obtain knowledge and understanding of industries of Ceramic , glass & nitric acid . 5. Enable the student to obtain knowledge in the Production of the (Paper**,** cement & Fertilizers) industries . 6. To make the student understand the basics of Carbon Industrial & Sulphuric Acid . 7. Enable the student to obtain knowledge and understanding in the subject of Gases (carbon dioxide, ammonia) & manufacturing of ammonia . 8. Enable the student to obtain knowledge and understanding in the subject of Nitrogen **,** helium and oxygen . 9. Empowering student the concept of pharmaceutical industries . 10. Enabling students to obtain knowledge in the manufacture of vegetable oils **,** Soap & Detergents and Sugar .		
Course Description	During the semester , the student a general overview of the principles and		

	concepts of petrochemicals & chemical industries 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.
Indicative Contents المحتويات الإرشادية	➢ A detailed study of the definition of petrochemicals, in addition to studying their components in a way that enables the student to understand these components correctly, the most important of which are olefins and aromatics. (**8 hour**) ➢ Production of Ethylene and Petrochemicals from methane& Ethylene (**9hour**) ➢ Propylene derivatives Thermoplastic& Thermoset (**12 hour**) ➢ Ceramic , glass, nitric acid pharmaceutical industries (**10 hour**) ➢ Paper, cement & Fertilizers (**12 hour**) ➢ Industrial of carbon & Sulphuric Acid (**8 hour**) ➢ Gases(carbon dioxide, ammonia) (**7 hour**) ➢ Nitrogen, helium & oxygen , Soap &Detergents and Sugar (**9 hour**)
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	• Daily discussion to determine the extent of students' understanding of the material and to evaluate the daily contributions. • Daily exams with various short scientific questions to understand the extent of their understanding of the material. • Giving part of each chapter's grade to homework assignments. • Daily exams (quizzes) and monthly exams for the curriculum and the final exam.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل **In class lectures** **28** **In class tests** **2**	79	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5.26

Tutorial 15 **Lab 30** **Final Exam 4**			
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل **Library, dorm, home memorizing 12** **Preparation for tests14** **Homework20**	46	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.06
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation
تقييم المادة الدراسية

		Time/ Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	**Quizzes**	4	16% (16)	2,5, 7 and 12	LO # 3, 4, ,6, and 10
	Projects / Lab.	1	10%(10)	Continuous	All
	Seminars	1	10% (10)	7	LO # 8
	Home work	2	4% (4)	8	LO # 7
Summative assessment	**Midterm Exam**	1	10% (10)	6	LO # 1-5
	Final Exam	1	50% (50)	16	All
Total assessment			100% (100Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction to petrochemical (olefins and aromatics)
Week 2	Production of Ethylene in all detail (Description , Steam cracking process , cooling process , compression , drying and Acteylene removal
Week 3	Production of Propylene derivatives , Thermoplastic & Thermoset
Week 4	Explain in detail the industries of nitric acid & Ceramic
Week 5	Explain in detail the industries of Paper and pharmaceutical industries .
Week 6	**Midterm one**
Week 7	Description of fibers Industries & Nitrogen fertilizers
Week 8	Production of Industrial fibers and rubber

Week 9	Description of cement & glass Industries
Week 10	Description the industrial of carbon & Sulphuric Acid
Week 11	Explain the concept of Gases(carbon dioxide, ammonia) & manufacture of ammonia
Week 12	Explain the concept of nitrogen , helium and oxygen
Week 13	Description of the manufacture of vegetable oils
Week 14	Explain the manufacture of ceramic
Week 15	Explain the Industry of Soap & Detergents and Sugar
Week 16	**Final Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1. Shereve،s Chemical Process Industries, fifth edition,George T. Austin.	Yes
Websites	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	

APPENDIX:

GRADING SCHEME مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C –Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group	**FX** – Fail	مقبول بقرار	(45-49)	More work required but credit awarded

(0 – 49)	**F –** Fail	راسب	(0-44)	Considerable amount of work required

Note:

NB Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.