MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**English Language**			**Module Delivery**	
Module Type	**B**			☐ **Theory** ☒ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**UOA 1101**				
ECTS Credits	**3**				
SWL (hr/sem)	**75**				
Module Level	1		**Semester of Delivery**	1	
Administering Department	EE		**College**	COE	
Module Leader	Abdullah Khalid Ahmed		**e-mail**	Abdullahkhalid.ahmed@uoanbar.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	M.Sc.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**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 Aims أهداف المادة الدراسية	1. Expand vocabulary and enhance communication in everyday situations. 2. Improve grammar skills for more accurate speaking and writing. 3. Develop better listening comprehension abilities. 4. Enhance spoken English fluency, accuracy, and pronunciation. 5. Improve reading comprehension and extract key information from texts. 6. Strengthen writing skills for well-structured and grammatically accurate compositions. 7. Increase cultural awareness of English-speaking societies and customs.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be able to: 1. Develop academic writing 2. Apply reading skills 3. Expand academic vocabulary through reading 4. Speak through group discussions and debates
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Tenses; Vocabulary (Jobs); Question forms; Writing (informal letter) • Present simple; Present continuous; Have/have to; Writing (Linking words +Describing a person) • Past simple; Past continuous; Have + noun; Writing (a story 1) • Count and noncount nouns; Expression of quantity; Articles; Vocabulary (clothes); Writing (filling in forms); • Verb patterns; Would like and like; Will and going to; Writing (postcard) • What … like? Comparative and superlatives; Vocabulary (adjective formation); Writing (relative closes) • Present perfect; Tense revision; Vocabulary (men and women); Writing (a biography) • have to & got to; have to & should & must; Vocabulary (job description); Writing (formal letter) • Present simple or will; Conditional clauses; Time clauses; Writing (discussing ideas) • Verb patterns; used to; Infinitives; Writing (formal letters) • The passive form; Active and passive; Vocabulary (words with more than one meaning); Writing (email) • Second conditional; might; Vocabulary (phrasal verbs); Writing (a story 2) • Present perfect continuous, word formation, Adverbs, writing letters • Past perfect, Hot verbs, writing a story
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, speaking interactive activities and by considering type of activities that are interesting to the students.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	27	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	2
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**	2	5% (10)	5, 10	LO #1, and 2
	Assignments	5	10% (10)	2, 4, 6, 8, 9, and 10	LO # 1-3
	participations	5	5% (1)	Through lectures	LO# 4
	Report	-	-	-	-
Summative assessment	**Midterm Exam**	2 hr	20% (20)	7	LO # 1-3
	Final Exam	2hr	60% (60)	After 16	LO # 1-3
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري		
	Material Covered	
Week 1	●Tenses ●Using a bilingual dictionary	● Questions ● Social expressions-1
Week 2	●Present tenses ●Collection: daily life	● Have/ have got ● Making conversation
Week 3	●Past tenses ●Time expressions	● Word formation ● Personal information
Week 4	●Much/ many- ●a few, a little, a lot of ●Shopping	● some/ any ● Articles ● Prices
Week 5	●Verb patterns-1 ●Hot verbs	● Future forms ● How do you feel?
Week 6	●What ……. Like? ●Synonyms and antonyms	● Comparatives and superlatives ● Directions
Week 7	**Mid-term Exam**	
Week 8	●Present perfect ●Adverbs word pairs	● For, since ● Short answers
Week 9	●Have (go) to ●Words that go together	● Should/ must ● At the doctor's
Week 10	●Time clauses ●Hot verbs	● If ● In the hotel
Week 11	●Verb patterns-2 ●-ed/ -ing adjectives	● Manage to, used to ● Exclamations
Week 12	●Passives ●Notices	● Verbs and nouns that go together
Week 13	●Second conditional ●Phrasal verbs	● Might ● Social expressions-2
Week 14	●Present perfect continuous ●word formation	● Adverbs ● writing letters
Week 15	●Past perfect ● Hot verbs	● writing a story
Week 16	**Preparatory for final exam**	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	John & Liz Soars, "New Headway Plus- Pre-Intermediate Student's Book", 10th ed 2012	Yes

Recommended Texts	-Raymond Murphy; "English Grammar in Use", 4th edition 2012 Understanding and Using English Grammar, Vol. A, 4th Edition 4th Edition	No
Websites	https://sachtienganhhn.net/pdf-embed/life-pre-intermediate-b1-student-book.html https://owl.purdue.edu/owl/research_and_citation/apa_style/apa_style_introduction.html	

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Computer Science**			**Module Delivery**	
Module Type	**B**			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	UOA 1102				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	1		**Semester of Delivery**	1	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Name:Suha Mahdi Salih		**e-mail**	Suha.Mahdi82@uoanbar.edu.iq	
Module Leader's Acad. Title	Teacher .Assistant		**Module Leader's Qualification**	MSc	
Module Tutor	Name:Suha Mahdi Salih		e-mail	Name:Suha Mahdi Salih	
Peer Reviewer Name	Name:Suha Mahdi Salih		**e-mail**	Name:Suha Mahdi Salih	
Scientific Committee Approval Date	01/06/2023		**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 presents an overview of fundamental computer science topics and an introduction to computer programming. Overview topics include an introduction to computer science and its history, computer hardware, operating systems, digitization of data, computer networks, office and application.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Students can: • Analyze, design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs. • Identify problems and formulate solutions for systems. • Communicate effectively with a range of audience. • Work effectively as part of a team to develop and deliver quality software artifacts. • Design solutions using approaches that integrate ethical, social, legal, and economic responsibilities 1.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. General Definitions. System, Computer System, Program, Hardware, Software, …etc. - Hardware Components. CPU, Main Memory, I/O, System Bus. CPU Structure (ALU, Registers, Control Unit, CPU Interconnection). Basic Computer Functions (Data Processing,) - Memory System Input/ output. Input Devices. Output Devices (Display Screens, Printers, Speakers). Mass Storage or External Storage - Representation of Information on Computer. Numeric Data. Number System (Decimal, Binary, Octal, Hexadecimal). Computer safety and licenses. Operating systems. Microsoft word, Microsoft PowerPoint, introduction to excel sheet: creation and manipulation. Advanced Microsoft word. Basic applications of Internet

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

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	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**	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 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	١-مكونات الحاسوب ٢-الاجزاء المادية للحاسوب ٣-اجهزة الادخال (input devices) ٤-اجهزة الاخراج (output devices) ٥-صندوق الحاسوب (computer case) ٦-الكيان البرمجي (software) ٧-الكيان المادي (hardware) مواصفات حاسوبك الشخصي
Week 2	١-مقدمة عن نظام التشغيل ٢-وظائف نظام التشغيل ٣-نظام التشغيل ويندوز ١٠ (مكونات سطح المكتب, قائمة ابدء, شريط المهام ومنطقة الاعلام) ٤-المجلدات والملفات ٥-بعض العمليات والاجراءات على النوافذ ٦-خلفيات سطح المكتب

	لوحة التحكم وكيفية ادارة الحاسوب من خلالها
Week 3	١-مقدمة عامة ٢-تشغيل برنامج Word ٣-واجهة برنامج Word ٤-تبويب ملف File Tab ٥-تبويب الصفحة الرئيسية Home Tab ٦-تبويب تخطيط الصفحة Page layout View Tabتبويب عرض
Week 4	٥,١ ١- تبويب ادراج ٢-مجموعة صفحات (Pages) ٣-مجموعة الجداول (
Week 5	١-تبويب ادوات الجدول (design and layout) ٢-تبويب ادوات الصورة (picture tools) ٣-مجموعة ارتباطات (Hyperlinks)
Week 6	١-مجموعة راس وتذييل الصفحة ٢-مجموعة نص ٣-مجموعة رموز
Week 7	١-تبويب مراجع (references Tab) i. مجموعة جداول المحتويات (Table of contents) ii. مجموعة الحواشي السفلية (Footnotes) iii. مجموعة فهرس (index) ٢-مجموعة جدول المصادر
Week 8	١-تبويب مراجعة iv. مجموعة تدقيق (Proofing) v. مجموعة اللغة (language) vi. مجموعة تعليقات (comments) vii. مجموعة تعقب (Tracking) ٢-مجموعة تغييرات (changes)
Week 9	١-مقدمة عامة ٢-تشغيل برنامج PowerPoint ٣-واجهة برنامج PowerPoint ٤-تبويب ملف (File Tab) ٥-تبويب الصفحة الرئيسية (Home Tab)
Week 10	١-مجموعة شرائح (Slides) ٢-مجموعة خط (Fonts) ٣-مجموعة فقرة ٤-مجموعة تحرير

Week 11	١-تبويب الخلفية تبويب عرض (view) viii. مجموعة طرق العرض التقديمية (presentation) b. انشاء شريحة رئيسية 2-ادراج الصور والجداول وطرق تعديلها-
Week 12	١-مقدمة عامة a. تشغيل برنامج Excel b. واجهة برنامج Excel c. تبويب ملف File Tab d. تبويب الصفحة الرئيسية Home Tab
Week 13	١-مجموعة الحافظة Clipboard i. مجموعة رقم Number ii. مجموعة انماط Styles iii. مجموعة خلايا Cells iv. مجموعة تحرير Editing 2-Tab Insertتبويب ادراج
Week 14	١-مجموعة الجداول Tables ٢-مجموعة رسومات v. Illustrations ٤-مجموعة مخططات Charts ٥-مجموعة عامل التصفية Filter ٦-مجموعة نص Text ٧-مجموعة رموز Symbols
Week 15	١-تبويب تخطيط الصفحة Page layout vi. مجموعة نسق Themes vii. مجموعة اعداد الصفحة Page setup مجموعة تغير الحجم لغرض الملائمة Select to Fit viii. مجموعة خيارات الورقة Sheet Options ٢-Arrangeمجموعة ترتيب
Week 16	١-مكونات الحاسوب ٢-الاجزاء المادية للحاسوب ٣-اجهزة الادخال (input devices) ٤-اجهزة الاخراج (output devices) ٥-صندوق الحاسوب (computer case) ٦-الكيان البرمجي (software) ٧-الكيان المادي (hardware) مواصفات حاسوبك الشخصي

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered

Week 1	Lab 1:مقدمة عن تطبيقات انظمة التشغيل
Week 2	Lab 2: word تطبيقات عن
Week 3	Lab 3: wordتطبيقات عن
Week 4	Lab 4: power pointتطبيقات عن
Week 5	Lab 5: power pointتطبيقات عن
Week 6	Lab 6: Excel تطبيقات عن
Week 7	Lab 7: Excel تطبيقات عن

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	**كتاب اساسيات الحاسوب وتطبيقاته المكتبية**	No
Recommended Texts		
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Calculus I**			**Module Delivery**	
Module Type	S			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	COE 1202				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		1	**Semester of Delivery**		1
Administering Department			**College**	Engineering	
Module Leader	Dr Moustafa Adil Al-Damook		**e-mail**	mustafa.adil@uoanbar.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		PhD
Module Tutor	Dr Moustafa Adil Al-Damook		**e-mail**	mustafa.adil@uoanbar.edu.iq	
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date		/ /2023	**Version Number**		

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module		**Semester**	
Co-requisites module		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. Tangent line and slope problems. 2. Drawing of functions. 3. Limit and continuity of functions. 4. Limits at infinity, horizontal asymptote, infinite limits, vertical asymptotes and drawing of functions. 5. Derivative of functions and rates of change. Differentiation of polynomials, product and quotient rules. 6. Derivatives of exponential, logarithmic, and trigonometric functions. 7. Chain rule and implicit differentiations. 8. Applications of differentiation maximum and minimum values (the mean value theorem). 9. Derivative of hyperbolic functions and indeterminate forms and L'hospital's rule. 10. Optimization problems and anti-derivative of functions.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Calculate Tangent line and slope problems. 2. Apply Drawing of functions. 3. Estimate Limit and continuity of functions. 4. Find Limits at infinity, horizontal asymptote, infinite limits, vertical asymptotes and drawing of functions. 5. Derivative of functions and rates of change. Differentiation of polynomials, product and quotient rules. 6. Derivatives of exponential, logarithmic, and trigonometric functions. 7. Chain rule and implicit differentiations. 8. Applications of differentiation maximum and minimum values (the mean value theorem). 9. Derivative of hyperbolic functions and indeterminate forms and L'hospital's rule. 10. Optimization problems and anti-derivative of functions.
Indicative Contents المحتويات الإرشادية	

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The most important strategies that will be adopted in delivering this module are: - Allow students to actively participate in the learning process with class discussions and exercises that support the initiative. - Incorporate flexible seating into my classroom - Knowledge application and Extended critical thinking - **Do Summative assessments** Occurs at end of chapter - **Do** Formative Assessment occurs through chapter to Covers complete content areas - Case-Based Learning.

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
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	87	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
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)	4, 9	LO # 1, 2,3,9 and 10
	Assignments	2	5% (5)	3, 12	LO # 4,5 and 6
	Report	1	5% (5)	13	LO # 7 and 8
	Midterm Exam	3 hr	10% (10)	7	LO # 1-7
Summative assessment	**Final Exam**	3 hr	50% (60)	16	All
			100		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Functions
Week 2	Functions
Week 3	Limits
Week 4	Limits
Week 5	Differentiation rules
Week 6	Differentiation rules
Week 7	The Chain Rule, Implicit Differentiation
Week 8	Applications of differentiation
Week 9	Applications of differentiation
Week 10	Exponential and logarithmic functions.
Week 11	Trigonometric functions and their derivatives
Week 12	Hyperbolic functions and their derivatives
Week 13	Advanced Applications of differentiation
Week 14	Derivative and anti- derivative functions
Week 15	Derivative and anti- derivative functions
Week 16	**Final Exam**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1. Stewart, J., Clegg, D. K., & Watson, S. (2020). Calculus: early transcendentals. Cengage Learning.	
Recommended Texts	. Thomas, G. B., Haas, J., Heil, C., & Weir, M. (2018). Thomas' Calculus. Pearson Education Limited.	
Websites		

Grading Scheme مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
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MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Genral Chemistry**			**Module Delivery**	
Module Type	**Support**			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**CHE1203**				
ECTS Credits	**7**				
SWL (hr/sem)	**175**				
Module Level			**Semester of Delivery**	1	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Abbas Hassan Faris		**e-mail**	abbashasan@uoanbar.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Dr. Hamad Khalifa		**e-mail**	habdulkadir56@uoanbar.edu.iq	
Scientific Committee Approval Date	01/06/2023		**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 goals of this course are to enable students to: 1. Scientific reasoning and quantitative analysis. Our majors will be able to apply chemical concepts to solve qualitative and quantitative problems. 2. Laboratory practice and safety. In order to learn the ways in which new scientific knowledge is created, our majors will experience how chemists interpret chemical and physical phenomena through experimental investigation. They will develop and apply the appropriate lab skills and instrumentation to solve chemical problems.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be able to: 1. Define the structure of atoms in terms of the nucleus with protons, neutrons, & electrons. 2. Write and balance chemical equations, name inorganic compounds and ions and describe the properties of the main group elements. 3. Carry out chemical calculations, including mass relations in chemical reactions, limiting reagent & reaction yield calculations, and calculations of reactions taking place in solution. 4. Understand the concept of oxidation-reduction, calculate oxidation numbers, and balance redox reactions. 5. Apply the ideal gas law in solving problems involving the gas phase 6. Solve problems in chemical thermodynamics and calorimetry. 7. Predict the electronic structure of atoms and ions from quantum theory, and9) relate the position of an element in the periodic table to its electronic structure and to the physical and chemical properties of the elements. 8. Describe the principles of chemical bonding and write Lewis structures. 9. Predict the geometry of the electron pairs and the shape of molecules using VSEPR theory, predict bond polarity and molecular dipoles. 10. Describe the valence bond theory, predict the hybridization of atoms in molecules, and describe bonding in molecules with single, double and triple bonds in terms of and π bonds, and delocalized molecular orbitals.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A: 1- Handling Numbers. Dimensional Analysis in Solving Problems Recognize chemical safety and hazardous materials icons

	2- Atomic Number. Mass Number. and isotopes. The Periodic Table. Molecules and Ions. Describe laboratory instruments and some basic techniques used in the chemistry laboratory, including balances and standard volumetric equipment 3- Chemical Formulas. Naming Compounds. Atomic Mass. Vogadro's number and Molar Mass of an Element. 4- Chemical Reactions and Chemical Equations. 5- Describe how to Prepare accurate laboratory reports of their experimental results; Amounts of Reactants and Products; limiting Reagent Calculations; Reaction Yield; General Properties of Aqueous Solutions. Precipitation Reactions. Acid-Base Reactions; Oxidation-Reduction Reactions; Concentration of Solutions. 6- Acid-Base Titrations, Cases Pressure. 7- The ideal Gas Equation; Gas Stoichiometry; Partial Pressures; The Nature of Energy and types of energy 8- Energy Changes in Chemical Reactions; introduction to Thermodynamics. Enthalpy of Chemical Reactions; Calorimetry; 9- Standard Enthalpy of Formation and Reaction From Classical Physics to Quantum Theory; Bohr's Theory of the Hydrogen Atom; Quantum Numbers; Atomic OrbitalsElectron Configuration; 10- Development of the Periodic Table; Periodic Classification of the Elements; Periodic Variation in Physical Properties; Ionization Energy; Electron Affinity Lewis Dot Symbols; The ionic Bond; The Covalent Bond; Electro negativity; Writing Lewis structure Formal Charge and Lewis Structures. 11- The Concept of Resonance. Exceptions to the Octet Rule Bond Energy 12- Molecular Geometry; Dipole Moment; Spectrophotometric Analysis of tetracycline; Valence Bond Theory. Hybridization of Atomic Orbital's. Hybridization in Molecules Containing Double and Triple Bonds. Delocalized Molecular Orbital's Part B: 1- Types of analysis in analytical chemistry and their uses. Units for expressing concentration. 2- preparing solutions,standard solution,amounts of reactants and products. 3- Chemical equilibrium and reversible reactions,thermodynamics & chemical equilibrium 4- Equilibrium constants for chemical reactions. 5- Describe how to Prepare accurate laboratory reports of their experimental results 6- Equilibrium constants for chemical reactions 7- Electrochemistry, relationship between cell potential and the equilibrium constants relationship between ΔG, K,and E0cell . the Nernst equation. 8- Volumetric analysis their uses and classification, titrimetric analysis calculations. 9-Acid-base titration 10- Precipitation titration 11- Complexometric titration 12- Oxidation-reduction titration 13- Gravimetric analysis.

	14- Introduction and applications of industrial analysis method.

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, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	93	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	82	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
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	10% (10)	3 and 10	LO #1, #2 and #3, #4
	Assignments	1	10% (10)	2 and 12	LO #5, #6
	Projects / Lab.	1	10% (10)	Continuous	LO #1, #2 and #3, #4
	Report	0	0 % (0)	-	-
Summative assessment	**Midterm Exam**	2hr	20% (20)	7	LO #1, #2 and #3, #4, #5
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	MEASUREMENTS IN CHEMISTRY
Week 2	Problem Solving in Chemistry - Dimensional Analysis
Week 3	Atoms, Molecules and Ions
Week 4	Mass Relationships in Chemical Reactions
Week 5	Reactions in Aqueous Solutions
Week 6	Gasses
Week 7	Thermochemistry
Week 8	Quantum Theory and the Electronic Structur of Atoms
Week 9	Chemical Bonding
Week 10	Electrochemistry
Week 11	Volumetric Methods of Analysis
Week 12	Titrations Based on Acid-Base Reactions
Week 13	Titrations Based on Precipitation Reactions
Week 14	Titrations Based on Complexation Reactions
Week 15	**Titrations Based on Redox reactions**
Week 16	**Gravimetric Methods of Analysis**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1:
Week 2	Lab 2:
Week 3	Lab 3:
Week 4	Lab 4:
Week 5	Lab 5:
Week 6	Lab 6:
Week 7	Lab 7:

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Introductory Chemistry Essentials, Nivaldo J. Tro	
Recommended Texts	Chemistry. Steven S. Zumdahl, Susan A. Zumdahl, Donald J. DeCoste	
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	PRINCIPLES OF CHEMICAL ENGINEERING I			**Module Delivery**	
Module Type	C			☒ **Theory** ☒ **Lecture** ☒ **Tutorial** ☐ **Lab** ☐ **Practical** ☐ **Seminar**	
Module Code	CHE 1301				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		1	**Semester of Delivery**		1
Administering Department		Type Dept. Code	**College**	Type College Code	
Module Leader	Hamed A. Fayyadh		**e-mail**	h.alfalahi@uoanbar.edu.iq	
Module Leader's Acad. Title		Assist. Prof.	**Module Leader's Qualification**		Ph.D.
Module Tutor			**e-mail**	E-mail	
Peer Reviewer Name		Dr. Omer Mustafa	**e-mail**	E-mail	
Scientific Committee Approval Date		01/06/2023	**Version Number**		

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	There is no prerequisite	**Semester**	-
Co-requisites module	There is no co- prerequisite	**Semester**	-

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	Course objectives will guide the participant to develop key concepts and techniques to design equipment in process plant. These key concepts can be utilized to make design and operating decisions, training, and development. Course such as these should be almost a requirement for engineers and can utilized as refresher for engineers with experience. 1. To introduce students, you to the principles concepts of thermal systems engineering using several contemporary applications. 2. To acquaint students with what material and energy balances are, and how to formulate and solve them. 3. To develop a fundamental understanding of chemical engineering processes. This objective is accomplished in three directions; • Conventional problems that reinforced students understanding of the basic concepts and principals (included in each lecture). • Most problems requiring significant numerical computations can be solved with a personal computer using either POLYMATH or MATHLAB. • To develop creative skill. A number of homework problems have been included that are designed to enhance critical thinking skills.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	At the end of the course, the student will be able to: 1. As the design of the chemical process represents a productive and commercial goal, so we expect through this program that the engineer will be familiar with the most basic principles of chemical process engineering that he needs to reach the optimal design of the chemical process. 2. The student should be able to develop industrial, chemical or transformational processes used to produce and develop chemical, pharmaceutical and food products. 3. The engineer should be a pioneer in green engineering by choosing an economical and controlled chemical process without leaving an impact on the environment. 4. The ability to choose the industrial process and conduct a mathematical analysis to balance the materials and energies during it, its conditions, the chemicals used in it, and the equipment needed to complete it. 5. The ability to use some personal computer such as HYSIS, POLYMATH and MATHLAB because some problems requiring significant numerical computations can be solved with these programs.

Indicative Contents المحتويات الإرشادية	**Part One: Introduction to Chemical Engineering Processes** 1. INTRODUCTION TO CHEMICAL ENGINEERING PROCESSES (Introductory Aspect to Chemical Engineering, Introductory Aspect to Chemical Engineering Industries, The Plain of Chemical Process Development) 2. DIMENSIONS, UNITS, AND THEIR CONVERSION (Units and Dimensions, Operations with Units, Conversion of Units and Conversion Factors, Force, Dimensional Consistency (Homogeneity), Significant Figures) 3. MOLES, DENSITY, AND CONCENTRATION (The Mole, Density, Specific Gravity, Flow Rate, Mole Fraction and Mass Fraction, Analysis of Multicomponent Solutions and Mixture, Concentration) 4. CHOOSING A BASIS, TEPERATURE, PRESSURE AND ITS CONVERSION (Choosing a Basis, Temperature, Pressure) **Part Two: Material Balance** 5. INTRODUCTION TO MATERIAL BALANCES/Terminologies (The Concept of a Material Balance, Open and Closed Systems, Steady-State and Unsteady-State Systems, Multiple Component Systems) 6. GENERAL STRATEGY FOR SOLVING MATERIAL BALANCES (Accounting for Chemical Reactions in Material Balances, Material Balances for Batch and Semi-Batch Processes, A General Strategy for Solving Material Balance Problems) 7. SOLVING MATERIAL BALANCE PROBLEMS FOR SINGLE UNITS WITHOUT REACTION (Analyze a problem statement, Apply the general strategy for solving material balance problem) 8. THE CHEMICAL REACTION EQUATION AND STOICHIOMETRY (Stoichiometry, Stoichiometric coefficients Terminology for Applications of Stoichiometry) 9. THE CHEMICAL REACTION EQUATION AND STOICHIOMETRY/ Other Terminologies (Limiting and Excess Reactants, Conversion and degree of completion, Selectivity, Yield) 10. MATERIAL BALANCES FOR PROCESSES INVOLVING REACTION by SPECIES MATERIAL BALANCES (Species Material Balances for Processes Involving a Single Reaction, Species Material Balances for Processes Involving Multiple Reactions) 11. MATERIAL BALANCES FOR PROCESSES INVOLVING REACTION by ELEMENT MATERIAL BALANCES (Element Material Balances for Processes Involving Multiple Reactions) 12. MATERIAL BALANCES FOR SINGLE UNITS PROCESSES INVOLVING COMBUSTION (Terminologies of Combustion, Examples on Combustion) 13. MATERIAL BALANCES FOR PROCESSES INVOLVING RECYCLE WITH OUT CHEMICAL REACTION (Introduction, Recycle without Chemical Reaction) 14. MATERIAL BALANCES FOR PROCESSES INVOLVING RECYCLE WITH CHEMICAL REACTION (Recycle with Chemical Reaction, Overall fraction conversion, Single - pass fraction conversion) 15. MATERIAL BALANCES FOR PROCESSES INVOLVING BYPASS AND PURG WITH AND WITHOUT CHEMICAL REACTION

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Through the Chemical Process Engineering Curriculum-I, the student learns about the most important technologies used in chemical process engineering calculations for the purpose of operating production devices and thus for the entire chemical process, as well as energy conservation and rationalization, and thus realizing all the causes behind manufacturing problems. In this part of the course, the student learns how to apply the law of conservation of mass to elements, devices, and units by material balances for the quantities entering and leaving the device. The aim of these calculations is to calculate the capacity of the different units and to shorten the devices needed to measure and design these quantities. And all this is done in the absence or presence of a chemical reaction.

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	87	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**150**		

Module Evaluation تقييم المادة الدراسية					
		Time /Number (hr)	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	1	20% (20)	5, 10	LO 1 to 2
	Assignments	2	5% (5)	2,5,12	LO 1 to 4
	Special Problem	2	5% (5)	13	LO 4 to 5
Summative assessment	**Midterm Exam**	2	10% (10)	12	LO 1 to 4
	Final Exam	3	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	INTRODUCTION TO CHEMICAL ENGINEERING PROCESSES
Week 2	DIMENSIONS, UNITS, AND THEIR CONVERSION
Week 3	MOLES, DENSITY, AND CONCENTRATION
Week 4	CHOOSING A BASIS, TEPERATURE, PRESSURE AND ITS CONVERSION
Week 5	INTRODUCTION TO MATERIAL BALANCES/ Terminologies
Week 6	GENERAL STRATEGY FOR SOLVING MATERIAL BALANCES
Week 7	SOLVING MATERIAL BALANCE PROBLEMS FOR SINGLE UNITS WITHOUT REACTION
Week 8	THE CHEMICAL REACTION EQUATION AND STOICHIOMETRY
Week 9	THE CHEMICAL REACTION EQUATION AND STOICHIOMETRY/ OTHER TERMENOLOGIES
Week 10	MATERIAL BALANCES FOR PROCESSES INVOLVING REACTION by SPECIES MATERIAL BALANCES
Week 11	MATERIAL BALANCES FOR PROCESSES INVOLVING REACTION by ELEMENT MATERIAL BALANCES
Week 12	MATERIAL BALANCES FOR SINGLE UNITS PROCESSES INVOLVING COMBUSTION
Week 13	MATERIAL BALANCES FOR PROCESSES INVOLVING RECYCLE WITH OUT CHEMICAL REACTION
Week 14	MATERIAL BALANCES FOR PROCESSES INVOLVING RECYCLE WITH CHEMICAL REACTION
Week 15	MATERIAL BALANCES FOR PROCESSES INVOLVING BYPASS AND PURGE WITH OUT CHEMICAL REACTION AND WITH CHEMICAL REACTION
Week 16	**FINAL EXAMINATION**

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	D. M. Himmelbiau, J. B. Riggs. Basic Principles and Calculations in Chemical Engineering (7th Ed.), Practice Hall (2004).	Yes
Recommended Texts	-	-
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Fundamentals of Electrical Engineering I			Module Delivery	
Module Type	S			☒ Theory ☒ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	COE 1201				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	1		Semester of Delivery	1	
Administering Department	Electrical		College	College of Engineering	
Module Leader	Naser Al-Falahy		e-mail	Naser.falahy@uoanbar.edu.iq	
Module Leader's Acad. Title	Assist. Prof		Module Leader's Qualification	PhD	
Module Tutor	Sameh Jassam Mohammed		e-mail	samehjassam@uoanbar.edu.iq	
Peer Reviewer Name			e-mail		
Scientific Committee Approval Date	30/June/2023		Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module		Semester	
Co-requisites module		Semester	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. To develop problem solving skills and understanding of circuit theory through the application of techniques. 2. To understand voltage, current and power from a given circuit. 3. This course deals with the basic concept of electrical circuits. 4. This is the basic subject for all electrical and electronic circuits. 5. To understand Kirchhoff's current and voltage Laws problems. 6. To perform mesh and Nodal analysis.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Recognize how electricity works in electrical circuits. 2. List the various terms associated with electrical circuits. 3. Summarize what is meant by a basic electric circuit. 4. Discuss the reaction and involvement of atoms in electric circuits. 5. Describe electrical power, charge, and current. 6. Define Ohm's law. 7. Identify the basic circuit elements and their applications. 8. Discuss the operations of sinusoid and phasors in an electric circuit. 9. Discuss the various properties of resistors, capacitors, and inductors. 10. Explain the two Kirchoff's laws used in circuit analysis. 11. Identify the capacitor and inductor phasor relationship with respect to voltage and current
Indicative Contents المحتويات الإرشادية	DC circuits – Current and voltage definitions, Passive sign convention and circuit elements, Combining resistive elements in series and parallel. Kirchhoff's laws and Ohm's law. Anatomy of a circuit, Network reduction, Introduction to mesh and nodal analysis.

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, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

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
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	87	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
As		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	10% (10)	5, 10	
	Assignments	2	5% (5)	2, 12	
	Projects / Lab.	1	10% (10)		
	Report	1			
Summative assessment	Midterm Exam	2hr	15% (15)	8	
	Final Exam	3hr	60% (60)	16	
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Week	Material Covered
Week 1	Introduction - Difference between Circuit Theory and Field Theory
Week 2	Basics of Network Elements
Week 3	Charge, Current and Voltage
Week 4	Power and Energy
Week 5	Resistance and Resistivity and Ohm's Law
Week 6	Kirchhoff's Laws
Week 7	Series Resistors and Voltage Division
Week 8	Parallel Resistors and Current Division
Week 9	Midterm Exam 1
Week 10	Wye-Delta Transformations
Week 11	Circuit Analysis - Nodal and Mesh
Week 12	Linearity and Superposition
Week 13	Source Transformations
Week 14	Thévenin and Norton Equivalents
Week 15	Maximum Power Transfer
Week 16	Midterm Exam 2

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
Week	Material Covered
Week 1	Lab 1: Equipment Familiarization
Week 2	Lab 2: Ohm's Law

Week 3	Lab 3: Kirchhoff's Laws
Week 4	Lab 4: Series Resistors and Voltage Division
Week 5	Lab 5: Parallel Resistors and Current Division
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Fundamentals of Electric Circuits, C.K. Alexander and M.N.O Sadiku, McGraw-Hill Education	Yes
Recommended Texts	DC Electrical Circuit Analysis: A Practical Approach Copyright Year: 2020, dissidents.	No
Websites	https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering	

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Human Rights & Democracy**			**Module Delivery**	
Module Type	**B**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**UOA 1103**				
ECTS Credits	**2**				
SWL (hr/sem)	**50**				
Module Level		1	**Semester of Delivery**		2
Administering Department			**College**	Engineering	
Module Leader	Muanna W Naji		**e-mail**	muanna.naji@uoanbar.edu.iq	
Module Leader's Acad. Title		Assistant Professor	**Module Leader's Qualification**		Ph.D.
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date		01/06/2023	**Version Number**		1.0

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى			
Prerequisite module		**Semester**	
Co-requisites module		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	This course is designed to give the student a definition of human rights and democracy idiomatically, the legitimacy of the origin of the right in the view of Islamic law, the pillars of the right and its types, personal freedom, intellectual freedom, economic rights and freedoms, Islam and slavery, the goals of human rights, the use of freedom and the general legitimate right, the right of a Muslim to His Muslim brother, the rights of parents, the right neighbor, the right of women, human rights in the divine religions, religious tolerance in Islam. thinking skills 1. Work on developing the intellectual property of the student. 2. Ensuring the student's personal development at the academic level. 3. Drawing ways of intellectual success to achieve personality building on the (family, social, academic, and professional) levels. 4. Learn the art of dealing with the above character building levels.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Explain the concept of "human rights and democracy" 2. The status of human rights and freedoms in Islam 3. Define and describe the relationship between human rights and democracy
Indicative Contents المحتويات الإرشادية	**Course Topics:** 1. Introducing human rights, democracy and the principle of freedoms. [Two hours] 2. The origin of right and freedom from the point of view of Islamic law, and the general concept. [3 hours] 3. Elements and types of human rights and freedoms. [8 hours] 4. Economic and political rights and freedoms. [3 hours] 5. Islam and slavery. [1 hour] 6. The objectives of human rights and democracy. [4 hours] 7. The project of using freedom and public right. [2 hours] 8. The right of a Muslim and humanity. [2 hours]

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	33	**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
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	50		

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Raise the intellectual level of students, which is the importance of human rights when it is reflected on the individual, society and the state

Module Evaluation تقييم المادة الدراسية					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	3, 10	LO #4, 6, 8 and 10
	Assignments	0			
	Projects / Lab.	0			
	Report	2	10% (10)	13	LO # 5, 7 and 13
Summative assessment	**Midterm Exam**	2 hr	20% (20)	7	LO # 1-7
	Final Exam	3hr	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري

	Material Covered
Week 1	The Universal Declaration of Human Rights and other countries speak of human rights over the individual, society and the state. Clarifying the meaning of right, duty, responsibility and guarantees of human rights before the judiciary.
Week 2	Sections of human rights in law and Sharia, statement of the rights of God Almighty and guarantees of human rights. It includes sections of the rights of the individual over society such as the right to protect life, honor and mind, and the right to protect money and property.
Week 3	The right to equality before the law and the right to equality and justice among individuals. The right of the individual to work, learn, express his opinion and freedom of thought.
Week 4	Clauses of preserving the freedoms contained in the Universal Declaration of Human Rights, and the impact of the study. Explanation of the meaning of freedom and democracy and the types and divisions of freedoms.
Week 5	Freedoms related to the material rights of an individual, including personal freedom. Freedoms related to the material rights of an individual, including civil liberties.
Week 6	Freedom of movement, residence and ownership. Freedoms related to the moral rights of the individual.
Week 7	Mid-term Exam + Unit-Step Forcing, Forced Response, the RLC Circuit.
Week 8	Statement of the sanctity of the home and the right of the individual to move. The rights of society over the individual include the right to freedom of belief and life, the right to honor protection, work and education.
Week 9	Ensuring equality before the law and the judiciary, freedom of opinion and thought, and protection of the mind The right to protection of property and travel.
Week 10	The rights of the individual over the individual, including social rights. Financial rights and its importance in ensuring social life.
Week 11	Finally, emphasizing the importance of commitment to applying human rights and their impact on the individual, society and the state.
Week 12	Freedom of belief, freedom of opinion and expression, and freedom of education. Political freedom, the culture of dialogue and its impact on proving freedom of opinion.
Week 13	One of the heroes of enslaving people and proving freedom for individuals. Highlighting the freedom of women and beautifying them in adhering to the teachings of faith and proving the importance of applying the principle of freedoms among individuals.
Week 14	Individual and international interest in applying the principle of freedoms. Rights and freedoms are two interrelated principles. The role of the individual, society and the state in establishing the principle of human rights and freedoms. And a statement of the negatives in the event of non-application of the principle of freedoms.
Week 15	Iraq and international treaties in the field of human rights and Iraq's position in eliminating dictatorship and racism and work to preserve public rights and public money and eliminate financial and administrative corruption.
Week 16	Preparatory week before the final Exam.

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Lectures on human rights, freedoms and democracy	Yes
Recommended Texts	1. Human rights and freedoms. Prof. Dr. Mustafa Al-Zalmi. 2. Some contemporary published research involving human rights and books on the Universal Declaration of Human Rights	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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**ENGINEERING DRAWING**			**Module Delivery**	
Module Type	S			☒ Theory ☒ Lecture ☒ Lab ☐ tutorial ☐ Practical ☐ Seminar	
Module Code	**COE 1205**				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	1		**Semester of Delivery**	2	
Administering Department	DWE		**College**	ENG	
Module Leader	Dr.Ahmed Adnan Saeed		**e-mail**	Ahmed.adnan@uoanbar.edu.iq	
Module Leader's Acad. Title	Lecturar		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Ahmed Ashoor		**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Construction Building	**Semester**	5
Co-requisites module		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1. 1. Recognize the value of engineering graphics as a language of communication. 2. Infer the nature of engineering graphics, the relationships between 2D and 3D environments. 3. Visualize, comprehend, and deduce wide variety of objects, drawing the missing views/section views, and orthographic projections of an object. 4. Produce three dimensional drawings utilizing CAD software.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	2. Understand the engineering drawing and measurement 3. Understand drawing with Autocad programme
Indicative Contents المحتويات الإرشادية	**1- Drawing and Measurement** 1.1- Standards of line type 1.2- engineering operation with draw 1.3- Dimensional Analysis 1.4- engineering projects 1.5- Sections 1.6- Isometric **2- Autocad** 2.1- principles of draw 2.2- items of Modify 2.3- Dimensions 2.4- text

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy that will be adopted in the delivery of engineering drawing course is to encourage students to understand and draw of principles engineering drawing and use basic tools, while improving and expanding their critical thinking skills at the same time. This will be achieved through classes and interactive tutorials and by looking at the types of simple experiments that involve investigating operations of engineering drawing.

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	87	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
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)	5 and 10	LO #1, #2
	Assignments	2	10% (10)	3 and 12	LO #3, #5
	studio.		10%(10)	3-13	
	Report				
Summative assessment	**Midterm Exam**	2hr	20% (20)	8 and 12	LO #1 - #4
	Final Exam	3hr	50% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي العملي	
	Material Covered
Week 1	Introduction: graphic language, standards, instruments, letters…etc
Week 2	Basics for interpreting drawings, line types, types of drawings and sketches
Week 3	Rules for using calipers to draw circles
Week 4	Engineering processes and their application for drawing geometric shapes
Week 5	Applications on the computer using the AutoCAD program
Week 6	Orthographic views. Deducing front, top, and side views from a pictorial
Week 7	Dimensioning and Drawing Scale
Week 8	Applications on the computer using the AutoCAD program
Week 9	Sectional views: full and half sections

Week 10	Applications on the computer using the AutoCAD program
Week 11	Applications on the computer using the AutoCAD program
Week 12	Drawing a missed view from given two views
Week 13	Applications on the computer using the AutoCAD program
Week 14	Pictorial sketching: isometric and oblique
Week 15	Applications on the computer using the AutoCAD program
Week 16	**Preparing to final exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Principles of Autocad
Week 2	Items of Draw
Week 3	Items of Modify
Week 4	Items of Dimensions
Week 5	Texts
Week 6	Drawing of shape
Week 7	Drawing of shape

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	كتاب الرسم الهندسي – عبد الرسول علي	yes
Recommended Texts		No
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Calculus II			**Module Delivery**	
Module Type	S			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	COE 1204				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	1		**Semester of Delivery**	2	
Administering Department	.....		**College**	Engineering	
Module Leader	Dr Moustafa Adil Al-Damook		**e-mail**	mustafa.adil@uoanbar.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	PhD	
Module Tutor	Dr Moustafa Adil Al-Damook		**e-mail**	mustafa.adil@uoanbar.edu.iq	
Peer Reviewer Name	.....		**e-mail**	.	
Scientific Committee Approval Date	/ /2023		**Version Number**	.....	

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	By the end of successful completion of this course, the student will be able to: 1. Evaluate of definite, indefinite and improper integrals by using different integration techniques. 2. Determine arc length, surface area and volume by using the applications of integration techniques. 3. Define polar coordinate graphs and solve related problems including area, arc length and volume. 4. Identify the properties of sequences and their limits with identifying standard convergent operations of power series.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Fundamentals of Integrals. 2. Definite and indefinite integrals. 3. Integration techniques -integration by parts. 4. Integration techniques- trigonometric integrals. 5. Integration techniques- partial fractions. 6. Applications of integrals- arc length and surface area. 7. Applications of integrals- volumes (Disk, Washer, Shell). 8. Polar coordinates - common polar coordinate graphs. 9. Polar coordinates - tangents with polar coordinates, curves defined by parametric equations. 10. Principles of sequences and series.
Indicative Contents المحتويات الإرشادية	

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The most important strategies that will be adopted in delivering this module are: - Allow students to actively participate in the learning process with class discussions and exercises that support the initiative. - Incorporate flexible seating into my classroom - Knowledge application and Extended critical thinking - **Do Summative assessments** Occurs at end of chapter

	- **Do** Formative Assessment occurs through chapter to Covers complete content areas - Case-Based Learning.

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
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	87	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
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)	4, 9	LO # 1, 2,3,9 and 10
	Assignments	2	5% (5)	3, 12	LO # 4,5 and 6
	Report	1	5% (5)	13	LO # 7 and 8
	Midterm Exam	3 hr	10% (10)	7	LO # 1-7
Summative assessment	**Final Exam**	3 hr	50% (60)	16	All

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Integral
Week 2	Integral
Week 3	Integration Techniques -Integration by Parts.
Week 4	Integration Techniques- Trigonometric Integrals.
Week 5	Integration Techniques- Partial Fractions
Week 6	**Exam**
Week 7	Applications of Integrals-Infinite Integral,Areas
Week 8	Applications of Integrals- Arc Length, Surface area
Week 9	Applications of Integrals- Volumes (Disk, Washer, Shell)
Week 10	Polar Coordinates - Common Polar Coordinate Graphs
Week 11	Polar Coordinates - Tangents with Polar Coordinates, Curves defined by parametric equations.
Week 12	**Exam**
Week 13	Sequences and Series
Week 14	Sequences and Series
Week 15	**Final Exam**

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1. Stewart, J., Clegg, D. K., & Watson, S. (2020). Calculus: early transcendentals. Cengage Learning.	
Recommended Texts	2. Thomas, G. B., Haas, J., Heil, C., & Weir, M. (2018). Thomas' Calculus. Pearson Education Limited.	
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Physical Chemistry I**			**Module Delivery**	
Module Type	**S**			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**CHE 1302**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level		1	**Semester of Delivery**		2
Administering Department		Type Dept. Code	**College**	Type College Code	
Module Leader	Khaled J. Hamid		**e-mail**	Khaled.j.h@uoanbar.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		M.Sc
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name		Dr. Hamad Khalifa	**e-mail**	habdulkadir56@uoanbar.edu.iq	
Scientific Committee Approval Date		01/06/2023	**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 goals of this course are to enable students to: 1. explore the scope of physical chemistry and its importance to chemical engineering education. 2. develop a fundamental understanding of the basic principles of physical chemistry. 3. develop problem-solving ability based on relevant laws, mathematical equations and graphical relationships.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be: 1. able to demonstrate an understanding of gas behavior using different equations of state and kinetic molecular model. 2. able to demonstrate an understanding of thermodynamics laws and their applications. 3. able to demonstrate knowledge about kinetics laws, define the rate of reaction and the rate constant. 4. skilled in problem solving and analytical reasoning as applied to scientific problems. 5. recognize how catalysts work in homogeneous and heterogeneous catalysis. 6. summarize what is meant by Nanotechnology and how we characterize them.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A - Thermodynamics</u> 1. Introduction to Physical Chemistry 2. Review of gas behavior from both theory and empirical viewpoints - The perfect gas: states of gases, the gas laws - Real gases: the Van der Waals equation 3. The First law of Thermodynamics: the basic concepts - Work, heat, energy - The Internal energy - Expansion work - Heat transactions (Heat Capacities) - Enthalpy - Adiabatic changes 4. Thermochemistry - Standard enthalpy changes - Standard enthalpies of formation - The temperature dependence of reaction enthalpies 5. The Second law of Thermodynamics - The dispersal of Energy - Entropy - Entropy change accompanying specific processes (Expansion, Phase transition, Heating) 6. The Third law of Thermodynamics:

	- The Nernst theorem - The Third law Entropies 7. Gibbs Free Energy (and Helmholtz Free Energy) - Criteria of spontaneity - Maximum work - Maximum non-expansion work - Standard molar Gibbs energies - (Properties of the Gibbs Energy [23 hrs] **Part B – Chemical Kinetics** 1. Chemical equilibrium 2. Chemical Kinetics: - The rates of reactions (a) The definition of rate (b) Rate laws and rate constants (c) Reaction order (d) The determination of the rate law - Integrated rate laws (a) First-order reactions (b) Second-order reactions - The Arrhenius equation (a) A first look at the energy requirements of reactions (b) The effect of a catalyst on the activation energy 3. Transport in Gases (definitions) - Diffusion - Effusion 4. Motion of liquids - Liquid viscosity - (electrolyte solutions) 5. Electrical conductance 6. Electrolytes 7. Catalysis: Homogeneous & Heterogeneous Catalysts definitions 8. Nanotechnology in Chemical Engineering. [22 hrs]

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, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students.

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	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	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	20% (20)	3 and 10	LO #1, #2 and #3, #4
	Presentation	1	10% (10)	2 and 12	LO #5, #6
	Projects / Lab.	1	10% (10)	Continuous	LO #1, #2 and #3, #4
	Report	0	0 % (0)	-	-
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1, #2 and #3, #4, #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 to Physical Chemistry
Week 2	Review of gas behavior from both theory and empirical viewpoints
Week 3	The First law of Thermodynamics 1: the basic concepts (Work, heat, energy, the Internal energy)
Week 4	The First law of Thermodynamics 2: Expansion work, Heat transactions (Heat Capacities), Enthalpy
Week 5	Thermochemistry: **(i)** Enthalpies of Physical Changes. **(ii)** Enthalpies of Chemical Change
Week 6	The Second law of Thermodynamics: The dispersal of Energy, Entropy and Entropy change accompanying specific processes (Expansion, Phase transition, Heating)
Week 7	The Third law of Thermodynamics: The Nernst theorem, The Third law Entropies

Week 8	Gibbs Free Energy (and Helmholtz Free Energy): Criteria of spontaneity, Maximum work , Maximum non-expansion work, Standard molar Gibbs energies (Properties of the Gibbs Energy)
Week 9	Chemical equilibrium
Week 10	Chemical Kinetics: The rates of reactions (a) The definition of rate (b) Rate laws and rate constants (c) Reaction order (d) The determination of the rate law
Week 11	- Integrated rate laws: (a) First-order reactions. (b) Second-order reactions - The Arrhenius equation (a) A first look at the energy requirements of reactions (b) The effect of a catalyst on the activation energy
Week 12	Catalysis: Homogeneous & Heterogeneous Catalysts definitions
Week 13	Electrolytes
Week 14	An Introduction to Nanotechnology
Week 15	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1:
Week 2	Lab 2:
Week 3	Lab 3:
Week 4	Lab 4:
Week 5	Lab 5:
Week 6	Lab 6:
Week 7	Lab 7:

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Atkin's Physical Chemistry: 9th or 10th edition	Yes
Recommended Texts	- Chemistry by Raymond Chang - Chemistry 3 by Andrew Burrows: 2nd edition	No
Websites	Chemistry 3 by Andrew Burrows: 2nd edition	

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Organic Chemistry**			**Module Delivery**	
Module Type	**S**			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**CHE1303**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level		1	**Semester of Delivery**		2
Administering Department		Type Dept. Code	**College**	Type College Code	
Module Leader	Hamad K. Abdulkadir		**e-mail**	habdulkadir56@uoanbar.edu.iq	
Module Leader's Acad. Title		Assistant Professor	**Module Leader's Qualification**		PhD
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name		Dr. Hamad Khaleefah Abdulkadir	**e-mail**	habdulkadir56@uoanbar.edu.iq	
Scientific Committee Approval Date		01/06/2023	**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 goals of this course are to enable students to: 1. explore the scope of organic chemistry and its importance to chemical engineering education. 2. Provide a thorough understanding and principles of organic chemistry. 3. Provide a thorough understanding practical applications of chemical and chemical properties of aliphatic organic compounds ,aromatic organic compounds. Preparation and reaction of Organic compounds.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be: 1. Able to differentiate between different types of organic materials and structures. 2. Able to relate materials properties and performance to the structure.. 3. Able to demonstrate knowledge about Bonding and isomerism. Alkanes and cycloalkanes. Alkenes and alkynes. 4. Understanding different property of organic and aromatic material. 5. Apply physics and chemistry to relate materials structure to their properties.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. 1. Introduction & Classification Organic Chemistry. Recognize chemical safety and hazardous materials icons, and apply laboratory safety rules. 2. Introduction & Classification Organic Chemistry. Aliphatic compounds. Describe laboratory instruments and some basic techniques used in the chemistry laboratory, including balances and standard volumetric equipment. 3. Alkyl halides properties, preparation and reactions. Describe and use UV/VIS spectrophotometric methods of analysis . 4. Bonding and isomerism. Describe how to Prepare accurate laboratory reports. of their experimental results 5. Alkanes and cycloalkanes. (Physical properties ,nomenclature,preparing,Reactions 6. Alkanes and cycloalkanes(Physical properties ,nomenclature,preparing,Reactions. 7. Alkenes . (Physical properties ,nomenclature,preparing,Reactions 8. Alkynes (Physical properties ,nomenclature,preparing,Reactions. 9. Aromatic compounds . (Physical properties ,nomenclature,preparing,Reactions 10. Aromatic compounds. (Physical properties ,nomenclature,preparing,Reactions 11. phenols and thiols. (Physical properties ,nomenclature,preparing,Reactions. 12. Ethers. (Physical properties ,nomenclature,preparing,Reactions 13. Aldehydes and ketones. (Physical properties ,nomenclature,preparing,Reactions

	14. Carboxylic acids and their derivatives. (Physical properties ,nomenclature,preparing,Reactions). 15. Amines, (Physical properties ,nomenclature,preparing,Reactions).

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, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students.

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	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	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	20% (20)	3 and 10	LO #1, #2 and #3, #4
	Presentation	1	10% (10)	2 and 12	LO #5, #6
	Projects / Lab.	1	10% (10)	Continuous	LO #1, #2 and #3, #4
	Report	0	0 % (0)	-	-
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1, #2 and #3, #4, #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 & Classification Organic Chemistry.
Week 2	names of organic compounds.
Week 3	Aliphatic compounds.
Week 4	alkyl halides properties, preparation and reactions.
Week 5	Alkanes and cycloalkanes
Week 6	Alkanes and cycloalkanes
Week 7	Alkenes
Week 8	Alkynes
Week 9	Aromatic compounds
Week 10	Alcohols
Week 11	Ethers and epoxies
Week 12	Amines
Week 13	Aldehydes and ketones.
Week 14	Carboxylic acids and their derivatives
Week 15	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1:
Week 2	Lab 2:
Week 3	Lab 3:
Week 4	Lab 4:
Week 5	Lab 5:
Week 6	Lab 6:
Week 7	Lab 7:

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1. Morrison, R. Thornton; Boyd, R. Neilson "Organic Chemistry" 6th edition, 2001.	Yes
Recommended Texts	-William H. Brown, Introduction to Organic Chemistry, Second Edition, John Wiley and Sons, INC., U. S. A. 2002.	No
Websites	Chemistry 3 by Andrew Burrows: 2nd edition	

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**PRINCIPLES OF Chemical ENGINEERING**			**Module Delivery**	
Module Type	**C**			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**CHE 1304**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level		1	**Semester of Delivery**		2
Administering Department		Type Dept. Code	**College**	Type College Code	
Module Leader	Abbas Hassan Faris		**e-mail**	abbashasan@uoanbar.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		Ph.D.
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name		Dr. Hamad Khalifa	**e-mail**	habdulkadir56@uoanbar.edu.iq	
Scientific Committee Approval Date		01/06/2023	**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 goals of this course are to enable students to: 1. Scientific reasoning and quantitative analysis. Our majors will be able to apply chemical concepts to solve qualitative and quantitative problems. 2. Laboratory practice and safety. In order to learn the ways in which new scientific knowledge is created, our majors will experience how chemists interpret chemical and physical phenomena through experimental investigation. They will develop and apply the appropriate lab skills and instrumentation to solve chemical problems.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be able to: 1. Define the structure of atoms in terms of the nucleus with protons, neutrons, & electrons. 2. Write and balance chemical equations, name inorganic compounds and ions and describe the properties of the main group elements. 3. Carry out chemical calculations, including mass relations in chemical reactions, limiting reagent & reaction yield calculations, and calculations of reactions taking place in solution. 4. Understand the concept of oxidation-reduction, calculate oxidation numbers, and balance redox reactions. 5. Apply the ideal gas law in solving problems involving the gas phase 6. Solve problems in chemical thermodynamics and calorimetry. 7. Predict the electronic structure of atoms and ions from quantum theory, and9) relate the position of an element in the periodic table to its electronic structure and to the physical and chemical properties of the elements. 8. Describe the principles of chemical bonding and write Lewis structures. 9. Predict the geometry of the electron pairs and the shape of molecules using VSEPR theory, predict bond polarity and molecular dipoles. 10. Describe the valence bond theory, predict the hybridization of atoms in molecules, and describe bonding in molecules with single, double and triple bonds in terms of and π bonds, and delocalized molecular orbitals.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A: 1- Handling Numbers. Dimensional Analysis in Solving Problems Recognize chemical safety and hazardous materials icons

	2- Atomic Number. Mass Number. and isotopes. The Periodic Table. Molecules and Ions. Describe laboratory instruments and some basic techniques used in the chemistry laboratory, including balances and standard volumetric equipment 3- Chemical Formulas. Naming Compounds. Atomic Mass. Vogadro's number and Molar Mass of an Element. 4- Chemical Reactions and Chemical Equations. 5- Describe how to Prepare accurate laboratory reports of their experimental results; Amounts of Reactants and Products; limiting Reagent Calculations; Reaction Yield; General Properties of Aqueous Solutions. Precipitation Reactions. Acid-Base Reactions; Oxidation-Reduction Reactions; Concentration of Solutions. 6- Acid-Base Titrations, Cases Pressure. 7- The ideal Gas Equation; Gas Stoichiometry; Partial Pressures; The Nature of Energy and types of energy 8- Energy Changes in Chemical Reactions; introduction to Thermodynamics. Enthalpy of Chemical Reactions; Calorimetry; 9- Standard Enthalpy of Formation and Reaction From Classical Physics to Quantum Theory; Bohr's Theory of the Hydrogen Atom; Quantum Numbers; Atomic OrbitalsElectron Configuration; 10- Development of the Periodic Table; Periodic Classification of the Elements; Periodic Variation in Physical Properties; Ionization Energy; Electron Affinity Lewis Dot Symbols; The ionic Bond; The Covalent Bond; Electro negativity; Writing Lewis structure Formal Charge and Lewis Structures. 11- The Concept of Resonance. Exceptions to the Octet Rule Bond Energy 12- Molecular Geometry; Dipole Moment; Spectrophotometric Analysis of tetracycline; Valence Bond Theory. Hybridization of Atomic Orbital's. Hybridization in Molecules Containing Double and Triple Bonds. Delocalized Molecular Orbital's Part B: 1- Types of analysis in analytical chemistry and their uses. Units for expressing concentration. 2- preparing solutions,standard solution,amounts of reactants and products. 3- Chemical equilibrium and reversible reactions,thermodynamics & chemical equilibrium 4- Equilibrium constants for chemical reactions. 5- Describe how to Prepare accurate laboratory reports of their experimental results 6- Equilibrium constants for chemical reactions 7- Electrochemistry, relationship between cell potential and the equilibrium constants relationship between ΔG, K,and E0cell . the Nernst equation. 8- Volumetric analysis their uses and classification, titrimetric analysis calculations. 9-Acid-base titration 10- Precipitation titration 11- Complexometric titration 12- Oxidation-reduction titration 13- Gravimetric analysis.

	14- Introduction and applications of industrial analysis method.

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, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students.

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	87	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
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)	3 and 10	LO #1, #2 and #3, #4
	Assignments	1	10% (10)	2 and 12	LO #5, #6
	Projects / Lab.	1	10% (10)	Continuous	LO #1, #2 and #3, #4
	Report	0	0 % (0)	-	-
Summative assessment	**Midterm Exam**	2hr	20% (20)	7	LO #1, #2 and #3, #4, #5
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	MEASUREMENTS IN CHEMISTRY
Week 2	Problem Solving in Chemistry - Dimensional Analysis
Week 3	Atoms, Molecules and Ions
Week 4	Mass Relationships in Chemical Reactions
Week 5	Reactions in Aqueous Solutions
Week 6	Gasses
Week 7	Thermochemistry
Week 8	Quantum Theory and the Electronic Structur of Atoms
Week 9	Chemical Bonding
Week 10	Electrochemistry
Week 11	Volumetric Methods of Analysis
Week 12	Titrations Based on Acid-Base Reactions
Week 13	Titrations Based on Precipitation Reactions
Week 14	Titrations Based on Complexation Reactions
Week 15	**Titrations Based on Redox reactions**
Week 16	**Gravimetric Methods of Analysis**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1:
Week 2	Lab 2:
Week 3	Lab 3:
Week 4	Lab 4:
Week 5	Lab 5:
Week 6	Lab 6:
Week 7	Lab 7:

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Introductory Chemistry Essentials, Nivaldo J. Tro	
Recommended Texts	Chemistry. Steven S. Zumdahl, Susan A. Zumdahl, Donald J. DeCoste	
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**CALCULUS III**			**Module Delivery**	
Module Type	**S**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	COE 2206				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	٢		**Semester of Delivery**	3	
Administering Department	CHE		**College**	COE	
Module Leader	Name: Khalid Awadh Mohammed		**e-mail**	E-mail: khalid_awad10@uoanbar.edu.iq	
Module Leader's Acad. Title	Asst.Prof		**Module Leader's Qualification**	MSc	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Calculus II	**Semester**	2 , (1st year)
Co-requisites module		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	The Objectives of this course are to enable students to: 1. 1- To understand these concepts of applications and how to evaluate volumes, surface area, and to understand analytic geometry. 2. 2-To provide practice at developing critical thinking skills, solving open ended problems and to work in teams 3. 3-To develop a deep understanding of issues related to the basic principles of polar Coordinates, vector analysis, determinants, Matrices and how to solve problems in chemical engineering.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be able to: 1. Perform calculus operations on vector-valued functions, including derivatives, integrals curvature, displacement, velocity, acceleration, and torsion. 2. Perform calculus operations on functions of several variables, including partial derivatives, directional derivatives, and multiple integrals. 3. Find extrema and tangent planes. 4. Solve problems using the Fundamental Theorem of Line Integrals, Green's Theorem, The Divergence Theorem and Stokes' Theorem. 5. Apply the computational and conceptual principles to the solutions of real-world problems.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: A-Vectors and the Geometry of Space, Three-Dimensional Coordinate Systems Vectors, The Dot Product, The Cross Product, Lines and Planes in Space. B- Vector-Valued Functions and Motion in Space, Curves in Space and Their Tangents , Integrals of Vector Functions; Projectile Motion, Arc Length in Space, Curvature and Normal Vectors of a Curve, Tangential and Normal Components of Acceleration. C- Partial Derivatives Functions of Several Variables, Partial Derivatives, The Chain Rule, Directional Derivatives and Gradient Vectors, Tangent Planes and Differentials, Extreme Values and Saddle Points. D- Multiple Integrals, Double and Iterated Integrals over Rectangles, Double Integrals over General Regions, Area by Double Integration, Triple Integrals in Rectangular Coordinates and matrices.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم

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

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	87	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
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**	3	10% (10)	3,7 and 10	LO #1, #2 and #4
	Assignments	2	10% (2)	2 and 12	LO #1, #2 and #3
	Projects / Lab.		10% (10)		
	Report		10% (10)		
Summative assessment	**Midterm Exam**	2hr/2	10% (25)	7,10	LO #1 - #5
	Final Exam	3hr	50% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Vectors and Properties of Vectors
Week 2	Geometry of Spaces

Week 3	Vector-Valued Functions
Week 4	Tangent and Normal Vectors and, Arch Length and Curvature
Week 5	Function of Several Variables
Week 6	Triple integrals and Applications
Week 7	Partial Derivatives and Chain Rules for Functions of Several Variables
Week 8	Tangent Planes and Normal Lines and, Extrema of Functions of Two Variables
Week 9	Iterated Integrals and Area in Plane
Week 10	Double Integrals and Volume
Week 11	Triple integrals and Applications
Week 12	Vector Field and Line Integrals
Week 13	Conservative Vector Field, Independent of Path and, and complex number
Week 14	matrix
Week 15	Matrix
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Thomas' Calculus Early Transcendentals 12th Edition.by George B. Thomas Jr. (Author), Maurice D. Weir (Author), Joel R. Hass (Author).	Yes
Recommended Texts	Calculus, by H. Anton, I. Bivens, and S. Davis, 8th Edition, 2002, Wiley.	No
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Physics			Module Delivery	
Module Type	Elective			☒ Theory ☒ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	COE 2207				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	2		Semester of Delivery	3	
Administering Department	Electrical		College	College of Engineering	
Module Leader	Ehsan H. Sabbar		e-mail	Ehsan.sabbar@uoanbar.edu.iq	
Module Leader's Acad. Title	Dr.		Module Leader's Qualification	Ph.D.	
Module Tutor			e-mail		
Peer Reviewer Name			e-mail		
Scientific Committee Approval Date	30/June/2023		Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module		Semester	
Co-requisites module	EE1201	Semester	5

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. Introduce fundamental concepts in physics. 2. Develop mathematical skills for problem-solving. 3. Cover mechanics, oscillations, and waves. 4. Introduce thermodynamics and fluid mechanics. 5. Explore electric and magnetic fields. 6. Cover basic principles of optics. 7. Develop practical laboratory skills. 8. Apply physics principles to engineering contexts.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Understand fundamental physics concepts. 2. Apply mathematics to solve physics problems. 3. Analyze motion, forces, and energy in engineering contexts. 4. Interpret oscillations and waves in engineering applications. 5. Apply thermodynamics and fluid mechanics to engineering problems. 6. Apply electric and magnetic field principles in engineering scenarios. 7. Explain optical phenomena and apply basic optics principles. 8. Conduct experiments, analyze data, and communicate findings. 9. Apply physics principles to address engineering challenges. 10. Make informed engineering decisions using physics knowledge.
Indicative Contents المحتويات الإرشادية	1. Introduction to Physics and Measurement. 2. Mechanics: Motion, Forces, and Energy. 3. Oscillations and Waves. 4. Thermodynamics. 5. Fluid Mechanics. 6. Electric and Magnetic Fields. 7. Optics. 8. Laboratory Sessions. 9. Engineering Applications.

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, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	33	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	92	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation تقييم المادة الدراسية					
As		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	10% (10)	5, 10	
	Assignments	2	5% (5)	2, 12	
	Projects / Lab.	1	10% (10)		
	Report	1			
Summative assessment	Midterm Exam	2hr	15% (15)	8	
	Final Exam	3hr	60% (60)	16	
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Week	Material Covered
Week 1	Physics and measurement; Kinematics of motion of a single particle in one and two dimensions; Kinematics of projectile and circular motion.
Week 2	Dynamics of motion of a single particle and multiple objects in one and two dimensions and Newton's Laws; Free body diagrams; various types of mechanical forces; Application on the use of Newton's Laws
Week 3	Work and energy; Conservative systems and the concept of potential energy; Conservation of mechanical energy
Week 4	System of particles; Linear momentum; Conservation of linear momentum and collisions; Elastic and Inelastic collisions; Center of mass.
Week 5	Kinematics and Dynamics of rotational motion; Torque; Moment of inertia; Angular momentum; Static equilibrium of rigid bodies; Elasticity and concepts of stress and strain
Week 6	Phases of matter; Pressure and density, Equations of Fluid static; Equations of fluid dynamics: Continuity and Bernoulli's equations.
Week 7	Oscillating systems; Simple Harmonic Motion (SHM); Energy of SHM; Damped oscillations; Forced oscillations and Resonance.
Week 8	Midterm Exam
Week 9	Types of waves: Transverse and Longitudinal; Traveling waves; Wave speed; The wave equation; Power and intensity in wave motion;
Week 10	Examples & Problems
Week 11	Reflection and transmission of wave; The principle of superposition; Interference of waves; Standing waves; Resonance
Week 12	Macroscopic and microscopic description of matter;
Week 13	Measuring temperature; Thermal expansion.
Week 14	Concept of temperature and thermal equilibrium (zeroth law of thermodynamics)
Week 15	Measuring temperature; Thermal expansion.
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
Week	Measurements and Data Analysis
Week 1	LAB1: Analyzing the kinematic components of 1Dmotion by using motion sensor
Week 2	LAB2: Determination of the Acceleration of Gravity by studying Free fall
Week 3	LAB3: Verification of Newton's Second Law
Week 4	LAB4: Frequency Modulation
Week 5	LAB5: Conservation of mechanical energy
Week 6	LAB6: Verification of Work – energy theorem
Week 7	LAB7: Static Equilibrium of a rigid object
Week 8	LAB8: Determination of the Acceleration of Gravity using the Simple Pendulum

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	• R.D. Knight, Physics for Scientists and Engineers, 2nd ed., Pearson 2008 Laboratory Manual, Compiled by Instructor	No
Recommended Texts	*University Physics* , William Moebs, Formerly of Loyola Marymount University Samuel J. Ling, Truman State University Jeff Sanny, Loyola Marymount University	No
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Physical Chemistry II**			**Module Delivery**	
Module Type	**S**			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**CHE 2305**				
ECTS Credits	**4**				
SWL (hr/sem)	**100**				
Module Level	2		**Semester of Delivery**	3	
Administering Department	CHE		**College**	CoE	
Module Leader	Khaled J. Hamid		**e-mail**	Khaled.j.h@uoanbar.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	M.Sc	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Dr. Hamad Khalifa		**e-mail**	habdulkadir56@uoanbar.edu.iq	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	CHE 1302	**Semester**	2
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 goals of this course are to enable students to: 1. explore the scope of physical chemistry and its importance to chemical engineering education. 2. develop a fundamental understanding of the basic principles of physical chemistry. 3. develop problem-solving ability based on relevant laws, mathematical equations and graphical relationships.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be: 1. able to demonstrate knowledge about kinetics laws, define the rate of reaction and the rate constant. 2. skilled in problem solving and analytical reasoning as applied to scientific problems. 3. recognize how catalysts work in homogeneous and heterogeneous catalysis. 4. summarize what is meant by Nanotechnology and how we characterize them.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. 1. Chemical equilibrium 2. Chemical Kinetics: - The rates of reactions (a) The definition of rate (b) Rate laws and rate constants (c) Reaction order (d) The determination of the rate law - Integrated rate laws (a) First-order reactions (b) Second-order reactions - The Arrhenius equation (a) A first look at the energy requirements of reactions (b) The effect of a catalyst on the activation energy 3. Transport in Gases (definitions) - Diffusion - Effusion 4. Motion of liquids - Liquid viscosity - (electrolyte solutions) 5. Electrical conductance 6. Electrolytes 7. Catalysis: Homogeneous & Heterogeneous Catalysts definitions 8. Nanotechnology in Chemical Engineering. [45 hrs]

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, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	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	20% (20)	3 and 10	LO #1, #2
	Presentation	1	10% (10)	2 and 12	LO #5, #6
	Projects / Lab.	1	10% (10)	Continuous	LO #1, #2 and #3, #4
	Report	0	0 % (0)	-	-
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	LO #1, #2 and #3, #4,
	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 Physical Chemistry II
Week 2	Revision to Physical Chemistry I
Week 3	Chemical equilibrium
Week 4	Chemical Kinetics: The rates of reactions (a) The definition of rate (b) Rate laws and rate constants
Week 5	(c) Reaction order (d) The determination of the rate law
Week 6	- Integrated rate laws: (a) First-order reactions. (b) Second-order reactions
Week 7	- The Arrhenius equation (a) A first look at the energy requirements of reactions (b) The effect of a catalyst on the activation energy
Week 8	Catalysis: Homogeneous & Heterogeneous Catalysts definitions
Week 9	Electrolytes
Week 10	Adsorption
Week 11	surface and colloid chemistry
Week 12	Electrochemistry
Week 13	An Introduction to Nanotechnology
Week 14	Nanotechnology for Chemical Engineering
Week 15	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1:
Week 2	Lab 2:
Week 3	Lab 3:
Week 4	Lab 4:
Week 5	Lab 5:
Week 6	Lab 6:
Week 7	Lab 7:

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Atkin's Physical Chemistry: 9th or 10th edition	Yes
Recommended Texts	- Chemistry by Raymond Chang - Chemistry 3 by Andrew Burrows: 2nd edition	No
Websites	Chemistry 3 by Andrew Burrows: 2nd edition	

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Fluid Mechanics-I			**Module Delivery**	
Module Type	C			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	CHE 2306				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	2		**Semester of Delivery**	3	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Mustafa B. Al-hadithi		**e-mail**	mustafaalhadithi@uoanbar.edu.iq	
Module Leader's Acad. Title	Assist. Prof.		**Module Leader's Qualification**	Ph.D.	
Module Tutor	**Ibrahim Kh. Abduljabbar**		**e-mail**	ibrahim.khadir@uoanbar.edu.iq	
Peer Reviewer Name	Dr. Omer Mustafa		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**		

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Calculas-I and Calculas-II	**Semester**	COE 1202 COE 1205
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 goals of this course are to enable students to: 1- Provide a thorough understanding and practical applications fluid mechanics analysis for determinate the solution in petrochemical engineering problems. 2- Testing and examine fluid mechanics under different load conditions to find the solution behavior. 3- Understanding and applying mathematical model for the solution of indeterminate fluid flow problems.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be able to: 1. Have a working knowledge of the basic properties of fluids and understand of viscosity, the consequences of the frictional effects it causes in fluid flow and calculate the capillary rise (or drop) in tubes due to the surface tension effect. 2. Analyze and determine the pressure distribution in fluid static problems under different load conditions. 3. Determine the manometer pressure for different shapes and locations. 4. Determine the magnitude, direction and location of pressure force on submerged body. 5. Find the magnitude and direction forces produced from fluid flow motion. 6. Apply energy equation along stream line, then find the resultant pressure. 7. Use control volume analysis to determine the forces associated with fluid flow, and volume analysis to determine the moments caused by fluid flow and the torque transmitted.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. CHAPTER-ONE INTODUCTION and FUNDAMENTAL CONCEPTS[12 hr] Introduction 1 Definition of Stress Definition of Fluid Fluid Properties Viscosity Causes of Viscosity Application of Viscosity Concept Compressibility Surface Tension of Liquids Surface Tension Phenomenon Capillarity Dimensions and Units

	CHAPTER TWO PRESSURE DISTRIBUTION in FLUIDS [20 hr] Forces a fluid Elements Pressure on a Stationary fluid Pressure Forces on a Fluid Element Incompressible Fluid Compressible Fluid Pressure Measurements Manometers Piezometer Tube U-Tube Manometers to Measure Pressure Difference Inverted Tube Manometer Hydrostatic Forces on Submerged Plan Surface Hydrostatic Forces on Curved Surface Buoyancy and Stability of Floating Body Buoyancy Force Stability Stability Related to Water Line Fluid in Rigid – Body Motion Acceleration on a Straight Path Rotation in a Cylindrical Container CHAPTER THREE FLUID FLOW – BASIC CONCEPT [10 hr] Definitions Description of Fluid Motion Variation of Flow Parameters in Time and Space Material Derivative and Acceleration Streamline, Path Lines, Stream Tube, Streak Lines Streamline Path Line Stream Tube Streak Line Movement of Fluid Element Pure Translation Linear Deformation Rate of Deformation in the Fluid Element Rotation CHAPTER FOUR DYNAMICS of FLUID FLOW [21 hr] Introduction Definitions Types of System Basic Laws Conservation of Mass- The Continuity Equation Continuity Equation – Differential Form Continuity Equation (C.E)- Vector From Free Body Method Energy Equation of Ideal Flow a long a Stream Line Conservation of Momentum

	Linear Momentum (L.M) The Application of Momentum Theorem Angular Momentum (Moment of Momentum) Radial – Flow Devices

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Leads students toward a clear understanding and firm grasp of the basic principles of fluid mechanics.. Encourages creative thinking and development of a deeper understanding and intuitive feel for fluid mechanics . The best way to learn is by practice. Special effort is made throughout the above contents to reinforce the material that was presented. Many of the illustrated example problems and at the end of each chapter problems are comprehensive and encourage students to review and revisit concepts and intuitions gained previously.

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	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**125**		

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

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Definitions of Stress on Fluid elements and fluid properties
Week 2	Dynamics viscosity , shear forces and shear stress. Distinction between Newtonian and NonNewtonian Fluid
Week 3	Compressibility, Surface tension of Liquids, Units and Dimensions
Week 4	Forces on Fluid element, Normal Stress in Stationary Fluid
Week 5	Fundamental equation of fluid static
Week 6	Hydrostatic Thrust on Submerged Surfaces
Week 7	Stability of Unconstrained bodies
Week 8	Applications solution of problems
Week 9	Scalar &Vector fields flow field description of fluid motion
Week 10	Variation of flow parameters in time and space material & acceleration, Applications
Week 11	Stream line, path lines, one, two and three dimensional flow
Week 12	Conservation of energy, Bernoulli's equation
Week 13	System, Conservation of mass, Conservation of momentum Applications
Week 14	Applications solution of problems
Week 15	**Preparatory week before the final Exam**
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	Calibration of Bourdon Gauge
Week 5	Center of Pressure
Week 6	Stability of s Floating Body
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1- White,_Frank_M._-_Fluid_Mechanics_7th_Ed_[McGraw_Hill] 2- F L U I D M E C H A N I C S **FUNDAMENTALS AND APPLICATION, by YUNUS A. ÇENGE** and **JOHN M. CIMBALA**	No
Recommended Texts	Fundamentals of fluid mechanics, 2nd edition by Dr. Mustafa B. Al-hadithi	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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Thermodynamic I			**Module Delivery**	
Module Type	C			☒ **Theory** ☒ **Lecture** ☒ **Tutorial** ☒ **Lab** ☐ **Practical** ☐ **Seminar**	
Module Code	CHE 2307				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	2		**Semester of Delivery**	3	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Hamed A. Fayyadh		**e-mail**	h.alfalahi@uoanbar.edu.iq	
Module Leader's Acad. Title	Assist. Prof.		**Module Leader's Qualification**	Ph.D.	
Module Tutor			**e-mail**	E-mail	
Peer Reviewer Name	Dr. Omer Mustafa		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**		

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Physical Chemistry, Calculus I, Calculus II	**Semester**	CHE 1302, COE 1202, COE 1205
Co-requisites module	There is no co- prerequisite	**Semester**	-

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	Course objectives will guide the participant to develop key concepts and techniques to design equipment in development process plant. These key concepts can be utilized to make design and operating decisions, training, and. Course such as these should be almost a requirement for engineers and can utilized as refresher for engineers with experience. 1. To introduce students to the principles concepts of thermal systems engineering using several contemporary applications. 2. Enable students to gain access to the science of thermodynamics by understanding how engineering analysis is done How to deal with laws, equations, illustrations, and other data, and link the data to reach the outputs and enable the student to be able to analyze, elicit and draw conclusions 3. Enable students to gain access to the science of thermodynamics by understanding how engineering analysis is done
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	At the end of the course, the student will be able to: 1. As the design of the chemical process represents a productive and commercial goal, so we expect through this program that the engineer will be familiar with the most thermal systems engineering that he needs to reach the optimal design of the chemical process. 2. That the student be able to distinguish between engineering thermal systems and the mechanism of linking them and their uses in the field of applied work. 3. The chemical engineer has the ability to differentiate between the laws of engineering thermodynamics and apply them mathematically and physically in the treatment and design of practical applications. 4. The engineer should be a pioneer in green engineering by choosing an economical and controlled Design without leaving an impact on the environment.

Indicative Contents المحتويات الإرشادية	1. WHAT IS THERMAL SYSTEMS ENGINEERING? 2. GETTING STARTED IN THERMODYNAMICS: INTRODUCTORY CONCEPTS AND DEFINITIONS 3. CONCEPTS OF UNIT AND DIMENTION AND FUNDEMENTAL VARIABLES 4. USING ENERGY AND THE FIRST LAW OF THERMODYNAMICS/Mechanical Concepts of Energy 5. ENERGY AND THE FIRST LAW OF THERMODYNAMICS/Broadening Our Understanding of Mechanical Work 6. EVALUATING PROPERTIES OF PURE SUBSTANCE 7. THE FIRST LAW OF THERMODYNAMICS FOR CLOSED SYSTEMS 8. THE FIRST LAW OF THERMODYNAMICS FOR OPEN SYSTEMS ((Introduction, Conservation of Mass for a Control Volume Open Systems) 9. THE FIRST LAW OF THERMODYNAMICS FOR OPEN SYSTEMS Conservation of Energy for a Control Volume Open Systems) 10. GENERAL APPLICATIONS of THE FIRST LAW OF THERMODYNAMICS FOR OPEN SYSTEMS(nozzles and diffusers, turbines, compressors and pumps) 11. GENERAL APPLICATIONS of THE FIRST LAW OF THERMODYNAMICS FOR OPEN SYSTEMS (throttling devices, heat exchangers Evaporator, Condenser, and Boiler) 12. THE IDEAL GASE LAWS AND IDEAL GAS MIXTURES (The Ideal Gas Laws 13. THE REAL GASE LAWS AND REAL GAS MIXTURES (Compressibility) 14. THE REAL GASE LAWS AND REAL GAS MIXTURES (Equation of State)

earning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The objective of this course is to organize the ideas of students about energy into forms suitable for engineering analysis. The presentation begins with a review of energy concepts from mechanics. The thermodynamic concept of energy is then introduced as an extension of the concept of energy in mechanics. The student studies energy and its transformations and the relationship between the properties of physical materials that are affected by these transformations from an engineering point of view, which takes into account the linkage between fluid mechanics, heat transfer and energy sources, as well as preparing the student to use engineering thermodynamics in his engineering practices effectively and successfully. Accurate proofs are used in these lectures to enable students to tackle various design issues to explore the wonders of this exciting science.

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	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**125**		

Module Evaluation تقييم المادة الدراسية					
		Time /Number (hr)	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	1	20% (20)	5, 10	LO 1 to 2
	Assignments	2	5% (5)	2,5,12	LO 1 to 4
	Lab.	2	10% (10)	13	LO 4
	Tutorials	2	5% (5)		
Summative assessment	**Midterm Exam**	2	10% (10)	12	LO 1 to 4
	Final Exam	3	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	WHAT IS THERMAL SYSTEMS ENGINEERING?
Week 2	GETTING STARTED IN THERMODYNAMICS: INTRODUCTORY CONCEPTS AND DEFINITIONS
Week 3	CONCEPTS OF UNIT AND DIMENTION AND FUNDEMENTAL VARIABLES
Week 4	USING ENERGY AND THE FIRST LAW OF THERMODYNAMICS/Mechanical Concepts of Energy
Week 5	ENERGY AND THE FIRST LAW OF THERMODYNAMICS/Broadening Our Understanding of Mechanical Work

Week 6	EVALUATING PROPERTIES OF PURE SUBSTANCE
Week 7	THE FIRST LAW OF THERMODYNAMICS FOR CLOSED SYSTEMS
Week 8	THE FIRST LAW OF THERMODYNAMICS FOR OPEN SYSTEMS
Week 9	THE FIRST LAW OF THERMODYNAMICS FOR OPEN SYSTEMS Conservation of Energy for a Control Volume Open Systems)
Week 10	GENERAL APPLICATIONS of THE FIRST LAW OF THERMODYNAMICS FOR OPEN SYSTEMS
Week 11	GENERAL APPLICATIONS of THE FIRST LAW OF THERMODYNAMICS FOR OPEN SYSTEMS (nozzles and diffusers, turbines, compressors and pumps)
Week 12	THE IDEAL GASE LAWS AND IDEAL GAS MIXTURES
Week 13	THE REAL GASE LAWS AND REAL GAS MIXTURES
Week 14	THE REAL GASE LAWS AND REAL GAS MIXTURES (Equation of State)
Week 15	WHAT IS THERMAL SYSTEMS ENGINEERING?
Week 16	**FINAL EXAMINATION**

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	***1.*** J. M. Smith, H.C.Van Ness, M.M. Abbott ***(Introduction to Chemical Engineering Thermodynamics)*** , Seventh Edition, McGraw- Hall (2005) ***2.*** J.W. Tester, M. Modell, (***Thermodynamics and its Application),*** 3rd Edition, Printice Hall, (1997)	Yes
Recommended Texts	-	-
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Mass Transfer I			**Module Delivery**	
Module Type	C			☒ **Theory** ☒ **Lecture** ☒ **Tutorial** ☐ **Lab** ☐ **Practical** ☐ **Seminar**	
Module Code	CHE 2308				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level		2	**Semester of Delivery**		3
Administering Department		CHE	**College**	COE	
Module Leader	Omar Mustafa Al-Kubaisi		**e-mail**	omalkuba@uoanbar.edu.iq	
Module Leader's Acad. Title		Asst. 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		01/06/2023	**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 course aims to provide students with a fundamental understanding of mass transfer and separation processes and to provide knowledge and abilities to calculate mass transfer flux using diffusion coefficients and using mass transfer coefficients and to carry out basic design of mass transfer equipment used in absorption and distillation.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1- To be able to distinguish between equimolar counter diffusion and diffusion through stagnant/ no diffusing medium 2- To be able to calculate the diffusion coefficient using correlation 3- To be able to calculate mass transfer flux using a diffusion flux
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A: Introduction to mass transfer and diffusion Definition of mass transfer; Types of mass diffusion; Mass transfer theories [10 hrs] Part B: Boundary conditions [5 hrs] Part C: Steady mass diffusion through a wall, Part D: Diffusion in a moving medium Part E: Mass convection Mass convection relations

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, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	77	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5
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**	5	10% (10)	3,6,7,10,13, and 10	LO #1, #2 and #3
	Assignments	2	5%(10)		
	Projects / Lab.				
	Report				
Summative assessment	**Midterm Exam**	2hr/2	30% (25)	5	LO #1 - #3
	Final Exam	3hr	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to mass transfer; Example of mass transfer;
Week 2	Mass transfer theories; Fick's law theory;
Week 3	Mass and Molar diffusion fluxes; Mass Diffusivity
Week 4	Conservation of species for a control volume
Week 5	Boundary conditions, Solubility and Henry's constant
Week 6	Mass transfer scenario
Week 7	Diffusion of vapor through a stationary gas : Stefan flow

Week 8	Equimolar counter diffusion
Week 9	Diffusion in a moving medium
Week 10	Introduction to Mass convection
Week 11	Convective mass transfer theories and relations
Week 12	Case 1: Special case (Reynolds analogy)
Week 13	Case 2: General case (Chilton-Colburn Analogy)
Week 14	Limitation on the heat-mass convection analogy
Week 15	**Mass diffusion with chemical reaction**
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Cengel, Y., & Heat, T. M. (2003). A practical approach. Heat and Mass Transfer. Kothandaraman, C. P. (2006). *Fundamentals of heat and mass transfer*. New Age International.	Yes
Recommended Texts		No
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Arabic Language**			**Module Delivery**	
Module Type	**B**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**UOA 2104**				
ECTS Credits	**2**				
SWL (hr/sem)	**50**				
Module Level	2		**Semester of Delivery**	4	
Administering Department	EE		**College**	Engineering	
Module Leader	Muanna W Naji		**e-mail**	muanna.naji@uoanbar.edu.iq	
Module Leader's Acad. Title	Assistant Professor		**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	01/06/2023		**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 Aims أهداف المادة الدراسية	This course aims to build students' knowledge and competence in the Arabic language, rhetoric, and Arabic literature of all kinds, to increase their ability to appreciate literature and develop their awareness of its concepts through the study of poetry, novels, and short stories. story. C- thinking skills: 1. Work on developing the intellectual property of the student. 2. Ensuring the personal development of the student at the academic level.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Develop academic essay writing proficiency 2. Apply reading skills 3. Expand academic vocabulary through reading 4. Improve critical thinking skills 5. Developing the student's intellectual property in the field of the Arabic language, to acquire verbal and actual ability and skill.
Indicative Contents المحتويات الإرشادية	Study the text of the Quran and analyze its language, spelling, and rules. [5 hrs] the rules of writing the hamza, Written verbatim by Arab and of number and numerical adjective. [15 hrs] punctuation. [5 hrs] the method of detection for words in Arabic Dictionaries, the applications of grammar and language- the actor and his deputy, Debutante and the news Acts missing, The case and exception. [10 hrs] Ancient literary studies, Definition of literature and its importance, Ages historical Arabic literature – Modern Literary Studies, Study the texts of poetic eras (pre-Islamic, Islamic, Umayyad, Abbasid, Andalusia), Study of ancient prose texts (speeches, messages), examine the texts of modern poetry and contemporary, examine the texts of modern prose (drama, novel, article). [10 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Raise the students' linguistic level, and build their intellectual progress by highlighting the importance of the Arabic language in their lives as their mother tongue.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	33	**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
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)	4, 10	LO #4, 6, 8 and 10
	Assignments	2			
	Projects / Lab.	1			
	Report	1	10% (10)	13	LO # 5, 8 and 13
Summative assessment	**Midterm Exam**	2 hr	20% (20)	7	LO # 1-7
	Final Exam	3hr	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Arabic grammar
Week 2	Arabic grammar

Week 3	Arabic grammar, Arabic grammar, its importance and place in the language.
Week 4	Arabic grammar, Hamza al-Wasl sites and parts.
Week 5	Dictionaries of the Arabic language, And ways to reveal the meanings of words in dictionaries
Week 6	The rules of number and number, the rule of distinguishing the number and its formulation, the definition of the number and how to read it
Week 7	Mid-term Exam + Unit-Step Forcing, Forced Response, the RLC Circuit
Week 8	Arabic literature / the most prominent features and characteristics of Arabic literature.
Week 9	Arabic literature / Historical eras of Arabic literature.
Week 10	Arabic literature / **The novel and its elements.**
Week 11	Rhetoric/ Truth and metaphor.
Week 12	Rhetoric/ The arts of rhetoric
Week 13	Rhetoric/ The arts of rhetoric
Week 14	Rhetoric/ Poetry / Muallaqat poets and some contemporary poets.
Week 15	Rhetoric/ Poetry / Muallaqat poets and some contemporary poets.
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Lectures in the Arabic language.	Yes
Recommended Texts	Meanings of grammar / Prof. Dr. Fadel Al-Samarrai	No
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Calculus IV**			**Module Delivery**	
Module Type	**S**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**COE 2208**				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	٢		**Semester of Delivery**	4	
Administering Department	CHE		**College**	COE	
Module Leader	Name: Khalid Awadh Mohammed		**e-mail**	E-mail: khalid_awad10@uoanbar.edu.iq	
Module Leader's Acad. Title	Asst.Prof		**Module Leader's Qualification**	MSc	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Calculus III	**Semester**	1 , (2nd year)
Co-requisites module		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	The Objectives of this course are to enable students to: 1. 1- To understand these concepts of applications and how to evaluate the solution of ordinary and higher function, complex number, and to understand analytic geometry. 2. 2-To provide practice at developing critical thinking skills, solving open ended problems and to work in teams 3. 3-To develop a deep understanding of issues related to the basic principles of Laplace Transforms, Fourier series , gamma and beta function , Matrices and how to solve problems in chemical engineering.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of the course students will be able to: 1. Classify differential equations by order, linearity, and homogeneity 2. Solve first order linear differential equations 3. Solve linear equations with constant coefficients 4. Use separation of variables to solve differential equations 5. Solve exact differential equations 6. Use variation of parameters to solve differential equations 7. Use the method of undetermined coefficients to solve differential equations 8. Determine whether a system of functions is linearly independent using the Wronksian. 9. Model real-life applications using differential equations 10. Use power series to solve differential equations 11. Use Laplace transforms and their inverses to solve differential equations 12. Solve systems of linear differential equations using matrix techniques and eigenvalues 13. Use numerical methods to solve differential equations
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: A- Solution of Ordinary Differential Equations. First order linear differential equations, Higher order Differential Equations B-Simultaneous Linear Differential Equations. C-Fourier series. Periodic functions, Trigonometric series, Euler Coefficients, Even and Odd Functions, Half Range Expansion, Applications. D-Laplace Transforms, Properties of Laplace Transforms, Inverse of Laplace transforms, Solution of Ordinary D.E's by Laplace transforms, D.E's with constant coefficients,D.E's with variable coefficients:, Solution of Simultaneous Linear D.E's by Laplace transforms

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

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	87	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
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**	3	10% (10)	3,7 and 10	LO #1, #2 and #4
	Assignments	2	10% (2)	2 and 12	LO #1, #2 and #3
	Projects / Lab.		10% (10)		
	Report		10% (10)		
Summative assessment	**Midterm Exam**	2hr/2	10% (25)	7,10	LO #1 - #5
	Final Exam	3hr	50% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	**First-Order Differential Equations: Initial-value problem. Separable variables.**

Week 2	**Homogeneous equations. Exact equations. Linear equations.**
Week 3	**Integrating factor, Bernoulli equation. Applications.**
Week 4	**Second-Order Differential Equations: Initial-value and Boundary-value problems.**
Week 5	**Linear differential operators. Reduction of order. Homogeneous equations with constant coefficients.**
Week 6	**Non-homogeneous equations. Method of undetermined coefficients. Method of variation of parameters.**
Week 7	**Some nonlinear equations. Applications. Higher order Differential Equations.**
Week 8	**Higher order Differential Equations**
Week 9	**Simultaneous Linear Differential Equations**
Week 10	**Fourier series solutions**
Week 11	**Euler Coefficients, Even and Odd Functions, Half Range Expansion, Applications**
Week 12	**Laplace Transforms: Definitions. Properties. Inverse Laplace transforms. Solving initial value problems.**
Week 13	**Application of Linear Algebra. Homogeneous linear systems. Non-homogeneous linear systems. Solving systems by Laplace transforms.**
Week 14	**Series Solutions: Cauchy- Euler equation method. Solutions about ordinary points. Solutions about singular points.**
Week 15	**Method of Frobenius. Second Solutions and Logarithm terms.**
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**

Required Texts	Differential Equations with Boundary-Value Problems, seventh edition. Dennis G. Zill, Michael R Cullen. Copyright 2009, Brooks/Cole. ISBN-13: 978-0-495-10836-8	Yes
Recommended Texts	Differential Equations with Boundary-Value Problems Student Solutions Manual. Warren S. Wright, Dennis G. Zill, Carol D. Wright. Copyright 2009, Brooks/Cole Publishing Company. ISBN 978-0-495-38316-1.	No
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Engineering Mechanic (Static)**			**Module Delivery**	
Module Type	**S**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	COE 2209				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	2		**Semester of Delivery**	4	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Dr. Ayad Aied Albadrany		**e-mail**	ayadaied@uoanbar.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D	
Module Tutor	**Omar H. Hussen**		**e-mail**	omer.hamaad@uoanbar.edu.iq	
Peer Reviewer Name	Asst.Prof Dr.Hamid Abdullah		**e-mail**	h.alfalahi@uoanbar.edu.iq	
Scientific Committee Approval Date	01/06/2023		**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 goals of this course are to enable students to: 1. To understand and use the general techniques of force vectors and equilibrium of particle and rigid body 2. To understand and use the general techniques of structural analysis and internal force and friction 3. To be able to isolate and analyze a mechanical system using free body diagrams techniques 4. To understand and use the general ideas of center of gravity, centroids and moments of inertia
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be able to: 1. An understand of the basic principles of mechanics and to apply them to different or new situations 2. An ability to construct free-body diagrams and to calculate the reactions necessary to ensure static equilibrium. 3. Knowledge of internal forces and moments in members. 4. An ability to calculate centroids and moments of inertia. 5. An ability to solve the problems involving dry friction in any mechanical system.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. 1. Review of force System: Force, rectangular components, moment, resultant couple (two and three dimensional systems). 2. Equilibrium: Mechanical systems, isolation and equilibrium conditions for two and three dimensional systems. 3. Structures: Plane trusses, method of joints, method of sections, frames. 4. Friction: Types of friction, dry friction, application of friction. 5. Centre forms: Centre of gravity, moment of inertia of the space

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, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students.

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
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	117	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	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	10% (20)	3 and 10	LO #1, #2 and #3, #4,#5
	Assignments	1	5% (5)	2 and 12	LO #1, #2 and #3, #4,#5
	Projects.Lab	1	0% (0)	2-14	
	Report	1	0 % (0)	1-15	
Summative assessment	**Midterm Exam**	2hr	15% (15)	7	LO #1, #2 and #3
	Final Exam	3hr	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Units, Force Systems & Resultant, Components of Force, Vectors
Week 2	Rectangular Components in Space
Week 3	Rectangular Components in Space
Week 4	Quiz
Week 5	Vector Products, Moment of forces, Rectangular Components of a Moment
Week 6	Rectangular Components of a Moment, Moment of a Couple, Couple Vectors
Week 7	First Exam
Week 8	Rigid Bodies: Equivalent Systems: Resultants
Week 9	Rigid Bodies: Equivalent Systems: Resultants
Week 10	Rigid Bodies: Equivalent Systems: Resultants
Week 11	Progress Exam
Week 12	Analysis of Structure: Frames & Machines
Week 13	Analysis of Structure: Trusses
Week 14	Centre of Area
Week 15	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1:
Week 2	Lab 2:
Week 3	Lab 3:
Week 4	Lab 4:
Week 5	Lab 5:
Week 6	Lab 6:
Week 7	Lab 7:

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	"Vector Mechanics For Engineers, Static and Dynamics" Beer. Ninth Addition	Yes
Recommended Texts	1 – ENGINEERING MECHANICS STATICS, HIGDON 2- ENGINEERING MECHANICS: STATIC, HIBBLER	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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Fluid Mechanics-II			**Module Delivery**	
Module Type	C			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	CHE 2310				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	2		**Semester of Delivery**	4	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Mustafa B. Al-hadithi		**e-mail**	mustafaalhadithi@uoanbar.edu.iq	
Module Leader's Acad. Title	Assist. Prof.		**Module Leader's Qualification**	Ph.D.	
Module Tutor	**Ibrahim Kh. Abduljabbar**		**e-mail**	ibrahim.khadir@uoanbar.edu.iq	
Peer Reviewer Name	Dr. Omer Mustafa		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**		

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Calculas-I , Calculas-II and Fluid Mechanics-I	**Semester**	COE 1202 COE 1205 CHE 2304
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 goals of this course are to enable students to: 1- Provide a thorough understanding and practical applications fluid mechanics analysis for determinate the solution in petrochemical engineering problems. 2- Testing and examine fluid mechanics under different load conditions to find the solution behavior. 3- Understanding and applying mathematical model for the solution of indeterminate viscous fluid flow in pipe for laminar and turbulent problems. 4- Understanding the basic vector analysis of the fluid flow in pumps, Use specific speed for preliminary design and selection of pumps .
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be able to: 1- Understand the numerous benefits of dimensional analysis, Know how to use the method of repeating variables to identify non-dimensional parameters. 2- Understand the concept of dynamic similarity and how to apply it to experimental modeling. 3- Have a deeper understanding of laminar and turbulent flow in pipes and the analysis of fully developed flow. 4- Calculate the major and minor losses associated with pipe flow in piping networks and determine the pumping power requirements. 5- Identify various types of pumps, and understand how they work. 6- Perform basic vector analysis of the flow into and out of pumps, Use specific speed for preliminary design and selection of pumps with performance requirements .
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. CHAPTER-ONE DYNAMIC SIMILARITY and DIMENSIONAL ANALYSIS [20 hr] Definition of physical Similarity Geometric Similarity (G.S) Kinematic Similarity (K.S) Dynamic Similarity (D.S) D.S of Flow Governed by Viscous, Pressure and Inertia Forces D.S of Flow with Gravity and Inertia Forces D.S of Flows with Surface Tension as the Dominant Forces D.S of Flows with Elastic Force The Application of D.S and the Dimensional Analysis The Concept Dimensional Analysis Dimensional of physical Quantities Buckingham's ***Pi*** Theorem (Method-2)

	Mathematical Description of ***Pi*** Theorem Procedure for Determination ***Pi*** Terms Selection of Repeating Variables Problems CHAPTER TWO VISCOUS INCOMPRESSIBLE FLOWS in PIPE Part -One (Laminar Flow) [12] Introduction Relationship between Shear Stress and Pressure Gradient Laminar Flow between Parallel Plates Couette Flow Maximum and minimum Velocities Pipe of Circular Cross – Section Hagen – Poiseuille Flow Volumetric Flow Rate Shear Stress in Horizontal Pipe Shear Stress in Inclined Pipe Part-Two (Turbulent Flow) [18 hr] Friction Factor Calculations Simple Pipe Problem Solution Procedure General Applications Minor Losses Pipe in Series Equivalent Pipe Pipes in Parallel Problems CHAPTER THREE TURBOMACHINERY [13 hr] Introduction Centrifugal Pump Impeller Classification of Centrifugal Pump Pump Head Pump Theory Pressure Developed by Impeller Manometric Head Pump Efficiency Pump Performance Curves Net Positive-Suction Head (NPSH) Outlet Blade Angles and Specific Speed Problems

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Leads students toward a clear understanding and firm grasp of the basic principles of fluid mechanics.Encourages creative thinking and development of a deeper understanding and intuitive feel for fluid mechanics .The best way to learn is by practice. Special effort is made throughout the above contents to reinforce the material that was presented. Many of the illustrated example problems and at the end of each chapter problems are comprehensive and encourage students to review and revisit concepts and intuitions gained previously.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**150**		

Module Evaluation تقييم المادة الدراسية					
		Time /Number (hr)	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	1	20% (20)	3 , 8	LO #1, #2 and #5, #6
	Assignments	2	5% (5)	2,5,12	LO 1 to 6
	Lab.	2	10% (10)	7 to15	LO 2,3,6
	Tutorials	2	5% (5)	2,5,12	LO 2,5,6
Summative assessment	**Midterm Exam**	2	10% (10)	11	LO #1, #2 and #3, #4
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Principle of physical Similarity
Week 2	Magnitude of different Forces acting on fluid element
Week 3	Dynamics similarity of flow, Applications
Week 4	Dimensional Analysis Pi-theorem
Week 5	Applications Solution of problems
Week 6	Viscous Incompressible flow, Flow between parallel plate, Couette flow.
Week 7	Flow in pipes shear stress, applications.
Week 8	Friction calculation in conduit applications.
Week 9	Minor Losses Pipe in Series Equivalent Pipe Pipes in Parallel
Week 10	Pipes in parallel and Pipes network analysis,
Week 11	Applications, solution of problems
Week 12	Centrifugal Pump classifications, theory of centrifugal pump
Week 13	Pump Performance Curves and Net Positive-Suction Head (NPSH).
Week 14	Applications, solution of problems
Week 15	**Preparatory week before the final Exam**
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	Flow Through Venturi Meter
Week 4	Impact of Jet
Week 5	Flow Types in Pipes
Week 6	Frictional Losses in Pipes
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1- White,_Frank_M._-_Fluid_Mechanics_7th_Ed_[McGraw_Hill] 2- F L U I D M E C H A N I C S **FUNDAMENTALS AND APPLICATION, by YUNUS A. ÇENGE** and **JOHN M. CIMBALA**	No
Recommended Texts	Fundamentals of fluid mechanics, 2nd edition by Dr. Mustafa B. Al-hadithi	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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Thermodynamic II			**Module Delivery**	
Module Type	C			☒ **Theory** ☒ **Lecture** ☒ **Tutorial** ☒ **Lab** ☐ **Practical** ☐ **Seminar**	
Module Code	CHE 2311				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	2		**Semester of Delivery**	4	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Hamed A. Fayyadh		**e-mail**	h.alfalahi@uoanbar.edu.iq	
Module Leader's Acad. Title	Assist. Prof.		**Module Leader's Qualification**	Ph.D.	
Module Tutor			**e-mail**	E-mail	
Peer Reviewer Name	Dr. Omer Mustafa		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**		

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Thermodynamic I , Physical Chemistry, Calculus I, Calculus II	**Semester**	CHE 2305 CHE 1302, COE 1202, COE 1205
Co-requisites module	There is no co- prerequisite	**Semester**	-

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	Course objectives will guide the participant to develop key concepts and techniques to design equipment in development process plant. These key concepts can be utilized to make design and operating decisions, training, and. Course such as these should be almost a requirement for engineers and can utilized as refresher for engineers with experience. 1. To introduce students to the principles concepts of thermal systems engineering using several contemporary applications. 2. Enable students to gain access to the science of thermodynamics by understanding how engineering analysis is done How to deal with laws, equations, illustrations, and other data, and link the data to reach the outputs and enable the student to be able to analyze, elicit and draw conclusions 3. Enable students to gain access to the science of thermodynamics by understanding how engineering analysis is done
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	At the end of the course, the student will be able to: 1. As the design of the chemical process represents a productive and commercial goal, so we expect through this program that the engineer will be familiar with the most thermal systems engineering that he needs to reach the optimal design of the chemical process. 2. That the student be able to distinguish between engineering thermal systems and the mechanism of linking them and their uses in the field of applied work. 3. The chemical engineer has the ability to differentiate between the laws of engineering thermodynamics and apply them mathematically and physically in the treatment and design of practical applications. 4. The engineer should be a pioneer in green engineering by choosing an economical and controlled Design without leaving an impact on the environment.

1. Indicative Contents ٢. المحتويات الإرشادية	**3.** **THE SECOND LAW OF THERMODYNAMICS AND ENTROPY** (Introducing the Second Law:, Identifying Irreversibility's:, Applying the Second Law to Thermodynamic Cycles, Analysis of Carnot heat engines, Analysis of Carnot refrigerators and heat pumps) **4.** **USING ENTROPY** (Introducing Entropy, Entropy Change in Internally Reversible Processes, Entropy Balance for Closed Systems, Entropy Rate Balance for Control Volumes, Isentropic Processes, Isentropic Efficiencies of Turbines, Nozzles, Compressors, and Pumps) **5.** **ANALYSIS OF ENGINEERING SYSTEMS BASED ON THE SECOND LAW OF THERMODYNAMICS** (Analysis of **Closed** System According to 2nd Law of Thermodynamics, Analysis of **Open** System According to 2nd Law of Thermodynamics) **6.** **APPLICATIONS OF SECOND LAW IN VAPOR POWER CYCLES** (Production of Power from Heat, Kind of Power Cycles, Modeling Vapor Power Systems, Analyzing Vapor Power Systems-Carnot and Rankine Cycle) **7.** **DEVIATION OF ACTUAL VAPOR POWER CYCLES FROM IDEAL RANKINE CYCLES** (Introduction, Mathematical Analysis Deviation of Actual Vapor Power Cycles from Ideal Rankine Cycles) **8.** **MODIFICATION METHODS OF THE STEAM RANKINE CYCLES** (Using Economizer, Increase Pressure in the Boiler, Decrease Pressure in the Condenser, Increase Temperature of Superheated Steam in the Boiler, Reheated Cycle, The Regenerative Cycle) **9.** **NUCLEAR POWER SYSTEM CYCLES** (Kind of Nuclear Power System Cycle, Analysis of nuclear system cycles based on 2nd Law of Thermodynamics) **10.** **APPLICATIONS OF SECOND LAW IN GAS POWER CYCLES** (Reciprocating Combustion Engines) **11.** **APPLICATIONS OF SECOND LAW IN GAS POWER CYCLES** (Gas Turbine Brayton Engine Cycle) **12.** **APPLICATIONS OF SECOND LAW IN REFRIGRATION AND LIQUEFACTION CYCLES** (Air Refrigeration system) **13.** **APPLICATIONS OF SECOND LAW IN REFRIGRATION AND LIQUEFACTION CYCLES** (Vapor Compression system) **14.** **APPLICATIONS OF SECOND LAW IN REFRIGRATION AND LIQUEFACTION CYCLES** (Vapor Absorption system) **15.** **APPLICATIONS OF SECOND LAW IN REFRIGRATION AND LIQUEFACTION CYCLES** (Refrigerants) 16. **VAPOR LIQUID EQUILIBRIUM** (Duhem's theorem, phase behavior for vapor –liquid system, VLE qualitative behavior, VLE by modified Raoults Law)

earning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The objective of this course is to organize the ideas of students about **THE SECOND LAW OF THERMODYNAMICS AND ENTROPY**. In this semester, we decided to analyze systems on the basis of the second principle of thermodynamics, and this analysis included steam, gas, nuclear power cycles, cooling, and liquefaction cycles, which are practical applications of the second principle of thermodynamics. The second law is a powerful tool in improving the performance of engineering devices, and we start our study in the concept of available work, and irreversible work, as well as studying the concept of irreversibility's due to various losses. Finally, we apply all the previous concepts to the open and closed system in the steady and unsteady state.

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	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**125**		

Module Evaluation تقييم المادة الدراسية					
		Time /Number (hr)	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	1	20% (20)	5, 10	LO 1 to 2
	Assignments	2	5% (5)	2,5,12	LO 1 to 4
	Lab.	2	10% (10)	13	LO 4
	Tutorials	2	5% (5)		
	Midterm Exam	2	10% (10)	12	LO 1 to 4

Summative assessment	**Final Exam**	3	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	THE SECOND LAW OF THERMODYNAMICS AND
Week 2	USING ENTROPY
Week 3	ANALYSIS OF ENGINEERING SYSTEMS BASED ON THE SECOND LAW OF THERMODYNAMICS
Week 4	APPLICATIONS OF SECOND LAW IN VAPOR POWER CYCLES
Week 5	DEVIATION OF ACTUAL VAPOR POWER CYCLES FROM IDEAL RANKINE CYCLES
Week 6	MODIFICATION METHODS OF THE STEAM RANKINE CYCLES
Week 7	NUCLEAR POWER SYSTEM CYCLES
Week 8	APPLICATIONS OF SECOND LAW IN GAS POWER CYCLES
Week 9	APPLICATIONS OF SECOND LAW IN GAS POWER CYCLES
Week 10	APPLICATIONS OF SECOND LAW IN REFRIGRATION AND LIQUEFACTION CYCLES
Week 11	APPLICATIONS OF SECOND LAW IN REFRIGRATION AND LIQUEFACTION CYCLES
Week 12	APPLICATIONS OF SECOND LAW IN REFRIGRATION AND LIQUEFACTION CYCLES
Week 13	APPLICATIONS OF SECOND LAW IN REFRIGRATION AND LIQUEFACTION CYCLES
Week 14	VAPOR LIQUID EQUILIBRIUM
Week 15	GENERAL REVIEW
Week 16	FINAL EXAMINATION

Learning and Teaching Resources

مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	***1.*** J. M. Smith, H.C.Van Ness, M.M. Abbott ***(Introduction to Chemical Engineering Thermodynamics)*** , Seventh Edition, McGraw- Hall (2005) ***2.*** J.W. Tester, M. Modell, (***Thermodynamics and its Application),*** 3rd Edition, Printice Hall, (1997)	Yes
Recommended Texts	-	-
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Mass Transfer II			**Module Delivery**	
Module Type	C			☒ **Theory** ☒ **Lecture** ☒ **Tutorial** ☐ **Lab** ☐ **Practical** ☐ **Seminar**	
Module Code	CHE 2309				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level		2	**Semester of Delivery**		4
Administering Department		CHE	**College**	COE	
Module Leader	Omar Mustafa Al-Kubaisi		**e-mail**	omalkuba@uoanbar.edu.iq	
Module Leader's Acad. Title		Asst. 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		01/06/2023	**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 provides students with the fundamentals governing mass transfer and the principles governing a range of processes such as absorption, distillation, humidification, leaching, liquid extraction and adsorption. Students will apply their theoretical knowledge to the design and evaluation of these processes.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On successful completion of the course students will be able to: 1. Interpret problems by presenting a sketch of the system containing information in the problem 2. Perform material and/or energy balances around separation processes 3. Utilise thermodynamic equilibrium data to support the description of the separation process 4. Combine principles of operating lines and equilibrium descriptions to analyse or design processes involving mass transfer 5. Undertake problem solving concerning the analysis and/or design of transfer processes 1-
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. • Absorption: equilibrium and operating lines, mass transfer driving force, transfer units. • Humidification: humidity-temperature diagram, adiabatic cooling lines, cooling tower. • Leaching: (solids): kinetics, counter-current washing. • Liquid Extraction: equilibrium stages, ternary diagrams. • Adsorption: break-through curve, kinetics.

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, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	77	**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**	1.5/1	10% (10)	7 and 13	LO #1, #2 and #3
	Assignments	3	5%(10)	3,9,12	
	Projects / Lab.				
	Report				
Summative assessment	**Midterm Exam**	2hr/2	30% (25)	5	LO #1 - #3
	Final Exam	3hr	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Humidification: Introduction; Definitions;
Week 2	Humidification: Adiabatic Saturation Curve; Gas Liquid Operation;
Week 3	Humidification: Equipment
Week 4	Drying: Introduction; definitions of moisture;
Week 5	Drying: Drying of soluble solids
Week 6	Drying: Classification drying process
Week 7	Drying: Equipment's
Week 8	Crystallization: Introduction; Definitions; Classification of Crystals;
Week 9	Crystallization: Principles of crystallization; Nucleation; Crystal Growth

Week 10	Crystallizer: Super-saturation by cooling
Week 11	Crystallizer: Super-saturation by evaporation
Week 12	Crystallizer: Super evaporation by cooling and evaporation
Week 13	Leaching: Definitions, Unsteady state operation
Week 14	Leaching: Steady State Operation
Week 15	**Leaching: Unsteady State operation**
Week 16	

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Cengel, Y., & Heat, T. M. (2003). A practical approach. Heat and Mass Transfer. Mass Transfer Theory and Practice	Yes
Recommended Texts		No
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Ethics and Leadership skills**			**Module Delivery**	
Module Type	**B**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**UOA 3105**				
ECTS Credits	**2**				
SWL (hr/sem)	**50**				
Module Level			**Semester of Delivery**	5	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Abdulsattar Ahmed A		**e-mail**	abdulsattar.ahmed@uoanbar.edu.iq	
Module Leader's Acad. Title	Asset.Teacher		**Module Leader's Qualification**	Master	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module		**Semester**	
Co-requisites module		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	The goals of this course are to enable students to: 1-Develop an awareness of ethical challenges in your everyday lives and work. 2-Develop an awareness of ethical leadership/decision-making through research, interviews, observations in the real world, reading the text, and planning a symposium as a team.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Following completion of this course, students will be able to: 1- Explain the basic concepts of leadership. 2- Build power and influence. 3- Add value to their sphere of influence 4- Give and receive feedback, actively listen, provide supportive communication, and coach and counsel their team members
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. **1.Introduction to leadership**: [4 hrs] Leadership definition, make a difference? Why is leadership **2-.Communication**[4 hrs] Communication types, Thoughts emotion and communication (head, heart and hands) What influences our communication, Damaging communication habits Connecting with others, Peer communication assessment **3. Self-Administration**[4 hrs] 4 **Effective team leadership**[4 hrs] What is team Why work in teams? Different types of teams Team roles Role of team leader

	5. **Administration Skills**[2 hrs] 6. **Leadership Skills**[2hrs] 7. **Leadership and management styles**[4 hrs] Management styles, Attributes of the engineering leader Modern leadership Characteristics of servant leader Command leadership vs. servant leadership 8. **Thinking and Smart Skills**[4 hrs] 9. **Education Development. Skills of Working Market and Commerce**[2 hrs] 10. **Marketing of Searches, Services and Ideas**[2 hrs] 11**. Making of Leaders and Leaders of Changing** [2 hrs] 12. **Leadership and management styles**[6 hrs] Management styles, Attributes of the engineering leader Modern leadership Characteristics of servant leader Command leadership vs. servant leadership 13. Introduction to Engineering Ethics[4 hrs] **14. Professional Ethics** Definition Origins Principles Professional Codes of Ethics[4 hrs] **15. Ethical Issues in Engineering Practice**[4 hrs] 1 -Safety Considerations 2- The Role of Good Design, Sustainable design and design for all , Safety and risk in Design. 3- Environmental Ethics

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Type something like: The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	33	**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
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 / Lab.				
	Report	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	**Midterm Exam**	3 hr	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 leadership.
Week 2	Communication
Week 3	Self-Administration
Week 4	**Effective team leadership**
Week 5	**Administration Skills**
Week 6	Leadership
Week 7	Skills Leadership and management styles
Week 8	Thinking and Smart Skills.
Week 9	Education Development

Week 10	Skills of Working Market and Commerce
Week 11	Marketing of Searches
Week 12	Making of Leaders and Leaders of Changing.
Week 13	**Leadership and management styles**
Week 14	. Professional Ethics
Week 15	15. Ethical Issues in Engineering Practice
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1- Benator, Barry and Thumann, Albert "Project Management and Leadership Skills for Engineering and Construction Projects." 2003, The Fairmont Press, Inc., USA	no
Recommended Texts	2- Fleddermann, C. B. (2012). Engineering Ethics. Upper Saddle River, NJ: Prentice Hall. 3- Csode of Ethics- Iraqi Engineers Association	No
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Engineering Statistics**			**Module Delivery**	
Module Type	**S**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	COE 3210				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	3		**Semester of Delivery**	5	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Name sattar A. Mutlag		**e-mail**	E-mail satmutt1961@uoanbar.edu.iq	
Module Leader's Acad. Title	Asset. Professor		**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	01/06/2023		**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module		**Semester**	
Co-requisites module		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	The Objectives of this course are to enable students to: 1. Understand the differentiate between a random process and a deterministic process. 2. Solve probability problems and its applications by to determine the sampled data; analyze it graphically. 3. Understand the relationship between both discrete and continuous random variables. 4. Understand the theoretical of the normal distribution with many populations in practice. 5. Learn statistical hypotheses by carrying statistical tests, using different significance levels
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On completion of this course, the student should be able to: 1. Use a number of methods and techniques for collecting and presentation the sets of data. 2. Calculation and demonstration the center tendency and variation of data 3. Compute the probabilities in a simple cases and using the rules of probability in computing; 4. Give an account of the concept random variable and be able to use some common probability distributions; 5. Understand the meaning of the central limit theorem; 6. Use point and interval estimates for some typical statistical problems; 7. Apply elementary regression for fitting measured data
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. **1 Fundamentals (Introduction to Statistics)** Introduction, Variables and Types of Data, Data Collection and Sampling Techniques, Observational and Experimental Studies. **2-Presentation of a Statistical Data** Introduction, Organizing Data, Grouped Frequency Distributions or Frequency Distributions Table, Graphs: Histograms, Frequency Polygons, Other Types of Graphs. 3- **Data Description** Measures of Central Tendency (Mean, Median and Mode), Measures of Variation, . Population Variance and Standard Deviation , Sample Variance and Standard Deviation, Variance and Standard Deviation for Tabulated . **4-Probability and Counting Rules** Sample Spaces and Probability, Tree diagram, Basic Probability Rules, Conditional Probability

	5-Discrete Probability Distributions Probability Distributions, Mean, Variance, Standard an Deviation, The Binomial Distribution. The Poisson Distribution **6-Continuous Probability Distributions** **The Normal Distribution**. Applications of the Normal Distribution. Normal Distributions Formula. The Standard Normal Distribution. Finding Areas Under the Standard Normal Distribution Curve (Table Method). A Normal Distribution Curve as a Probability Distribution Curve. Applications of the Normal Distribution **7-confidence Intervals and Sample Size** Confidence Intervals for the Mean When σ is Known. A point estimate. Confidence Intervals. Sample Size. t-Distribution. Confidence Intervals for the Mean When σ is Unknown. The chi-square Distribution **8-Hypothesis Testing** Steps in Hypothesis Testing—Traditional Method. The null hypothesis (H_0) , The alternative hypothesis (H_1) . The level of significance. *z* Test for a Mean . P-Value Method for Hypothesis Testing. t Test for a Mean. z Test for a Proportion. X_2 Test for a Variance or Standard Deviation **9-testing the Difference between Two Means, Two Proportions, and Two Variances** **10Correlation and Regression**

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Type something like: The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem)	33	**Structured SWL (h/w)**	2

الحمل الدراسي المنتظم للطالب خلال الفصل		الحمل الدراسي المنتظم للطالب أسبوعيا	
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	67	**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)	5, 10	LO #1, 2, 10 and 11
	Assignments	2	10% (10)	2, 12	LO # 3, 4, 6 and 7
	Projects / Lab.				
	Report	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	**Midterm Exam**	3 hr	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	**1 Fundamentals (Introduction to Statistics)**
Week 2	**2-Presentation of a Statistical Data**
Week 3	3- **Data Description**
Week 4	**Probability and Counting Rules** Sample Spaces and Probability, Tree diagram,
Week 5	Basic Probability Rules, Conditional Probability
Week 6	**Discrete Probability Distributions** Probability Distributions, Mean, Variance, Standard an Deviation
Week 7	, The Binomial Distribution. The Poisson Distribution
Week 8	**Continuous Probability Distributions**

Week 9	**The Normal Distribution**. Applications of the Normal Distribution. Normal Distributions Formula. The Standard Normal Distribution. Finding Areas Under the Standard Normal Distribution Curve (Table Method).
Week 10	A Normal Distribution Curve as a Probability Distribution Curve. Applications of the Normal Distribution
Week 11	**confidence Intervals and Sample Size**
Week 12	**Hypothesis Testing** Steps in Hypothesis Testing—Traditional Method. The null hypothesis (H_0) , The alternative hypothesis (H_1) .
Week 13	The level of significance. *z* Test for a Mean . P-Value Method for Hypothesis Testing. t Test for a Mean. z Test for a Proportion. X_2 Test for a Variance or Standard Deviation
Week 14	**testing the Difference between Two Means, Two Proportions, and Two Variances**
Week 15	**Correlation and Regression**
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1. Elementary Statistics A Step by Step Approach, Eighth Edition, By Allan G. Bluman	no

Recommended Texts	2. Probability and Statistics For Engineers and Scientists, Fourth Edition, By Sheldon Ross	No
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Reactor design l**			**Module Delivery**	
Module Type	**C**			**Theory** **x Lecture** **Lab** **x Tutorial** **☐ Practical** **☐ Seminar**	
Module Code	**CHE 3312**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	3		**Semester of Delivery**	5	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Suha Akram		**e-mail**	e-mail	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Name (if available)		**e-mail**	suhaakram@uoanbar.edu.iq	
Peer Reviewer Name	Name		**e-mail**	suhaakram@uoanbar.edu.iq	
Scientific Committee Approval Date	01/06/2023		**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. This course enables the student to develop a clear understanding of the fundamentals of reactor engineering 2. Understanding the chemical reaction engineering. Focus is placed on batch, plug flow , and continuous stirred reactor design. 3. Reaction engineering applications in various engineering and environmental processes are also presented.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be able to: 1. Define process variables and parameters of chemical reactors 2. Implement the kinetic models based on the physical picture of the process or conducted kinetic experiment 3. Vary the reaction kinetics in homogeneous systems and apply mathematical numerical and / or analytical methods in estimation of the kinetic model parameters 4. Set up the mathematical models of the processes with chemical reaction in various types of reactors (kinetic and reactor model) and apply the methodology of chemical engineering when choosing a reactor for the implementation of certain types of reactions 5. Apply the acquired knowledge in modeling and design of chemical reactors and apply mathematical methods, models and techniques in solving case studies
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Chemical reaction, reactor types, mass balance and conversion, rate laws design equation, stoichiometric tables, variable volume, isothermal reactor design, batch reactor CSTR and PFR, reactors in series and Parallel, reversible reaction, equilibrium conversion.

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

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	87	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5
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)	5 and 10	LO #1, #2
	Assignments	2	5% (5)	2 and 12	LO #3, #4
	Projects / Lab.	----			
	Report	----			
Summative assessment	**Midterm Exam**	2	25% (25)	7	LO #1 - 3
	Final Exam	3hr	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	**define the chemical reactor as the basic unit of chemical processes, define the process space, system boundaries, and input and output variables of the process , define the basic division and classification of chemical reactors**
Week 2	**types of reaction, single and multiple reaction , in parallel, series, reversible, and catalytic reactions**
Week 3	**define the dependence of reaction rate on temperature**
Week 4	**define the characteristics of the kinetics of reactions in homogeneous systems - define the characteristics of the kinetics of reactions in heterogeneous systems**
Week 5	**Define the integral method of the kinetic model parameters estimation**
Week 6	**Progress Exam 1**
Week 7	**define the reactor model for batch reactor**
Week 8	**define the reactor model for CSTR reactor - define the reactor model for plug-flow reactor**
Week 9	**Single reactor design batch , plug, and mixed flow reactor**
Week 10	**Select the best reactor that give best conversion**
Week 11	**Multiple-Reactor Systems in series and in parallel, choosing same type of reactors**
Week 12	**Progress Exam 2**
Week 13	**Multiple-Reactor Systems in series and in parallel, choosing different type of reactors, Recycle Reactor**
Week 14	**Multiple-Reactor Systems in series and in parallel, choosing shape type of reactors Autocatalytic Reactions**
Week 15	**Size Comparison of Single Reactors and multiple reactors**
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**Chemical reaction engineering by Octane leavenspiel**	Yes
Recommended Texts	**Elements of chemical reaction engineering** **By:** **H. Scott Fogler**	No
Websites	https://www.uoanbar.edu.iq/English/staff-page.php?ID=728	

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
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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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Unit Operation |**			**Module Delivery**	
Module Type	**C**			☒ **Theory** ☒ **Lecture** ☒ **Tutorial** ☐ **Lab** ☐ **Practical** ☐ **Seminar**	
Module Code	**CHE 3313**				
ECTS Credits	6				
SWL (hr/sem)	**150**				
Module Level		3	**Semester of Delivery**		5
Administering Department		Chemical &Petrochemical Engineering	**College**	Type College Code	
Module Leader	Badoor M.Kurji		**e-mail**	Bdoorm.kurji@uoanbar.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		M.Sc
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date		06/06/2023	**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 aims of the course are: 1. To develop an understanding of the transport processes of momentum, heat and mass. 2. To present the basic transport equations and to apply these equations to practical unit operations and separation process. 3. To build the capacity in the design of equipment for physical transformation. 4. To develop knowledge in modern separation processes and sustainable energy.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be demonstrate and apply the fundamentals of the major unit operations in Chemical Engineering namely: 1. distillation 2. extraction 3. Leaching In terms of the essential requirements for the unit design, detailed calculations to find the number of stages and/or the size of unit needed to perform a certain function.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A vapor-liquid equilibrium method of distillation flash and differential distillation rectifications continuous, Lewis Sorel method rectifications continuous, McCabe Thiele method **Part B** Steam distillation multi component distillation batch distillation **Part C** liquid- liquid equilibrium, single stage extraction liquid solid extraction equipments for leaching

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	In-class lessons; Tutorials; Self-directed work; Home works.

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	87	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
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**	5	10% (10)	4,6, 9, 11 and 13	LO #1, #2 and #3
	Presentation				
	Projects / Lab.				
	Report				
Summative assessment	**Midterm Exam**	1.5h/2	30% (30)	5	LO #1, #2 and #3
	Final Exam	3h	60% (60)	16	all
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Distillation: vapor-liquid equilibrium
Week 2	method of distillation
Week 3	flash and differential distillation
Week 4	rectifications continuous, Lewis Sorel method
Week 5	rectifications continuous, McCabe Thiele method
Week 6	feed condition, reflux ratio
Week 7	Enthalpy concentration diagram.
Week 8	Steam distillation

Week 9	multi component distillation
Week 10	batch distillation
Week 11	liquid –liquid Extraction :liquid- liquid equilibrium, single stage extraction
Week 12	liquid solid extraction
Week 13	equipments for leaching, equilibrium relations and single stage calculation
Week 14	Counter-current multi stage leaching, constant underflow in counter-current.
Week 15	Multistage leaching. for variable and constant underflow in counter current multistage leaching

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Chemical Engineering, volume 2 and Volume 1, 5th EDITION	Yes
Recommended Texts		
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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Heat Transfer I		**Module Delivery**		
Module Type	C		☒ **Theory** ☒ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**		
Module Code	CHE 3314				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	3		**Semester of Delivery**	5	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Mustafa B. Al-hadithi		**e-mail**	mustafaalhadithi@uoanbar.edu.iq	
Module Leader's Acad. Title	Assist. Prof.		**Module Leader's Qualification**	Ph.D.	
Module Tutor	**Ibrahim Kh. Abduljabbar**		**e-mail**	ibrahim.khadir@uoanbar.edu.iq	
Peer Reviewer Name	Dr. Omer Mustafa		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**		

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Calculas-I , Calculas-II, Fluid Mechanics-I, Fluid Mechanics-II	**Semester**	COE 1202 COE 1205 CHE 2304 CHE 2308
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 goals of this course are to enable students to: 1- Provide a thorough understanding and practical applications heat transfer analysis for determinate the solution in petrochemical engineering problems. 2- Testing and examine heat transfer under different load conditions to find the solution behavior. 3- Understanding and applying mathematical model for the solution of indeterminate different modes of heat transfer for various problems in industry. 4- Understanding the solar energy determination for various solar applications and energy saving .
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be able to: 1. Calculate the rate equations and the conservation laws may be used to solve numerous heat transfer problems. 2. The student should learn to evaluate the heat flow through a 1-D, SS system with no heat sources for rectangular and cylindrical geometries. Many other geometries exist in nature or in common engineering designs. The student, using a similar development, should be able to develop an appropriate equation to describe systems of arbitrary, simple geometry. 3. The student should learn to evaluate Composite thermal resistances for 1-D, Steady state heat transfer with no heat sources placed in parallel or in series may be evaluated in a manner similar to electrical resistances placed in parallel or in series. 4. Students should be able to write boundary conditions for (a) very long fins, (b) insulated tip fins, (c) convective tip fins and (d) fins with a specified tip temperature. 5. The student should appreciate the inherent nature of the discretization process, and know how to formulate the finite difference equations for the discrete points of a nodal network. 6. Although one may find it convenient to solve these equations using hand calculations for a coarse mesh involving direct or iterative techniques. 7. The students should be able to calculate the convection problems, the correlations may be selected and used with the appropriate form of the energy balance to solve the problem.
	Indicative content includes the following. **C HAPT E R 1** **Introduction** 1 Conduction Heat Transfer Thermal Conductivity Convection Heat Transfer Radiation Heat Transfer Dimensions and Units **C HAPT E R 2** **Steady-State Conduction— One Dimension** The Plane Wall

Indicative Contents المحتويات الإرشادية	Insulation and *R* Values Radial Systems The Overall Heat-Transfer Coefficient Critical Thickness of Insulation Heat-Source Systems Cylinder with Heat Sources Conduction-Convection Systems Fins Thermal Contact Resistance . **C HAPT E R 3** **Steady-State Conduction—Multiple Dimensions** Mathematical Analysis of Two-Dimensional Heat Conduction The Conduction Shape Factor Numerical Method of Analysis Numerical Formulation in Terms of direct method and Gauss-Seidel Iteration. **C HAPT E R 4** **Unsteady-State Conduction** Lumped-Heat-Capacity System Transient Heat Flow in a Semi-Infinite Solid (**Applicability of the Heisler Charts**) Convection Boundary Conditions Multidimensional Systems Transient Numerical Method **C HAPT E R 5** **Empirical and Practical Relations for Forced-Convection Heat Transfer** Laminar Boundary Layer on a Flat Plate Energy Equation of the Boundary Layer The Thermal Boundary Layer The Relation Between Fluid Friction and Heat Transfer Turbulent Flow in a Tube Empirical Relations for Pipe and Tube Flow Flow Across Cylinders and Spheres Flow Across Tube Banks

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Leads students toward a clear understanding and firm grasp of the basic principles of heat transfer. Encourages creative thinking and the development of a deeper understanding and an intuitive feel for heat transfer. Emphasizes that the best way to learn is through practice. Special efforts are made throughout the content to reinforce the presented material. Many of the illustrated example problems, as well as the problems at the end of each chapter, are comprehensive and encourage students to review and revisit previously acquired concepts and intuitions.

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	87	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**150**		

Module Evaluation تقييم المادة الدراسية					
		Time /Number (hr)	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	1	10% (20)	5 , 10	LO #1, #2 and #5, #6, #7
	Assignments	2	5% (5)	2,5,12	LO 1 to 6
	Lab.	2	10% (10)	7 to15	LO 2,3,6
	Tutorials	2	5% (5)	2,5,12	LO 2,5,6
Summative assessment	**Midterm Exam**	2	10% (10)	11	LO #1, #2 and #3, #4#5
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Rate equations: conduction, convection, and radiation.
Week 2	Heat diffusion equation, boundary and initial conditions, One dimensional steady state conduction
Week 3	Heat transfer through composite walls for different shape
Week 4	Critical thickness of insulation for cylinder and sphere.

Week 5	Applications. And quiz
Week 6	Steady state heat conduction through fins of uniform cross section
Week 7	fin effectiveness and fin efficiency.
Week 8	Applications, Two-dimensional steady state conduction, analytical solution
Week 9	Finite difference method: explicit and implicit formulation, applications.
Week 10	Transient conduction in solids with negligible internal temperature gradients, Biot number and Fourier number.
Week 11	Applications. And quiz
Week 12	Flow over a body, velocity and thermal boundary layers, drag-co-efficient and heat transfer coefficient, Flow inside a duct; hydrodynamics and thermal entry lengths; fully developed and developing flow.
Week 13	Heat transfer from Horizontal surface and horizontal cylinders
Week 14	. Heat transfer from Bank of tubes
Week 15	**Preparatory week before the final Exam**
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	Longitudinal heat conduction
Week 4	Radial heat conduction
Week 5	Heat transfer through extended Surface
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1- Heat transfer by J.P. Holman. 2- Heat and mass transfer; Fundamentals and pplications. By	Yes

	Cengel, Yunus A, Ghajar, Afshin J	
Recommended Texts	Specific Lectures by Dr. Mustafa B. Al-hadithi	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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Engineering Material			**Module Delivery**	
Module Type	C			☒ **Theory** ☒ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	CHE 3315				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	3		**Semester of Delivery**	5	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Hamed A. Fayyadh		**e-mail**	h.alfalahi@uoanbar.edu.iq	
Module Leader's Acad. Title	Assist. Prof.		**Module Leader's Qualification**	Ph.D.	
Module Tutor	**Omar H. Hussen**		**e-mail**	omer.hamaad@uoanbar.edu.iq	
Peer Reviewer Name	Dr. Omer Mustafa		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**		

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Egineering Mechanic (Static), Calculus I, Calculus II	**Semester**	COE 2208, COE 1202, COE 1205
Co-requisites module	There is no co- prerequisite	**Semester**	-

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	11. Course objective: The main objective of these lectures is to provide the student with a clear and thorough presentation of the theory and application of strength of materials. These objectives are accomplished in two directions; 1. Generous collection of detailed examples featuring a structured problem-solving approach that encourages systematic thinking. 2. To develop creative skill. a number of homework problems have been included that are designed to enhance critical thinking skills. 3. Experimental lab is used to develop practical experience for students.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	At the end of the course, the student will be able to: 1. Distinguish between Engineering Material. 2. To introduce students How to analysis of Particle's. 3. To introduce students How to analysis of Rigid Body. 4. Distinguish between Stress, Simple Stress, Bearing Stress, distinguish between Tube and Spherical Pressure Vessels, Bearing Stress Thermal stress, 5. study the relationships among the various forms of material deformation under load 6. How to draw Shear force, and bending moment diagram, Shear force, and bending moment diagram 7. distinguish between Analytical and graphical deflection, buckling

Indicative Contents المحتويات الإرشادية	1. Distinguish between Engineering Materials 2. STRUCTURE OF MATERIALS **(Atomic structure, Subatomic structure (level), Macroscopic structure, Microscopic structure)** 3. CLASSIFICATION OF MATERIALS **(Metals, Ceramics, Polymers, Composites)** 4. ADVANCED MATERIALS **(Semiconductors, Biomaterials, Smart Materials, Nanomaterials)** 5. introduce students How to analysis of Particle's **(External loads, Joint Load, Member Load, Analysis of Internal Forces)** 6. introduce students How to analysis of Rigid Body 7. What is a stress, simple stress? **(Definition of Stress, Simple, Stresses, Normal stress, Solved Examples in Normal Stress)** 8. What is a shearing stress? **(Definition of Shearing Stress, Solved Examples in Shearing Stress)** 9. What is a Bearing Stress? **(Definition of bearing Stress, Solved Examples in bearing Stress)** 10. distinguish between tube and spherical pressure vessels **(Thin-Walled Cylinder Pressure Vessels, Spherical Shell, Solved Examples in Thin-Walled Pressure Vessels)** 11. study the relationships among the various forms of material deformation under load (**Axial deformation and strain, Stiffness, K, Multiple axial load, Solved Examples in axial deformation)** 12. What is a thermal stress? **(Analysis of Thermal Stress, Solved Examples in Thermal Stress)** 13. How to draw shear force, and bending moment diagram 14. How to use Deformation of Members 15. distinguish between Analytical and graphical deflection, buckling 16. Special Topic

earning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	10. Course overview: The course includes an introduction to introduce you to : Introduction to material science and Engineering, Analysis of Forces in Strength of Materials - Particle's, Analysis of Forces in Strength of Materials – Rigid Body , Stress, Simple Stress, Normal Stress, Shearing Stress, Bearing Stress, Thin-Walled Pressure Vessels, Strain (Simple strain, Strain -Stress diagram, Hook's Law, Poisson's ratio), Thermal stress, Axial Force, Shear force, and bending moment diagram, Axial Force, Shear force, and bending moment diagram, Deformation of Members under Axial load, Analytical and graphical deflection, buckling.

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	87	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**150**		

Module Evaluation تقييم المادة الدراسية					
		Time /Number (hr)	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	1	20% (20)	5, 10	LO 1 to 2
	Assignments	2	5% (5)	2,5,12	LO 1 to 10
	Lab.	2	10% (10)	13	LO 5,6
	Tutorials	2	5% (5)	2-12	
Summative assessment	**Midterm Exam**	2	10% (10)	12	LO 1 to 4
	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 material science and Engineering
Week 2	STRUCTURE OF MATERIALS
Week 3	CLASSIFICATION OF MATERIALS
Week 4	ADVANCED MATERIALS
Week 5	Analysis of Forces in Strength of Materials - Particle's
Week 6	Analysis of Forces in Strength of Materials – Rigid Body

Week 7	What is a stress, simple stress?
Week 8	What is a shearing stress?
Week 9	What is a Bearing Stress?
Week 10	distinguish between tube and spherical pressure vessels
Week 11	Thin-Walled Pressure Vessels
Week 12	Strain (Simple strain, Strain -Stress diagram, Hook's Law, Poisson's ratio)
Week 13	Axial Force, Shear force, and bending moment diagram
Week 14	How to use Deformation of Members
Week 15	Analytical and graphical deflection, buckling
Week 16	**FINAL EXAMINATION**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Tensile Test
Week 2	Bending Test
Week 3	Compressive Strength Test
Week 4	Impact Strength Test
Week 5	Shear Test

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	***1.*** Singer “strength of materials” 3rd edition,1980 and 4th edition R.C.Hibbeler “ Mechanics of Materials” 8th edition,2008 R.J.Hearn “Mechanics of Materials “ 3rd edition,1997 Textbook Popov “ Engineering Mechanics of Solids”,1990. J.W. Tester, M. Modell, (***Thermodynamics and its Application)***, 3rd Edition, Printice Hall, (1997)	Yes
Recommended Texts	-	-
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Numerical Methods**			**Module Delivery**	
Module Type	**S**			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☐ **Tutorial** ☒ **Practical** ☐ **Seminar**	
Module Code	**COE 3211**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level	3		**Semester of Delivery**	6	
Administering Department	ME		**College**	Eng.	
Module Leader	Dr. Ghalib R. Ibrahim		**e-mail**	ghalib.ibrahim@uoanbar.edu.iq	
Module Leader's Acad. Title	Assist. Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	**Omar H. Hussen**		**e-mail**	omer.hamaad@uoanbar.edu.iq	
Peer Reviewer Name	Dr. Khaldoon F. Brethee		**e-mail**	Khaldon77m@uoanbar.edu.iq	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	ENG 109 Calculus IV.	**Semester**	4
Co-requisites module		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. To enhance the student's ability to think logically and mathematically in modeling systems. 2. To use numerical methods to solve ordinary differential equation. 3. To knowledge Numerical Solutions of Partial Differential Equations and how they can serve as models for physical processes such as mechanical vibrations, transport phenomena including diffusion, heat transfer, and advection, and electrostatics. 4. Select and execute appropriate methods to achieve objectives. 5. Interpret and communicate the results.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. find roots of functions by using a range of methods 2. solve systems of linear and non-linear and non-linear algebraic equations by using a range of methods 3. apply numerical interpolation, differentiation, integration and solving engineering problem 4. use techniques for solving ordinary differential equations 5. Use MATLAB or other numerical tools for solving problems by numerical methods.
Indicative Contents المحتويات الإرشادية	**part-I: Basic Tools** **Unit-1:** Error Analysis **[3hrs]** • Measuring Errors • Sources of Error • Consistency, Order, Smoothness and Convergence **Unit-2**: Roots of equations (Nonlinear Equations) **[6hrs]** • Bisection Method • False-Position Method (Optional) • Newton-Raphson Method • Secant Method (Optional) **Unit-3**: Simultaneous Linear algebraic Equations **[6hrs]** - Gauss-Elimination method (simple and partial pivoting methods) - Gauss-Jordan Method - Matrix Inversion method • Indirect (Iterative) Method - Jacobi Method - Gauss-Seidel Method - Successive Over-Relaxation Method **Unit-4**: Numerical Differentiation and Integration **[6hrs]** - Numerical differentiation using difference method - Numerical Integration, Trapezoid and Simpson's Rules - Extrapolation of Errors **Unit-5:** Interpolation and Curve Fitting **[6hrs]** - Direct Fit Polynomial - Least Squares Method - Logarithmic regression (Optional)

	- Exponential regression (Optional) - Linear interpolation , Quadratic Interpolation - Lagrange Interpolation (Optional) - Newton Divided Difference Interpolation (Optional) **Part-II: Numerical Solutions of Ordinary Differential Equations [3hrs]** **Unit-6**: Initial Value Problem **[6hrs]** - Euler's Method - Runge-Kutta 2nd - Runge-Kutta 4th - Higher Order Equations **Unit-7**: Boundary Value Problem **[3hrs]** - Equilibrium (Finite Difference) Method **Part-III: Numerical Solutions of Partial Differential Equations [6hrs]**

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. Also, encourage students to learn various methods for analyzing the time response, frequency response and stability of the systems. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

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
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	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	15% (15)	5, 10	LO #4and 5
	Assignments	2	5% (5)	2, 12	LO # 4and 5
	Projects / Lab.	-	-	-	
	Report	-	-	-	-
Summative assessment	Midterm Exam	2 hr	20% (20)	7	LO # 4and 5
	Final Exam	3hr	60% (60)	16	LO # 4and 5
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Error Analysis
Week 2	Roots of equations
Week 3	Roots of equations
Week 4	Simultaneous Linear algebraic Equations
Week 5	Numerical Differentiation and Integration
Week 6	Numerical Differentiation and Integration
Week 7	Interpolation and Curve Fitting
Week 8	Initial Value Problem (Euler's Method & Runge-Kutta 2^{nd})
Week 9	Initial Value Problem (Euler's Method & Runge-Kutta 2^{nd})
Week 10	Initial Value Problem (Runge-Kutta 4^{th} & Higher Order Equations)
Week 11	Initial Value Problem (Runge-Kutta 4^{th} & Higher Order Equations)
Week 12	Boundary Value Problem (Finite Difference Method)
Week 13	Boundary Value Problem (Finite Difference Method)
Week 14	Numerical Solutions of Partial Differential Equations
Week 15	Numerical Solutions of Partial Differential Equations
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	**Available in the Library?**
Required Texts	Numerical Methods for Engineers, S. C. Chapra and R. P Canale, McGraw-Hill, 6th edition 2010.	Yes
Recommended Texts		
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Unit Operation ‖**			**Module Delivery**	
Module Type	**C**			☒ **Theory** ☒ **Lecture** ☒ **Tutorial** ☐ **Lab** ☐ **Practical** ☐ **Seminar**	
Module Code	**CHE 3316**				
ECTS Credits	5				
SWL (hr/sem)	**125**				
Module Level		3	**Semester of Delivery**		6
Administering Department		Chemical &Petrochemical Engineering	**College**	Type College Code	
Module Leader	Badoor M.Kurji		**e-mail**	Bdoorm.kurji@uoanbar.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		M.Sc
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date		06/06/2023	**Version Number**		1.0

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Unit Operation |	**Semester**	1
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 aims of the course are: 1. To develop an understanding of the transport processes of momentum, heat and mass. 2. To present the basic transport equations and to apply these equations to practical unit operations and separation process. 3. To build the capacity in the design of equipment for physical transformation. 4. To develop knowledge in modern separation processes and sustainable energy.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be understand: 1. The concept of two-phase systems and the interactions and separation techniques involved in the operation. 2. Know how to fully design a cooling tower. 3. Understand and apply the concepts of boiling point rises and particle analysis during evaporation. 4. Design Evaporators, Crystallizers, Distillation columns and Dryers.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A Evaporation: heat transfer in evaporators, boiling at submerged surface forced convection, boiling at submerged surface vacuum operation multiple effect evaporators, general principles comparison between backward and forward feeds **Part B** Drying: introduction and general principles rate of drying, dry periods Humidification terms; humidity data for air water system and cooling Towers **Part C** Crystallization: crystallization and type of crystal, yields and heat and material balances in crystallization models of crystallization mechanical and physical separation processes sedimentation filtration

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	In-class lessons; Tutorials; Self-directed work; Home works.

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	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	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**	5	10% (10)	4,6, 9, 11 and 13	LO #1, #2 and #3
	Presentation				
	Projects / Lab.				
	Report				
Summative assessment	**Midterm Exam**	1.5h/2	30% (30)	5	LO #1- #4
	Final Exam	3h	60% (60)	16	all
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Evaporation: heat transfer in evaporators, boiling at submerged surface
Week 2	forced convection, boiling at submerged surface
Week 3	Forced convection boiling
Week 4	vacuum operation
Week 5	multiple effect evaporators, general principles
Week 6	comparison between backward and forward feeds
Week 7	comparison between backward and forward feeds
Week 8	Drying: introduction and general principles

Week 9	rate of drying, dry periods
Week 10	Humidification terms; humidity data for air water system.
Week 11	Cooling Towers:
Week 12	Crystallization: introduction, crystallization and type of crystal, yields and heat and material balances in crystallization
Week 13	models of crystallization mechanical and physical separation processes
Week 14	sedimentation
Week 15	filtration

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Chemical Engineering, volume 2 and Volume 1, 5th EDITION	Yes
Recommended Texts		
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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Reactor design ll**			**Module Delivery**	
Module Type	**C**			**Theory** **x Lecture** **Lab** **x Tutorial** **☐ Practical** **☐ Seminar**	
Module Code	**CHE 3317**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	3		**Semester of Delivery**	6	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Suha Akram		**e-mail**	e-mail	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Name (if available)		**e-mail**	suhaakram@uoanbar.edu.iq	
Peer Reviewer Name	Name		**e-mail**	suhaakram@uoanbar.edu.iq	
Scientific Committee Approval Date	01/06/2023		**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. This course enables the student to develop a clear understanding of the fundamentals of practical reactor engineering 2. Understanding the chemical reaction engineering. Focus is placed on non ideal batch, plug flow , and continuous stirred reactor design. 3. Reaction engineering applications in various engineering and environmental processes are also presented.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be able to: 1. implement energy balance on batch, PFR and XSTR 2. find the charachteristic design of adiabatic PFR and CSTR 3. Vary the reaction kinetics in homogeneous systems and apply mathematical numerical and / or analytical methods in unsteady state batch reactor 4. Set up the mathematical models of the processes with multiplr chemical reaction in various types of reactors (kinetic and reactor model) and apply the methodology of chemical engineering when choosing a reactor for the implementation of certain types of reactions 5. Apply the above out comes to design a complex reactors for a certain industrial applications
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Non- isothermal reactor design, energy balance equation, heat of reaction, heat added, adiabatic operation–CSTR, adiabatic operation –PFR, unsteady state batch reactor, adiabatic equilibrium, conversion, multiple reactions, parallel reaction, series reaction, complex reaction, yield and selectivity, application of design process.

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

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	87	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
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)	5 and 10	LO #1, #2
	Assignments	2	5% (5)	2 and 12	LO #3, #4
	Projects / Lab.	----			
	Report	----			
Summative assessment	**Midterm Exam**	2	25% (25)	7	LO #1 - 3
	Final Exam	3hr	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Basic of -non isothermal reactors
Week 2	**Energy balance and first thermodynamic law**
Week 3	**Calculation of conversion for reversible reactions**
Week 4	**Enthalpy and heat of reaction**
Week 5	**Exercises**
Week 6	**Adiabatic operation**
Week 7	**PFR design for adiabatic operation**
Week 8	**Mix flow reactor**
Week 9	**adiabatic and non-adiabatic operation for plug reactor with recycle**
Week 10	**Progress exam**
Week 11	**Multiple-Reactor Systems in series and in parallel,** **choosing same type of reactors**
Week 12	**Progress Exam 2**
Week 13	**Multiple-Reactor Systems in series and in parallel,** **choosing different type of reactors, Recycle Reactor for non isothermal**
Week 14	**Multiple-Reactor Systems in series and in parallel,** **choosing shape type of reactors Autocatalytic Reactions**
Week 15	**Size Comparison of Single Reactors and multiple** **Reactors innon adaibatic**
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**Chemical reaction engineering by Octane leavenspiel**	Yes
Recommended Texts	**Elements of chemical reaction engineering** **By:** **H. Scott Fogler**	No
Websites	https://www.uoanbar.edu.iq/English/staff-page.php?ID=728	

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Engineering Environment**			**Module Delivery**	
Module Type	**C**			☒ **Theory** ☒ **Lecture** ☒**Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**CHE 3318**				
ECTS Credits	**4**				
SWL (hr/sem)	**100**				
Module Level		3	**Semester of Delivery**		6
Administering Department		Type Dept. Code	**College**	Type College Code	
Module Leader	Abbas Hassan Faris		**e-mail**	abbashasan@uoanbar.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		Ph.D.
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name		Dr. Hamad Khalifa	**e-mail**	habdulkadir56@uoanbar.edu.iq	
Scientific Committee Approval Date		01/06/2023	**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 goals of this course are to enable students to: 1. Scientific reasoning for how to protect water quality, emphasizing fundamental principles. 2. The theory and conceptual design of systems for treating municipal wastewater and drinking water, as well as reactor theory, process kinetics, and models. 3. Physical, chemical, and biological processes are presented, including sedimentation, filtration, biological treatment, disinfection, and sludge processing. Finally, there is a discussion of engineered and natural processes for wastewater treatment.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be able to: 1. An ability to apply knowledge of mathematics, science, and engineering 2. An ability to design a system component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 3. An ability to identify, formulate and solve engineering problems. 4. The broad education necessary to understand the impact of engineering solutions in a global economic and environmental and societal context. 5. Recognition of the need for, and an ability to engage in life-long learning. 6. Knowledge of contemporary issues. 7. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. 1. BOILER water and cooling water 2. Concept 3. – Importance 4. – Location 5. – Commonly used desalination process 6. – Distillation – Electrodialysis 7. – Reverse osmosis 8. – Freezing 9. – Solar distillation- 10. Purpose – 11. Problem associated with water quality and equipment 12. – Steam system fundamentals

	13. – Hot water closed system 14. – Measurement and control of pH, corrosion, fouling 15. – Microbial analysis 16. – Ozone control 17. – Study of microorganism 18. – Energy efficient operations and maintenance. 19. WASTE water treatment 20. - Home and Agriculture 21. – Various waste water treatment processes 22. – Optimization 23. – Benefits and costs 24. – Microbial and sanitation water treatment 25. – Biofilm formation and removal 26. – Microbial trend analysis 27. – Pretreatment system and equipment.

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, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	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	20% (20)	3 and 10	LO #1, #2 and #3, #4
	Assignments	1	10% (10)	2 and 12	LO #5, #6
	Projects / Lab.	0	0% (0)	Continuous	LO #1, #2 and #3, #4
	Report	0	0 % (0)	-	-
Summative assessment	**Midterm Exam**	2hr	20% (20)	7	LO #1, #2 and #3, #4, #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 to Water Supply and Wastewater
Week 2	Why Treat Water and Wastewater?
Week 3	Water Quality Parameters.
Week 4	Aerobic and Anaerobic Decomposition
Week 5	Effect of Pollution on Stream
Week 6	Sedimentation-Flocculation; Filtration; Chemical Treatment
Week 7	Effect of Pollution on Groundwater
Week 8	Measurement of Water Quality
Week 9	SETTLING
Week 10	Primary conditions in filter design
Week 11	Solid Analysis
Week 12	Properties and Contamination of Water
Week 13	Sedimentation Tank
Week 14	Reactor Tanks - Mixed Tanks, First-order Kinetics, Plug Flow.
Week 15	Reactor Tanks - Dispersed Flow
Week 16	Softening; Chemical Treatment - Adsorption and Ion Exchange

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	-
Week 2	-
Week 3	-
Week 4	-
Week 5	-
Week 6	-
Week 7	-

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Environmental Engineering, Ruth F. Weiner and Robin Matthews	
Recommended Texts	Fundamental of Wastewater Treatment and Engineering, Rumana Riffat	
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Heat Transfer II		**Module Delivery**		
Module Type	C		☒ **Theory** ☒ **Lecture** ☒ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**		
Module Code	CHE 3319				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	3		**Semester of Delivery**	6	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Mustafa B. Al-hadithi		**e-mail**	mustafaalhadithi@uoanbar.edu.iq	
Module Leader's Acad. Title	Assist. Prof.		**Module Leader's Qualification**	Ph.D.	
Module Tutor	**Ibrahim Kh. Abduljabbar**		**e-mail**	ibrahim.khadir@uoanbar.edu.iq	
Peer Reviewer Name	Dr. Omer Mustafa		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**		

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Calculas-I , Calculas-II, Fluid Mechanics-I, Fluid Mechanics-II,	**Semester**	COE 1202 COE 1205 CHE 2304 CHE 2308
Co-requisites module	Heat Transfer-I	**Semester**	CHE 3313

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	The goals of this course are to enable students to: 1- Provide a thorough understanding and practical applications heat transfer analysis for determinate the solution in petrochemical engineering problems. 2- Testing and examine heat transfer under different load conditions to find the solution behavior. 3- Understanding and applying mathematical model for the solution of indeterminate different modes of heat transfer for various problems in industry. 4- Understanding the solar energy determination for various solar applications and energy saving .
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be able to: 1. Understand the physical mechanism of natural convection, Derive the governing equations of natural convection, and obtain the dimensionless Grashof number by nondimensionalizing them, Evaluate the Nusselt number for natural convection associated with vertical, horizontal, and inclined plates as well as cylinders and spheres 2. Perform a general energy analysis on heat exchangers. 3. Obtain a relation for the logarithmic mean temperature difference for use in the LMTD method, and modify it for different types of heat exchangers using the correction factor. 4. Develop relations for effectiveness, and analyze heat exchangers when outlet temperatures are not known using the effectiveness-NTU method. 5. Differentiate between evaporation and boiling, and gain familiarity with different types of boiling, Develop a good understanding of the boiling curve and the different boiling regimes corresponding to different regions of the boiling curve. 6. Calculate the heat flux and its critical value associated with nucleate boiling, and examine the methods of boiling heat transfer enhancement. 7. Derive a relation for the heat transfer coefficient in laminar film condensation over a vertical plate, Calculate the heat flux associated with condensation on inclined and horizontal plates. 8. Classify electromagnetic radiation, and identify thermal radiation, Understand the idealized blackbody, and calculate the total and spectral blackbody emissive power. 9. Calculate the fraction of radiation emitted in a specified wavelength band using the blackbody radiation functions, Understand the concept of radiation intensity, and define spectral directional quantities using intensity, Develop a clear understanding of the properties emissivity, absorptivity, reflectivity. 10. Define view factor, and understand its importance in radiation heat transfer calculations, Develop view factor relations, and calculate the unknown view factors in an enclosure by using these relations, Calculate radiation heat transfer between black surfaces, Determine radiation heat transfer between diffuse and gray surfaces in an enclosure using the concept of radiosity. 11. Obtain relations for net rate of radiation heat transfer between the surfaces of a two zone enclosure, including two large parallel plates, two long concentric cylinders, and two concentric spheres. Determine the solar energy analysis on flat plate solar collector.

Indicative Contents المحتويات الإرشادية	Indicative content includes the following. **C HAPT E R- 1** **NATURAL CONVECTION** Physical Mechanism of Natural Convection Equation of Motion and the Grashof Number Natural Convection Over Surfaces Vertical Plates (Ts = constant) Vertical Plates (q·s = constant) Vertical Cylinders Inclined Plates Horizontal Plates Horizontal Cylinders and Spheres **C HAPT E R- 2** **Heat Exchangers** The Overall Heat-Transfer Coefficient Fouling Factors Types of Heat Exchangers The Log Mean Temperature Difference Effectiveness-NTU Method Heat-Exchanger Design Analysis **C HAPT E R -3** **Boiling and Condensation Heat Transfer** Boiling Heat Transfer Pool Boiling 626 Boiling Regimes and the Boiling Curve Natural Convection Boiling (to Point A on the Boiling Curve) Nucleate Boiling (Between Points A and C) Transition Boiling (Between Points C and D) Film Boiling (Beyond Point D) Heat Transfer Correlations in Pool Boiling Nucleate Boiling Peak Heat Flux Minimum Heat Flux 632 Film Boiling Condensation Heat Transfer Film Condensation Flow Regimes Heat Transfer Correlations for Film Condensation **C HAPT E R- 4** **THERMAL RADIATION** Blackbody Radiation Radiation Intensity Solid Angle Intensity of Emitted Radiation Incident Radiation Radiosity Spectral Quantities Radiative Properties Emissivity Absorptivity, Reflectivity, and Transmissivity Kirchhoff's Law Atmospheric and Solar Radiation The View Factor, View Factor Relations Radiation Heat Transfer: Black Surfaces Radiation Heat Transfer: Diffuse, Gray Surfaces

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Leads students toward a clear understanding and firm grasp of the basic principles of heat transfer. Encourages creative thinking and the development of a deeper understanding and an intuitive feel for heat transfer. Emphasizes that the best way to learn is through practice. Special efforts are made throughout the content to reinforce the presented material. Many of the illustrated example problems, as well as the problems at the end of each chapter, are comprehensive and encourage students to review and revisit previously acquired concepts and intuitions.

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	87	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	**150**		

Module Evaluation تقييم المادة الدراسية					
		Time /Number (hr)	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	1	10% (20)	5 , 10	LO #1, #2 and #5, #6, #7,#8,#9
	Assignments	2	5% (5)	2,5,12	LO 1 to 10
	Lab.	2	10% (10)	7 to15	LO 2,3,6
	Tutorials	2	5% (5)	2,5,12	LO 2,5,6,7,8,9,10,11
Summative assessment	**Midterm Exam**	2	10% (10)	12Atmospheric and Solar Radiation	LO #1, #2 and #3, #4#5,6,7,8,9
	Final Exam	3	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Free convection heat transfer calculation
Week 2	1- Heat exchanger types and flow arrangement, Overall heat transfer coefficient, fouling factor and LMTD for parallel flow and counter flow.
Week 3	effectiveness-NTU method, parallel and counter flow heat exchanger, Heat exchanger design and multi-pass cross flow.
Week 4	Applications.
Week 5	Different regimes of boiling and mechanism of condensation. The boiling curve, Pool boiling correlations
Week 6	Condensation heat transfer phenomena, Film condensation inside horizontal tube.
Week 7	Applications.
Week 8	Definitions, concept of a black body, Kirchoff's law, Lambert's Cosine Law, Stefan-Boltzman's law
Week 9	Plank's distribution law, Wein's displacement law, configuration factor.
Week 10	Radiation heat exchange between two parallel plates.
Week 11	Methods of Solving Radiation Problems ,Radiation Heat Transfer in Two-Surface Enclosures Radiation Heat Transfer in Three-Surface Enclosures
Week 12	Applications.
Week 13	Concept of solar energy. Atmospheric and Solar Radiation Calculations
Week 14	Applications
Week 15	**Preparatory week before the final Exam**
Week 16	**Final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Heat transfer by Free convection
Week 2	Heat transfer by Force convection
Week 3	Heat transfer by radiation
Week 4	Heat transfer through double pipe heat exchange (Counter flow)

Week 5	Heat transfer through double pipe heat exchange (Co-Current flow)
Week 6	
Week 7	

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1- Heat transfer by J.P. Holman. 2- Heat and mass transfer; Fundamentals and pplications. By Cengel, Yunus A, Ghajar, Afshin J	Yes
Recommended Texts	Specific Lectures by Dr. Mustafa B. Al-hadithi	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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Chemical and petrochemical industry**			**Module Delivery**	
Module Type	**C**			**Theory** **x Lecture** **Lab** **Tutorial** **☐ Practical** **☐ Seminar**	
Module Code	**CHE 3320**				
ECTS Credits	**4**				
SWL (hr/sem)	**100**				
Module Level	3		**Semester of Delivery**	6	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Sufyan fadhil		**e-mail**	e-mail	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Name (if available)		**e-mail**	sufyanfadhil@uoanbar.edu.iq	
Peer Reviewer Name	Name		**e-mail**	sufyanfadhil@uoanbar.edu.iq	
Scientific Committee Approval Date	01/06/2023		**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. Chemical engineering underlies the chemical and petrochemical process industries, and the emphasis on this has been the main objective of this course. 2. The objectives sought are to present a cross section of the manufacturing procedures employed by modern chemical and petrochemical industries, largely separated into their unit chemical processes and unit physical operations through the help of flow charts. 3. Such processes naturally include a considerable variety of operations based on data and principles from other branches of science and engineering.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be able to: 1. Understand and use of different types of flow diagrams in chemical and petrochemical applications 2. Develop a basic understanding of chemical processes. 3. Understand the principles of materials manufacturing processes. 4. Understand various types of chemical and physical operations.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Treatment of industrial water, industrial gases, Soap and detergents, Fermentation industries, Characteristics of petrochemical industries, methane and their derivatives, (acetylene and methanol), propylene and derivatives,(isopropyl alcohol, Phenol and poly propylene), Introduction of benzene derivatives (ethylbenzene, styrene), polymers(LDPE, HDPE, PP, PVC, PS).

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

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	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**	2	10% (10)	5 and 10	LO #1, #2
	Assignments	2	5% (5)	2 and 12	LO #3, #4
	Projects / Lab.				
	Report	----	-----	13	LO #4
Summative assessment	**Midterm Exam**	2	25% (25)	7	LO #1
	Final Exam	3hr	60% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	**General chemical process**
Week 2	**Water softening by ion exchanger**
Week 3	**Lime-Soda ash process**
Week 4	**Hydrogen production processes**
Week 5	**Ammonia production process**
Week 6	**Soap production**
Week 7	**Detergent production**
Week 8	**Fermentation processes**
Week 9	**Petrochemical engineering,feed stock,intermediate,finished product**
Week 10	**Primary fractionator or stabilizers, hydrogen separator**
Week 11	**methane and their derivatives**
Week 12	**propylene and derivatives,**
Week 13	**Phenol and poly propylene**
Week 14	**Introduction of benzene derivatives**
Week 15	**polymers(LDPE, HDPE, PP, PVC, PS).**
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	THE CHEMICAL PROCESS INDUSTRIES R. NORRIS SHREVE	Yes
Recommended Texts	Fundamentals of Petroleum and Petrochemical Engineering Uttam Ray Chaudhuri	No
Websites	https://www.uoanbar.edu.iq/English/staff-page.php?ID=728	

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Engineering Economy**			**Module Delivery**	
Module Type	**S**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**COE 4212**				
ECTS Credits	3				
SWL (hr/sem)	75				
Module Level	4		**Semester of Delivery**	7	
Administering Department	CHE		**College**	COE	
Module Leader	Name: Khalid Awadh Mohammed		**e-mail**	E-mail: khalid_awad10@uoanbar.edu.iq	
Module Leader's Acad. Title	Asst.Prof		**Module Leader's Qualification**	MSc	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	By the end of the semester, students should be able to: 1. Understand and apply fundamental concepts and use of terminology of engineering economics. 2. Derive and use the engineering economy factors to account for the time value of money. 3. Use multiple factors to find equivalent amounts for cash flows that have nonstandard placement. 4. Make computations for interest rate and cash flows that are on a time basis other than a year. 5. Utilize Present, Future Worth Analysis and Annual Worth Analysis techniques to evaluate and select alternatives. 6. Perform Incremental Rate of Return analysis to select best alternative of multiple projects
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be able to: A- calculate the value of money according to time. 1- compares single payment at present with single payment in the future 2- compares single payment in the future with annual payment 3- compares single payment at present with annual payment B-calculates the value of money using arithmetic and geometric gradients C- compares alternative investment decisions F-compares alternative investment decisions using present worth, future worth and annual worth methods G- compares alternatives using rate of return and incremental rate of return methods K-performs benefit/cost analysis L-finds the most economical solution among alternatives in engineering problems. M-could learn the fundamental knowledge about investment planning
Indicative Contents المحتويات الإرشادية	Indicative content includes the following: Topics covered in this course include time value of money, analysis of alternatives using net present value and internal rate of return, depreciation, taxes, and inflation. Monte Carlo simulation is used throughout the course to study variability in engineering designs and the resulting economic impact. Engineering ethics case studies are presented and analyzed.Contemporary economic issues affecting engineers are discuses.

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

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
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	42	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3
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**	3	10% (10)	3,7 and 10	LO #1, #2 and #4
	Assignments	2	10% (2)	2 and 12	LO #1, #2 and #3
	Projects / Lab.		10% (10)		
	Report		10% (10)		
Summative assessment	**Midterm Exam**	2hr/2	10% (25)	7,10	LO #1 - #5
	Final Exam	3hr	50% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Quantifying alternatives for easier decision making
Week 2	Quantifying alternatives for easier decision making
Week 3	The value of one future payment compared to a uniform series of payments
Week 4	The value of one present payment compared to a uniform series of payments
Week 5	Arithmetic gradient, G: The constant increment to series of periodic payments
Week 6	Geometric gradient: The constant percentage increment
Week 7	Present worth method of comparing alternatives
Week 8	Annual payments methods for comparing alternatives
Week 9	Future worth method of comparing alternatives and rate of return method
Week 10	Incremental rate of return on required investment
Week 11	Probability evaluation and benefit cost analysis
Week 12	depreciation
Week 13	Home ownership and mortgage financing: Owning versus renting
Week 14	Equipment replacement analysis
Week 15	Benefit cost analysis
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Principles of Engineering Economic Analysis, White, Case, and Pratt. Wiley & Son	Yes
Recommended Texts		No
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Petroleum & Natural gas Engineering**			**Module Delivery**	
Module Type	**C**			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**CHE 4321**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level		**4**	**Semester of Delivery**		7
Administering Department		Type Dept. Code	**College**	Type College Code	
Module Leader	Osama Ali Mohsen		**e-mail**	Osama.a.m@uoanbar.edu.iq	
Module Leader's Acad. Title		Lecturer	**Module Leader's Qualification**		M.Sc.
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name		Name	**e-mail**	E-mail	
Scientific Committee Approval Date		01/06/2023	**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 main objective of oil and gas properties module is to familiarize the students with the theories of genesis of petroleum origin and to find out the main formation of oil and gas. The practical part of this course aims to give an experimental knowledge about physical properties of crude oil such as flash point, fire point, and water content. study of concept of gas processing, the principal types of natural gas, its applications both as feedstock in petrochemicals industries and as an energy source.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Understand the characteristics of crude oil properties and natural gas 2. Understand the mechanism of oil exploration techniques 3. Familiar with steps of oil field development 4. Familiar with crude oil products and test methods 5. identify the geological origins of petroleum reservoirs and reservoir fluids 6. illustrate the differences between conventional and unconventional reservoirs
Indicative Contents المحتويات الإرشادية	1- Introduction to History of Petroleum and Natural gas 2- Definition of Petroleum and its classification, Physical and chemical properties of Crude oil and natural gas, 3- Definition of Crude oil & natural gas Classification 4- Organic and Inorganic theories of formation of crude oil and natural gas , Rock Types (Igneous , Sedimentary and Metamorphic) 5- General chemical hydrocarbon composition in petroleum. Hydrocarbons (Paraffins, Olefins, and Naphthenes) 6- Classification of Laboratory test and physical properties (Slat Content, The weight percentage of sulfur content, Pour point and Cloud point, Ash Content.) 7- Origin Of Hydrocarbons 8- Thermal Cracking, Catalytic Cracking, Hydro cracking 9- Properties of Natural gas (Molecular weight, viscosity, pressure, Temperature, density, compressibility factor and specific gravity) 10- Types of natural gas (Resources, Rich gas, lean gas) 11- Gaseous fuel 12- Principal uses of natural gas (Natural gas industry-Petrochemicals- Energy-calorific values) 13- Natural gases impurities 14- Principles of low temperature processes: relative volatility, boiling points, component mixtures. 15- Coke performance

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1- Teaching the Course of Petroleum & Natural gas Engineering Based on Goal Problem 2- Oriented Mode and Blended Learning Techniques 3- Combined face-to-face lecture sessions with a virtual visit to an oil refinery the use of educational videos, group working and discussions in class with supportive 4- coursework involving summative and formative coursework. 5- Working in lab for increasing imagination about testing of oil and gas

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	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	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	20% (20)	4,8	
	Assignments		5%(5)		
	Projects / Lab.	1	10% (10)	13	
	Report	6	5% (5)	2,3,6,9,10,12	
Summative assessment	**Midterm Exam**	2hr	10% (10)	7,14	
	Final Exam	3hr	50% (50)	16	
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to History of Petroleum and Natural gas
Week 2	Definition of Petroleum and its classification, Physical and chemical properties of Crude oil and natural gas,
Week 3	Definition of Crude oil & natural gas Classification
Week 4	Organic and Inorganic theories of formation of crude oil and natural gas, Rock Types (Igneous, Sedimentary and Metamorphic)
Week 5	General chemical hydrocarbon composition in petroleum. Hydrocarbons (Paraffins, Olefins, and Naphthene's)
Week 6	Classification of Laboratory test and physical properties (Slat Content, the weight percentage of sulfur content, Pour point and Cloud point, Ash Content.)
Week 7	Origin Of Hydrocarbons
Week 8	Thermal Cracking, Catalytic Cracking, Hydro cracking
Week 9	Properties of Natural gas (Molecular weight, viscosity, pressure, Temperature, density, compressibility factor and specific gravity)
Week 10	Types of natural gas (Resources, Rich gas, lean gas)
Week 11	Gaseous fuel
Week 12	Principal uses of natural gas (Natural gas industry-Petrochemicals- Energy- calorific values)
Week 13	Natural gases impurities
Week 14	Principles of low temperature processes: relative volatility, boiling points, component mixtures.
Week 15	Coke performance
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Measuring API ° gravity of Crude Oil through measuring specific gravity by pycnometer
Week 2	Measuring API ° gravity of Crude Oil through measuring specific gravity by hydrometer
Week 3	Determination of smoke point of light petroleum product
Week 4	Measuring Flash point and fire point (closed abel test) and Open Test.
Week 5	Carbon Residue of Petroleum Products, Conradson Carbon Residue Test (CCR).
Week 6	Measuring of Aniline point and Diesel index

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	- Characterization and Properties of Petroleum Fractions, M. R. Riazi - The Chemistry and Technology of Petroleum, FOURTH EDITION, JAMES G. SPEIGHT. - Handbook of Petroleum Processing, DAVID S. J. "STAN" JONES, PETER R. PUJAD´O,2006.	No
Recommended Texts	- A.J. Kidnap, Parish, D.Mc Carty: Fundamental of Natural Gas, 2nd edition.	No
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Transport phenomena**			**Module Delivery**	
Module Type	**Core**			**Theory** **x Lecture** **Lab** **x Tutorial** **☐ Practical** **☐ Seminar**	
Module Code	**CHE 4322**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	4		**Semester of Delivery**	7	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Sufyan fadhil		**e-mail**	e-mail	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Name (if available)		**e-mail**	sufyanfadhil@uoanbar.edu.iq	
Peer Reviewer Name	Name		**e-mail**	sufyanfadhil@uoanbar.edu.iq	
Scientific Committee Approval Date	01/06/2023		**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. Understand the basic unifying concept behind transport phenomena 2. Understand the general form and solution strategy for transport phenomena problems 3. Through examples develop an understanding of how the general form is converted to a specific solution
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Students are familiar and are able to apply the basic concepts conservation of mass, energy, and momentum. 2. Students can formulate and solve problems in fluid, energy and mass transport. 3. The ability to choose and apply mathematical and numerical methods for solving transport phenomena problems. 4.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Introduction and basics concepts of transport phenomena ,Newton's law of viscosity, temperature and pressure effect on viscosity, Molecular Theory of the Viscosity of Gases at Low Density, shell balance in different flow ship for finding velocity and momentum distribution, equation of continuity, equation of motion and equation of change in momentum transport, Fourier's Law of Heat Conduction (Molecular Energy Transport, Shell Energy Balances; Boundary Conditions, Fick's Law of Binary Diffusion (Molecular Mass Transport), Shell Mass Balances; Boundary Conditions.

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

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	87	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
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)	5 and 10	LO #1, #2
	Assignments	2	5% (5)	2 and 12	LO #3
	Projects / Lab.				
	Report	-----	----	13	LO #2
Summative assessment	**Midterm Exam**	2	25% (25)	7	LO #1
	Final Exam	3hr	60% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	**Introduction of transport phenomena, Newton's law of viscosity, Molecular Theory of the viscosity of gases at low density**
Week 2	**Shell momentum Balance and boundary conditions, Flow of a falling film, flow through a circular tube**
Week 3	**Flow through an annulus , flow through two adjacent immiscible fluids,**
Week 4	**Equation of continuity , equation of motion, equation of change,**
Week 5	**Use of the equation of change to solve flow problems, tutorial about the previous subjects.**
Week 6	**Progress Exam 1**
Week 7	**Fourier's law of heat conduction, shell energy balance and boundary conditions**
Week 8	**Heat conduction with electrical source, heat conduction with a nuclear heat source, with a viscous heat source, chemical heat source, and through composite walls**
Week 9	**Energy equation , special forms of the equations of change to solve steady state problems**
Week 10	**Fick's law of binary diffusion ,temperature and pressure dependence of diffusivities, Quiz**
Week 11	**Shell mass balance, boundary conditions , diffusion through a stagnant gas film**
Week 12	**Progress Exam 2**
Week 13	**Diffusion into a falling liquid film, diffusion and chemical reaction inside a porous catalyst**
Week 14	**Equation of continuity for multicomponent mixture, Research**
Week 15	**Analogies between heat, mass and momentum transport, list and explain differences between Analogies between heat, mass and momentum transport, list and explain differences between**
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**Transport phenomena R. Byron Bird**	Yes
Recommended Texts	**Transport phenomena A unified Approach- Robert S. Brodkey**	No
Websites	https://www.uoanbar.edu.iq/English/staff-page.php?ID=728	

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Equipment Design**			**Module Delivery**	
Module Type	**C**			☒ **Theory** ☒ **Lecture** ☒ **Tutorial** ☐ **Lab** ☐ **Practical** ☐ **Seminar**	
Module Code	**CHE 4323**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level		4	**Semester of Delivery**		7
Administering Department		Chemical &Petrochemical Engineering	**College**	Type College Code	
Module Leader	Omar Al-Kubaisi		**e-mail**	omalkuba@uoanbar.edu.iq	
Module Leader's Acad. Title		Asst. 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		01/06/2023	**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 overall objective of this course is to introduce the selection, sizing and detailed design of important equipment used in full-scale chemical engineering processes. Students will learn equipment design procedures, which will include computation of materials and energy requirements; consideration of manufacturing, operational and environmental aspects; adherence to relevant design codes and practices; process safety; and handling of imprecise or incomplete data. Computer software for equipment design will be introduced.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Ability to demonstrate general knowledge of chemical process & equipment design. 2. Ability to general design of a chemical plants and construct flowsheets. 3. Ability to design of piping systems & pumps. 4. Ability to design of heat & mass transfer equipment design
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. PART A: An introduction to the design of chemical engineering units [3 hrs] Nature of design; Codes and standards; Design factors; Part B – Flowsheeting Flowsheet presentation; [4 hrs] Part C- Piping and instrumentation The P &I diagram; Valve Selection; Pipe size selection; Part D- Separational Column Introduction to continuous distillation; design method for binary system; Approximate column sizing; plate contractors; plate hydraulic design; Part E- Heat Transfer Equipment Introduction; basic design procedure and theory; overall heat transfer equipment;

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	In-class lessons; Tutorials; Self-directed work; Homeworks

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	77	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5

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**	5	10% (10)	3,6,9,12, and 4	LO #2, #3 and #4,
	Assignments				
	Projects / Lab.				
	Report				
Summative assessment	**Midterm Exam**	1.5hr/2	30% (30)	5	LO #1 - #7
	Final Exam	3hr	60% (40)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction to fundamental of chemical engineering process equipment
Week 2	Flowsheeting; why we need different kinds of flowsheets
Week 3	Introduction to heat transfer equipment; heat transfer resistance;
Week 4	Tubes dimensions; tube materials; tube arrangements; tube side passes
Week 5	Shell types; shell tube bundle;
Week 6	Mean temperature difference; true temperature difference estimation
Week 7	Kern’s method for designing the tube and shell
Week 8	Separation Column Design; Distillation column design;
Week 9	Bubble point and dew point; feed composition by utilizing flash calculation
Week 10	Plate design parameter
Week 11	Approximate column sizing; selection of plate contractors
Week 12	Plate hydraulic design
Week 13	Plate Design Procedure

Week 14	Plate pressure drop
Week 15	**Optimizing the distillation column**
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Sinnott , Chemical Engineering Design, Vol.6 , 4th ed.	Yes
Recommended Texts		No
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Control Processes I**			**Module Delivery**	
Module Type	**C**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	CHE 4324				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level	4		**Semester of Delivery**	7	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Dr. Ayad Aied Albadrany		**e-mail**	ayadaied@uoanbar.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Suha Mahdi		**e-mail**	Suha.Mahdi82@uoanbar.edu.iq	
Scientific Committee Approval Date	01/06/2023		**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 goals of this course are to enable students to: 1. apply the models of physical techniques with equations to derive and analyze the transfer functions of open and closed loop control systems. 2. able the student is responsible for designing, developing, and implementing solutions that control dynamic systems. Dynamic systems are systems that constantly change. The main aim of a control systems engineer is to bring stability to these constantly changing systems to produce the desired outcome. 3. construct a system that has a desirable response to standard inputs. A desirable transient response is one that is sufficiently fast without excessive oscillations. A desirable steady-state response is one that follows the desired output with sufficient accuracy. 4. make a plant stable that operates in a predictable way, either by eliminating the error or by regulating the error bounded within the tolerance band, which ultimately leads to safety (for users & environments), reliability (for operators), and profitability (for stakeholders).
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be able to: 1. Identify open and closed loop control system and formulate mathematical model for physical systems. 2. Interpret and apply block diagram representations of control systems and design PID controllers based on empirical tuning rules 3. Compute stability of linear systems using the Routh array test and use this to generate control design constraints 4. Use Evans root locus techniques in control design for real world systems 5. Analyze performance characteristics of system using Frequency response methods 6. Learn the measurement systems, errors of measurement, as well as explain working principles of sensors and transducers.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. 1. Transfer function 2. Open and closed loop system 3. Reduction in block diagram 4. Stability of system 5. Routh method 6. Errors 7. PID controllers 8. Root locus

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, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students.

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
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	92	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
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% (20)	3 and 10	LO #1, #2 and #3, #4,#5
	Assignments	1	5% (5)	2 and 12	LO#1, #2 , #5, #6
	Projects.Lab	1	0% (0)	2-14	
	Report	1	0 % (0)	1-15	
Summative assessment	**Midterm Exam**	2hr	15% (15)	7	LO #1, #2 and #3, #4, #5
	Final Exam	3hr	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to automatic control
Week 2	Representation of control components
Week 3	Representation of control systems: Mass, spring damper system.
Week 4	Representation of control systems: Hydraulic system
Week 5	Representation of control systems: Pneumatic system
Week 6	Representation of control systems: Electrical system
Week 7	Representation of control systems: Thermal system
Week 8	Steady-state operation
Week 9	Laplace transformer
Week 10	Transient and steady-state responses
Week 11	Steady-state errors in control systems
Week 12	Stability of control systems
Week 13	The rout locus method
Week 14	The rout locus method
Week 15	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1:
Week 2	Lab 2:
Week 3	Lab 3:
Week 4	Lab 4:
Week 5	Lab 5:
Week 6	Lab 6:
Week 7	Lab 7:

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1.Modern Control Engineering, Fifth Edition 2010, Katsuhiko Ogata	Yes
Recommended Texts	1.Modern Control Systems, Twelfth Edition 2011, by Richard C. Dorf and Robert H. Bishop, Prentice Hall. 2.Automatic Control Systems, Ninth Edition 2010, by Farid Golnaraghi and Binjamin C. Kuo, John Wiley. 3.Measurement Systems Applications and Design, 5th edition 2003, by E. Doebelin, McGraw Hill.	No
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Control Processes II**			**Module Delivery**	
Module Type	**C**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	CHE 4326				
ECTS Credits	**2**				
SWL (hr/sem)	**125**				
Module Level	4		**Semester of Delivery**	8	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Dr. Ayad Aied Albadrany		**e-mail**	ayadaied@uoanbar.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Asst.Prof Dr.Hamid Abdullah		**e-mail**	h.alfalahi@uoanbar.edu.iq	
Scientific Committee Approval Date	01/06/2023		**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 goals of this course are to enable students to: 1. Apply the fundamental mechanic equations to derive and analyze the transfer function for advanced electromechanical systems. 2. Design PID controllers for any control system in order to obtain optimum signal output. 3. Know the stability case, instability case and the percentage of error for any control system. 4. Construct a signal flow system from block diagrams. 5. Construct state space matrix for dynamic, electrical, thermal systems
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be able to: 1. Analyze the transfer function for electromechanical systems compound with mechanical gears systems 2. Analyze the transfer function for mechanical gear systems with three degree of freedom. 3. Determine and analyze the transient response and steady state error for control systems consist of two signal inputs. 4. design analyze PID controllers for any control system 5. Create and analyze the state space of dynamic or electrical or thermal systems 6. Design and analyze signal flow diagram for control systems
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. 1. Transfer function for advanced electromechanical systems compound of gearbox 2. Open and closed loop system, feedback, forward, Gain 3. Design PID controllers for any control system 4. Reduction in block diagram for two signal in*-puts 5. Convert block diagrams to signal flow diagrams, Mason rule 6. State space for dynamic or electrical or thermal systems 7. Stability and errors

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, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students.

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
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	92	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
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% (20)	3 and 10	LO #1, #2 and #3, #4,#5
	Assignments	1	5% (5)	2 and 12	LO#1, #2 , #5, #6
	Projects.Lab	1	0% (0)	2-14	
	Report	1	0 % (0)	1-15	
Summative assessment	**Midterm Exam**	2hr	15% (15)	7	LO #1, #2 and #3, #4, #5
	Final Exam	3hr	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Transfer function for mechanical gearbox part 1
Week 2	Transfer function for mechanical gearbox part 2
Week 3	Transfer function for thermal models
Week 4	Reduction in block diagrams for two inputs system
Week 5	Reduction in block diagrams for two inputs system
Week 6	Space state for mechanical system
Week 7	Space state for electrical system
Week 8	Advanced Laplace transformation
Week 9	Transient response and Steady state errors for two signal inputs
Week 10	Transient response and Steady state errors for two signal inputs
Week 11	PID controllers
Week 12	PID controllers
Week 13	Convert block diagrams to signal flow diagrams
Week 14	Convert block diagrams to signal flow diagrams
Week 15	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1:
Week 2	Lab 2:
Week 3	Lab 3:
Week 4	Lab 4:
Week 5	Lab 5:
Week 6	Lab 6:
Week 7	Lab 7:

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1.Modern Control Engineering, Fifth Edition 2010, Katsuhiko Ogata	Yes
Recommended Texts	1.Modern Control Systems, Twelfth Edition 2011, by Richard C. Dorf and Robert H. Bishop, Prentice Hall. 2.Automatic Control Systems, Ninth Edition 2010, by Farid Golnaraghi and Binjamin C. Kuo, John Wiley. 3.Measurement Systems Applications and Design, 5th edition 2003, by E. Doebelin, McGraw Hill.	No
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Petroleum Refinery			**Module Delivery**	
Module Type	C			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☒ **Seminar** ☐ **Practical** ☐ **Tutorial**	
Module Code	CHE 4327				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	**Four**		**Semester of Delivery**	1	
Administering Department	*Type Dept. Code*		**College**	Type College Code	
Module Leader	Omar Mustafa Hussein		**e-mail**	omalkuba@uoanabr.edu.iq	
Module Leader's Acad. Title	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	15/6/2023		**Version Number**	1	

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	• Formation of capability to apply knowledge in theoretical basics of petroleum refining processes for professional activity and education work. • Formation of capability to understand and apply basic terms for work in English speaking environment, preparation of documentation in English, presentation of results of professional activity in English.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	• Explain and apply the principles for the management of hydrocarbon molecules to form refined and petrochemical products from crude oil • Explain, analyze, and assess the technologies of processes that comprise a modern refinery and petrochemicals complex • Explain and apply the principles for analyzing and improving the profitability of refining and petrochemicals processing • Apply troubleshooting skills in resolving operating problems • Identify the challenges facing the refining and petrochemicals industry, and will gain virtual work experience on a virtual oil refinery and petrochemicals site.
Indicative Contents المحتويات الإرشادية	• Refinery and petrochemicals complex overview; • Separations processes e.g. atmospheric and vacuum distillation; • Treatment processes e.g. hydrotreating (including sulphur recovery), naphtha reforming; • Conversion processes e.g. catalytic cracking, coking for the upgrade of heavy hydrocarbons; • Gasoline production e.g. alkylation, isomerisation, blending; • Lubes production; • Petrochemicals e.g. light olefins for polymerisation, aromatics; • Utilities production, energy consumption and carbon dioxide emissions; • Strengths, weaknesses, opportunities and threats.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	• Teaching the Course of Petroleum Refinery Engineering Based on Goal Problem-Oriented Mode and Blended Learning Techniques • Combined face-to-face lecture sessions with a virtual visit to an oil refinery, the use of educational videos, group working and discussions in class with supportive coursework involving summative and formative coursework.

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	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	4

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**	1.5		3,6,9,12,15	
	Assignments	0			
	Projects / Lab.	0			
	Report	0			
Summative assessment	**Midterm Exam**	40			
	Final Exam	60			
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

	Material Covered
Week 1	An introduction to crude oil and its processing
Week 2	Laboratory Testing of Crude Oils
Week 3	Process Descriptions of Refinery Processes
Week 4	Description of the Crude Distillation Unit
Week 5	Description of the Desalting Process
Week 6	Reflux arrangement
Week 7	Thermal Cracking Processes
Week 8	Coking, Types of Coking, Coke Drums
Week 9	What is the meaning of hydro processing?
Week 10	Typical Hydrocracking reactions
Week 11	Feed Specifications of Hydrocracker
Week 12	Catalyst
Week 13	Thermodynamics and Kinetics of Hydrocracking
Week 14	Fixed-bed catalytic reactors

Week 15	Vessel Dimensions

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	• Fahim M.A., Sahhhaf T.A., Elkilani A.S. Fundamentals of Petroleum Refining: – First Edition. – Elsivier. – 2010. – 485 p. • Chaudhuri U.R. Fundamentals of Petroleum and Petrochemical Engineering. – CRC Press. – 2011. – 406 p. • Devold H. Oil and gas production handbook. – SRH Media. – 2013. –340 p.	Online
Recommended Texts		
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

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Technology of catalyst**			**Module Delivery**	
Module Type	**C**			**Theory** **x Lecture** **Lab** **Tutorial** **☐ Practical** **☐ Seminar**	
Module Code	**CHE 4328**				
ECTS Credits	**5**				
SWL (hr/sem)	**100**				
Module Level	4		**Semester of Delivery**	8	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Sufyan fadhil		**e-mail**	e-mail	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Name (if available)		**e-mail**	sufyanfadhil@uoanbar.edu.iq	
Peer Reviewer Name	Name		**e-mail**	sufyanfadhil@uoanbar.edu.iq	
Scientific Committee Approval Date	01/06/2023		**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. This course enables the student to develop a clear understanding of the fundamentals of catalysis 2. Understanding the heterogeneous chemical reaction engineering. Focus is placed on catalysts, catalytic reaction mechanisms, and catalytic reactor design. 3. Catalysis applications in various engineering and environmental processes are also presented.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be able to: 1. derive various equations in adsorption phenomena. 2. Estimate process variables like adsorption rate, adsorption constants, surface area of catalyst. 3. Write and solve reaction rate equation in heterogeneous sytems. 4. Understand the significance of the catalysis in the reactor design .
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Catalytic functions, Catalytic materials, Balanced structure of catalytic pellets, Catalytic design and development, Catalyst preparation, Catalyst characterization (Bulk properties, Particle properties, Surface properties), Catalyst deactivation. Application of catalysis in chemical and petrochemical industry.

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

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
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	67	**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)	5 and 10	LO #1, #2
	Assignments	2	5% (5)	2 and 12	LO #3, #4
	Projects / Lab.	---			
	Report	----			
Summative assessment	**Midterm Exam**	2	25% (25)	7	LO #1 - 3
	Final Exam	3hr	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	**Introduction to Catalysis,**
Week 2	**Catalst materials**
Week 3	**Structures of catalytic pellets**
Week 4	**Kinetics models for heterogeneous reactions**
Week 5	**Chemical and physical adsorption**
Week 6	**Catalyst characterization**
Week 7	**Rate equation for solid-liquid catalytic reactions**
Week 8	**Rate equation in terns of fluid phase concentration at the catalyst surface**
Week 9	**Adsorption of inerts**
Week 10	**Problems in catalyst rate equation derivation**
Week 11	**Design equation of reactors for gas-solid reactions**
Week 12	**Packed-bed reactors and fluidized bed reactors**
Week 13	**Catalyst deactivation**
Week 14	**Mass transfer effect on catalytic reaction**
Week 15	**Catalyst preparation**
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**Elements of chemical reaction engineering** **By:** **H. Scott Fogler**	Yes
Recommended Texts	**Chemical engineering kinetics , J. Smith**	No
Websites	https://www.uoanbar.edu.iq/English/staff-page.php?ID=728	

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

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MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Engineering Analysis and Modeling**			**Module Delivery**	
Module Type	**C**			**Theory** **x Lecture** **X Lab** **Tutorial** **☐ Practical** **☐ Seminar**	
Module Code	**CHE 4329**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	4		**Semester of Delivery**	8	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Suha Akram		**e-mail**	e-mail	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Name (if available)		**e-mail**	suhaakram@uoanbar.edu.iq	
Peer Reviewer Name	Name		**e-mail**	suhaakram@uoanbar.edu.iq	
Scientific Committee Approval Date	01/06/2023		**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. This course enables the student to develop a clear understanding of the fundamentals of chemical process modeling 2. Application of various mathematical tools to solve a certain problem. 3. Deploy a novel simulation packages to study different alternatives of chemical process design.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of successful completion of this course, the student will be able to: 1.learn basic definitions and fundamental principles related to process modelling and simulation 2. . Understand different types of models and their hierarchy as well as the general steps followed in developing a process model. 3. Develop appropriate mathematical models of varying complexities for different chemical engineering systems. 4. Know and learn about the commonly available mathematical tools and techniques as used in the simulation of developed models.. 5. Simulate a process using process simulators (ASPEN Plus/ ASPEN Hysys)
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Use and scope of mathematical modeling, Principles of model formulation, Role and importance of steady-state and dynamic simulation, Classification of models, Model building, Modeling difficulties, Degree-of-freedom analysis, Selection of design variables, Review of numerical techniques, Model simulation. Fundamental Laws: Equations of continuity, energy, momentum, and state, Transport properties, Equilibrium and chemical kinetics, Review of thermodynamic correlations for the estimation of physical properties like phase equilibria, bubble and dew points. Modeling of Specific Systems: Constant and variable holdup CSTRs under isothermal and non-isothermal conditions, Stability analysis, Heat conduction in a bar, Laminar flow of Newtonian liquid in a pipe, Gravity flow tank, Single component vaporizer, Multi-component flash drum, Absorption column, Ideal binary distillation column and Batch distillation with holdup etc. Simulation: Simulation of the models, Sequential modular approach, Equation oriented approach, Partitioning and tearing, Introduction and use of process simulation software (Aspen Plus/ Aspen Hysys) for flow sheet simulation.

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

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	62	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	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)	5 and 10	LO #1, #2
	Assignments	2	5% (5)	2 and 12	LO #3, #4
	Projects / Lab.	----			
	Report	----			
Summative assessment	**Midterm Exam**	2	25% (25)	7	LO #1 - 3
	Final Exam	3hr	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to Process Modeling Systematic Approach to Model Building, Classification of Models. Conservation Principles
Week 2	**Conservation of mass**
Week 3	**Mass transfer with reaction problems**
Week 4	**Thermodynamic Principles and conservation of energy**
Week 5	**Modelling of Mass transfer based transport problems.**
Week 6	**the continuity equation and conservation of momentum**
Week 7	**Steady state models giving rise to differential algebraic equation (DAE) systems; Rate based approaches for staged processes;**
Week 8	**Modeling of differential contactors – distributed parameter models of packed beds; Packed bed reactors;**
Week 9	**Modeling of reactive separation processes; Review of solution strategies for Differential Algebraic Equations (DAEs),**
Week 10	**Partial Differential Equations (PDEs), and available numerical software libraries. Introduction to unsteady state models and their applications.**
Week 11	**imulation and their approaches, Modular, Sequential, , Simulation softwares and their applications**
Week 12	**Simultaneous and Equation solving approach**
Week 13	**Simulation softwares and their applications**
Week 14	**Review of solution techniques and available numerical software libraries.**
Week 15	**Review of thermodynamic procedures and physical property data banks.**
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	**1. Luyben W.L., "Process Modeling, Simulation, and Control for Chemical Engineering", McGraw Hill.** **2. Franks R.E.G., "Modeling and Simulation in Chemical Engineering", Wiley Intrscience, NY**	Yes
Recommended Texts	**A. K. Jana, "Chemical Process Modelling and Computer Simulation", PHI,(2011)**	No
Websites	https://www.uoanbar.edu.iq/English/staff-page.php?ID=728	

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.

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Corrosion Engineering**			**Module Delivery**	
Module Type	**C**			☒ **Theory** ☒ **Lecture** ☐ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**CHE 4330**				
ECTS Credits	**5**				
SWL (hr/sem)	١٢٥				
Module Level	4		**Semester of Delivery**	8	
Administering Department	Type Dept. Code		**College**	Type College Code	
Module Leader	Kadhum Ahmed Abed		**e-mail**	E-mail kadhum1968@uoanbar.edu.iq	
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	01/06/2023		**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module		**Semester**	
Co-requisites module		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. **understand the fundamentals of corrosion** 2. **understand the importance of studying corrosion in the industry** 3. **learn about the safety, environment, and economic impacts that corrosion can yield** 4. **explain corrosion principles and understand electrochemistry** 5. **define the factors that affect corrosion** .
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	This course aims the students to be able: 1. Provide an introduction to the corrosion phenomenon and its repercussions is carried out 2. Provide an understanding of various corrosion processes, protection methods and materials selection with practical examples 3. Estimate the disastrous effects of corrosion on the economy, safety, energy consumption and environment. 4. Determine the probable corrosion type, estimate the corrosion rate and propose the most reasonable protection method as regards safety, price and environmental considerations..
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. **Corrosion of metals and alloys (2hrs)** Local cell model and mixed potential; Potential-pH diagram; General corrosion; Localized corrosion (4 hrs) **Passivation and passive film (4 Hrs)** Polarization curve; Measurement of passive film – impedance, ellipsometry and other methods (4hrs) **Atmospheric corrosion (4 hrs)** Atmospheric corrosion through thin water layer Weathering steels (4hrs) **Corrosion protection (4hrs)** Protection on the basis of electrochemistry;(4hrs) Cathodic protection; Anodic protection (4hrs

	Inhibitor (2hrs) **New trends for study on corrosion (2hrs)** Optical technique; Electrochemistry (2hrs)

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Type something like: The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	77	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	5
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, 10	LO #1, 2, 10 and 11
	Assignments	2	10% (10)	2, 12	LO # 3, 4, 6 and 7
	Projects / Lab.				
	Report	1	10% (10)	13	LO # 5, 8 and 10

Summative assessment	**Midterm Exam**	3 hr	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	**Corrosion of metals and alloys**
Week 2	Local cell model and mixed potential; Potential-pH diagram; General corrosion; Localized corrosion
Week 3	**Passivation and passive film**
Week 4	Polarization curve; Measurement of passive film – impedance, ellipsometry and other methods
Week 5	**Atmospheric corrosion**
Week 6	Atmospheric corrosion through thin water layer Weathering steels
Week 7	**Corrosion protection**
Week 8	Protection on the basis of electrochemistry; Cathodic protection; Anodic protection
Week 9	Inhibitor
Week 10	**New trends for study on corrosion**
Week 11	Optical technique; Electrochemistry
Week 12	**Corrosion of metals and alloys**
Week 13	Local cell model and mixed potential; Potential-pH diagram; General corrosion; Localized corrosion
Week 14	**Passivation and passive film**
Week 15	Polarization curve; Measurement of passive film – impedance, ellipsometry and other methods
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	

Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1. **Principles of Corrosion Engineering and Corrosion Control Zaki Ahmad**, 1st edition 2 Smith, Foundations of Materials Science and Engineering, 4th Edition, McGraw Hill, 2009. 3. William D. Callister, Material science and Engineering and Introduction, Wiley, 2006	no
Recommended Texts	, Materials Science and Engineering, , PHI, 2002 2. Donald R. Askland and Pradeep.P. Phule, The Science and Engineering of Materials, Cengage Learning, 4lh Ed., 2003. 3. George Ellwood Dieter, Mechanical Metallurgy, McGraw-Hill. 4. ASM Handbooks, American Society of Metals.	No
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

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.