MODULE DESCRIPTION FORM

Module Information					
Module Title	**Mathematics**			Module Delivery	
Module Type	**B**			☒ Theory ☐ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☒ Seminar	
Module Code	**CoS1209**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level		UGI	Semester of Delivery		2
Administering Department		CHE	College	CoS	
Module Leader	**ASMAA SALAH AZIZ**		e-mail	asmaas982@uomosul.edu.iq	
Module Leader's Acad. Title		LECTURER	Module Leader's Qualification		M.Sc.
Module Tutor			e-mail		
Peer Reviewer Name		Name	e-mail	E-mail	
Scientific Committee Approval Date			Version Number	1.0	

Relation with other Modules			
Prerequisite module	N/A	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1- Understanding basic concepts: Students should develop a solid understanding of fundamental concepts in calculus, such as limits, continuity, derivatives, and integrals. 2- Calculating derivatives: Students should be able to calculate derivatives using various differentiation techniques, including the power rule, chain rule, product rule, quotient rule, and trigonometric derivatives. 3- Applying differentiation: Students should be able to apply differentiation to solve problems related to rates of change, optimization, curve sketching, related rates, and applied problems in various fields. 4- Understanding the Fundamental Theorem of Calculus: Students should comprehend the Fundamental Theorem of Calculus and be able to use it to evaluate definite integrals and find antiderivatives. 5- Solving differential equations: Students should gain an understanding of basic techniques for solving first-order differential equations and solving separable, linear, and homogeneous differential equations. 6- Multivariable calculus: Depending on the level of the course, students may be introduced to multivariable calculus and learn concepts such as partial derivatives, multiple integrals, and vector calculus.
Module Learning Outcomes	1. study the functions and the domain . 2. evaluation the range of functions and their drawing. 3. A study of the limits and Luptal's rule. 4. A continuity study. 5. Derivability. 6. A study of the derivation of the transcendental exponential ,trigonometric and natural logarithm functions.
Indicative Contents	Indicative content includes the following. Part A – Theoretical lectures Introduction of real functions with Their Graphs , the Domain and Range of the functions with different techniques for polynomial function , fractional functions. Radical functions (odd and even roots) . [10 hrs] Limit of a Function and Limit Laws, The Precise Definition of a Limit, One-Sided Limits , Limits Involving Infinity, Asymptotes of Graphs [15 hrs] . The Derivative at a Point , The Derivative as a Function , Differentiation Rules , The

	Derivative as a Rate of Change , The Chain Rule ,Implicit Differentiation [15hrs]. Indeterminate Forms and L'Hopital's Rule [5hrs] . Derivative with higher power, Partial derivation and its applications [15 hrs] Exponential functions and their Derivatives, Logarithmic functions and their Derivatives, Trigonometric functions and their Derivatives [15hrs]. Part B – Additional and Advanced Exercises. [18 hrs] Introduction of Transcendental Functions with applications [12 hrs] Advanced Exercises and homework's.[40 hrs].

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopted in the delivery of this unit is to encourage students to participate in the exercises, 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 include some sampling activities that are of interest to the students. Mathematics, including calculus, requires practice to reinforce understanding and develop problem-solving skills. Work through a variety of problems, both from your textbook and supplementary resources. Start with simple problems and gradually increase the difficulty level.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem)	64	Structured SWL (h/w)	4
Unstructured SWL (h/sem)	61	Unstructured SWL (h/w)	4
Total SWL (h/sem)	125		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 12	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	4 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	---		Continuous	All
	Report	---		13	LO #5, #8 and #10
Summative assessment	Midterm Exam	2hr	20% (10)	7	LO #1 - #7
	Final Exam	3hr	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction of real functions and Their Graphs.
Week 2	Finding Domain and Range of the functions with different techniques.
Week 3	Limit of a Function and Limit Laws.
Week 4	Limits Involving Infinity.
Week 5	Indeterminate Forms and L'Hopital's Rule.
Week 6	Continuity with Additional and Advanced Exercises.
Week 7	The Derivative as a Function and Differentiation Rules
Week 8	The Chain Rule ,Implicit derivation .
Week 9	Derivative with higher power
Week 10	Partial derivation and its applications
Week 11	The Law of Cauchy-Riemann - The Law of Laplace
Week 12	Exponential functions and their Derivatives
Week 13	Logarithmic functions and their Derivatives
Week 14	Trigonometric functions and their Derivatives
Week 15	Using the Natural Logartim function to find derivatives of complex functions that are difficult to derive from ordinary laws

Delivery Plan (Weekly Lab. Syllabus) N/A	
	Material Covered
Week 1	

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	1- أي. برسل /الجزء الاول /1982 حسبان التفاضل والتكامل مع الهندسة التحليلية /. 2- George B. Thomas, Jr. Massachusetts '' INSTRUCTOR'S SOLUTIONS MANUAL SINGLE VARIABLE '' 3 - Calculus 11th Thomas	Yes yes Yes
Recommended Texts	1- د. رمضان محمد جهينة و د.احمد عبد العالي هب الريح التفاضل والتكامل /الجزء الاول /دار الكتاب الجديد المتحدة. 2 - ROBERT T. SMITH, ROLAND B. MINTON, '' Calculus Fourth Edition'' 2012	Yes No
Websites	https:// **www.wolframalpha.com .**	

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	**Chemistry**			Module Delivery	
Module Type	**Core**			☒ Theory ☒ Lecture ☒ Lab ☐ Tutorial ☒ Practical ☐ Seminar	
Module Code	**COS-1103**				
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	Rana Abdallmalik Alquaba		e-mail	ranaalqubua@uomosul.edu.iq	
Module Leader's Acad. Title			Module Leader's Qualification		
Module Tutor	Kalid Natheer		e-mail		
Peer Reviewer Name	Name		e-mail	E-mail	
Scientific Committee Approval Date	02/06/2023		Version Number	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1. To understand the basic concepts of Periodic Table (P.T) 2. To study about chemical and physical properties and behavior of elements.. 3. In order to study transition metals to understand the trends in properties and reactivity of the d-block elements. 4. To explain the typical physical and chemical properties of the transition metals. To identify simple classes for transition metals and describe their chemical properties.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. To understand the key elemnts of Periodic Table (P.T) 2. To be able to write electronic configuration of given atomic number. 3. To be able to use Crystal Field Theory to understand the magnetic properties (and in simple terms the colour) of coordination compounds. 4. To be able to describe the stability of metal complexes by the use of formation constants and to calculate thermodynamic parameters from them. 5. To be able to recognize the types of isomers in coordination compounds. 6. To be able to calculate bond order of different molecules.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A – Theoretical lectures</u> 1. Transition elements, definition, physical properties, characteristic properties. [2hr] 2. Group (1) and group 2,3,4,5,6 and d-block elements, f-block ele,coordination chemistry, important of complexes. [6hr] 3. Chain theory ,Werner's theory ,type of ligands, classification of metal complexes. [4hr] 4. Nomenclature of coordination compounds, Bonding theories for coordination compounds, and isomerism. [4hr] 5. EAN rules, valence bond theory [4hr] 6. Crystal field theory. [4hr] 7. CFSE for octahedral ,tetrahedral, and square planer. [4hr] Exp.6 Acetylaceton Complexes (Part 1 and 2) [6hr]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Reviewing and recalling key terms, Effective Questioning Techniques, Using a visual image, using a model, using a periodic table.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	109	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	7.3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	41	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	2.7
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	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 الأسبوعي النظري	
	Material Covered
Week 1	Periodic Table (P.T)
Week 2	Blocks of periodic table (P.T)
Week 3	Complete of
Week 4	First Quiz
Week 5	Electronic configuration of elements
Week 6	1. Ionization potential (T.P) of Periodic properties, 2- Electron affinity (E.A) ,3- Atomic size
Week 7	Shielding
Week 8	Electronegativity
Week 9	Acid and Base chemistry

Week 10	2.Lewis Acid and Base, Hard base and soft base and hard acid
Week 11	2. Lewis structures 2. Valence bond theory 3. Molecular orbital theory (MOT
Week 12	Ts he MOT of Heteronuclear diatomic molecules
Week 13	Werner theory Chelate ligand VBT of coordination compounds
Week 14	1 st course Mid Term Examination
Week 15	Crystal field theory Factor influence the ligand field splitting

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Introduction of analytical chemistry
Week 2	the identification of the glassware used in the laboratory
Week 3	Exp1. Analysis of Group I
Week 4	Exp 2. Systematic Separation
Week 5	detection of Group II
Week 6	Exp 3. Separation of Group IIA and IIB
Week 7	Analysis of Group (IIA)
Week 8	Separation of Group IIA and IIB ,
Week 9	Analysis of Group (IIA)
Week10	Exp. 4 Separation of Group IIA , IIB
Week 11	Analysis of Group (IIB)cat ion
Week 12	Quiz

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts		
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	**Cytology**			Module Delivery	
Module Type	**Basic**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**CoS12011**				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	2		Semester of Delivery	2	
Administering Department	CHE		College	CoS	
Module Leader	Amel Taha yaseen		e-mail	amal2005biochem@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor	Raghad Abdalmawjood Mohammed		e-mail	raghadhamo@uomosul.edu.iq	
Peer Reviewer Name	Prof.Dr. Thikra Ali Allwsh		e-mail	thekraaliallwsh@uomosul.edu.iq	
Scientific Committee Approval Date	13/06/2023		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	1. Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles 2. Students will understand how these cellular components are used to generate and utilize energy in cells 3. Students will understand the cellular components underlying mitotic cell division. 4. Students will apply their knowledge of cell biology to selected examples of changes or losses in cell function. These can include responses to environmental or physiological changes, or alterations of cell function brought about by mutation .
Module Learning Outcomes	-Explain the basic structure of cells -Identify the function and organization of the various organelles in eukaryotic cells - Describe intracellular trafficking of macromolecules Discuss endocytosis and exocytosis - Describe compartmentalization of cells, structure and function of cell organelles, the cytoskeleton, transport across cell membranes. - Discuss key biological processes in cells and their regulation - Evaluate the important biological processes in cells. - Conduct laboratory practical's, collect data, interpret and discuss results. - Utilize immune fluorescence microscopy for monitoring sub cellular trafficking of proteins.
Indicative Contents	Indicative content includes the following. Part A – Theoretical lectures -Introduction of cell biology, define of the cell, function of cell ,cell theory, protoplasm theory . Types of cell, prokaryotic and Eukaryotic cell , plant , animals and bacteria cell. Cell content, plasma membrane and cell wall. nucleus and cytoplasm. The organelles (Mitochondria ,The Endoplasmic Reticulum , The Golgi apparatus, Lysosomes, Cilia and Flagella, Centriole) The Cytoskeleton (Movement and Cell Junctions ,Vacuole , Vacuole functions) The chemistry of the cell , elements of life. biological micro molecules. Salt and ions (Ionic Dissociation and Regulation of pH, Acids, bases, pH, buffers, Buffers-Bio ,The importance of some ions for living organisms) Biological Macromolecule (carbohydrate, protein, lipid , Nucleic acids) Membrane transport mechanisms. Energy – releasing pathway (cellular respiration) Cell cycle .Chromosomes : History, types and functions of chromosomes Mitotic cell division, Meiosis. Part B – Practical labs

	MICROMETRY. The microscope. The Cell. The prokaryotic and eukaryotic cells. cellular organelles, Cytoplasmic organelles, Ribosomes,. Centrosome, Chromosomes. Mitochondria, Golgi apparatus, Endoplasmic reticulum, Lysosome , vesicles. Cell cycle. The cell wall and modification of plasma membrane, The meiotic division.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1. Using Power Point as a means to present the lecture. 2. Using the seminar method. 3. Using the method of increasing student interaction in the lecture by asking questions with short and quick answers. 4. Using the method of giving homework that makes the student have the ability to research and learn more about the subject.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	64	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	36	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	2
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 12	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	4 and 12	LO #2, #3 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 الأسبوعي النظري

	Material Covered
Week 1	Introduction of cell biology, define of the cell, function of cell ,cell theory, protoplasm theory .
Week 2	Types of cell , prokaryotic and Eukaryotic cell , plant , animals and bacteria cell.
Week 3	Cell content, plasma membrane and cell wall.
Week4	nucleus and cytoplasm
Week 5	The organelles (Mitochondria ,The Endoplasmic Reticulum , The Golgi apparatus, Lysosomes, Cilia and Flagella, Centriole)
Week6	The Cytoskeleton (Movement and Cell Junctions ,Vacuole , Vacuole functions)
Week 7	The chemistry of the cell , elements of life.
Week8	biological micro molecules .
Week 9	Salt and ions(Ionic Dissociation and Regulation of pH, Acids, bases, pH, buffers, Buffers-Bio The importance of some ions for living organisms)
Week 10	Biological Macromolecule (carbohydrate, protein, lipid, Nucleic acids)
Week 11	Membrane transport mechanisms.
Week 12	Energy – releasing pathway (cellular respiration) .
Week 13	Cell cycle .
Week 14	Chromosomes : History, types and functions of chromosomes
Week 15	Mitotic cell division, Meiosis.

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: MICROMETRY.
Week 2	Lab 2: The microscope.
Week 3	Lab 3: The Cell.
Week 4	Lab 4: The prokaryotic and eukaryotic cells.
Week 5	Lab 5: cellular organelles
Week 6	Lab 6: Cytoplasmic organelles
Week 7	Lab 7: Ribosomes,. Centrosome, Chromosomes
Week 8	Lab 8: Mitochondria, Golgi apparatus, Endoplasmic reticulum
Week 9	Lab9: Lysosomes, vesicles.
Week10	Lab 10: Cell cycle.
Week 11	Lab 11: The cell wall and modification of plasma membrane
Week 12	Lab 12: The meiotic division

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Bolsover ,S.R., Hymas ,J.S., Shepard ,E.A.,White ,H.A. and Wiedemann ,C.G . (Cell Biology) 2nd ed. Johon Wiley & Sons,Inc. (2004)	No
	Rodwell, V.W. ,Bender,D.A., Botham,K.M. ,Kennelly,P.J. and Well ,p.A .(Harper`s Illustrated biochemistry).31st ed. McGraw-Hill Education,(2018).	No
	Tyagi ,R., Godara ,P. and Kansal ,L.(Cell Biology) Part I, Biyani Group of Colleg,(2011).	No

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**			Module Delivery	
Module Type	**Core**			☐Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**CoS-23017**				
ECTS Credits	3				
SWL (hr/sem)	75				
Module Level		1	Semester of Delivery		1
Administering Department		chemistry	College	Science	
Module Leader	Ibrahim Mohammed Ahmed		e-mail	ibrhim__alhlima@uomosul.edu.iq	
Module Leader's Acad. Title		Assistant Professor	Module Leader's Qualification		Ph.D.
Module Tutor	Mawaddah Mohammed sulaiman		e-mail	mwada.m.suliman@uomosul.edu.iq	
Peer Reviewer Name		Rabah Khalil	e-mail	E-mail: rabahalikhalil@uomosul.edu.iq	
Scientific Committee Approval Date		02/06/2023	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 Objectives أهداف المادة الدراسية	1. Clarification of how computer fundamentals can make significant contributions to a student skill in chemistry. 2. Identify Computer which are useful in scientific stage. 3. This course deals with the basic concept of the most important windows, office word, and information technology aspects of this modulare. 4. Learn about the most important scientific terms (Terminology) and their definitions related to this topic. 5. To understand the impact of these Computer in Development Chemistry Applied.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. 1. List with description, the fundamental of computer discription. 2. Define the various terms information technology with fundamental of windows and Office . 3. Summarize what is meant by external and internal features and structures of ostracode. 4. Identify the Windows O.S and Microsoft Office Word. 5. Explain the internet and Computer Architecture. 6.Identify the Application of Microsoft Office with Word and excel application.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Practical labs Slides, Practical Application on the computer.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Expanding students' perceptions about this science and its contents it includes that help in Computer Fundamentals. In addition to the use of different methods of describe Office application and windows. This will be achieved through lectures, labs.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	49	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem)	26	Unstructured SWL (h/w)	2

الحمل الدراسي غير المنتظم للطالب خلال الفصل		الحمل الدراسي غير المنتظم للطالب أسبوعيا	
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	
	Assignments	2	10% (10)	2 and 12	
	Report	1	10% (10)	13	
Summative assessment	Midterm Exam	2hr	10% (10)	7	
	Final Exam	3hr	60% (60)	16	
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الأسبوعي النظري

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	
Week 10	

Week 11	
Week 12	
Week 13	
Week 14	
Week 15	

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Introduction to computer: characteristics of computer: speed-accuracy-versatility-storage capacity.
Week 2	Lab 2: Generations of computer. Classifications of computers. Component of computer system: CPU, ALU, memory unit, Input/Output. Computer Hardware: Central processing unit "CPU". Read only. Memory "ROM".
Week 3	Lab 3: Classification of secondary storage devices. Input/output devices. Types of input/output devices. Classification of input/output devices.
Week 4	Lab 4: Windows 7: Touring windows 7 desktop- exploring your computer.
Week 5	Lab 5: Navigating with windows explorer- operating system.
Week 6	Lab 6: Adding gadgets-aero peak- the toolbar- pinning an application- the notification area.
Week 7	Lab 7: Customize the desktop- window components- showing the desktop windows accessories- security settings and software..
Week 8	Lab 8:Introduction to information technology: digital world. Application to computer in different fields. IT and your life: the future now.
Week 9	Lab9: IT jobs and carriers. Online internet, worldwide web and cyberspace. Computer technology
Week10	Lab 10: Internet services and web technologies: What's the internet, terms to know. Web page and website, Home pages, web server. Internet providers, IP address, domain name. Spamming.
Week 11	Lab 11: Parts of URL, Search engines, access information, shopping. Online chat, downloading software, disadvantages of internet.
Week 12	Lab 12: Microsoft word 2013: Getting started, saving the document, toolbars and tabs, formatting, inserting and adding objects, printing, other helpful functions, shortcut keys for Microsoft office.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Boyce, Jim. Windows 7 bible. John Wiley & Sons, 2011. Acklen, L. (2004). Absolute Beginner's Guide to Microsoft Office Word 2003. Que Publishing.	No 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					
Module Title	**Mathematics and Statistics**			Module Delivery	
Module Type	**Core**			☒ Theory ☐Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	CoS23118				
ECTS Credits	**3**				
SWL (hr/sem)	75				
Module Level		UGII	Semester of Delivery		3
Administering Department		**CHE**	College	**CoS**	
Module Leader	ASMAA SALAH AZIZ		e-mail	asmaas982@uomosul.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		13/06/2023	Version Number		1.0

Relation with other Modules			
Prerequisite module	CoS1209	Semester	
Co-requisites module		Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives أهداف المادة الدراسية	1. إعطاء مفهوم التكامل 2. اعطاء طرق جديدة في التكامل 3. يتعرف الطالب على كيفية حل المسائل الرياضية بأكثر من طريقة من طرق التكامل اعطاء مقدمة عن المعادلات التفاضلية وبعض طرق حلها
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. مقدمه عن التكامل المحدد و غير المحدد وخواصه 2. تطبيق التكامل على الدوال الجبرية 3. المثلثية والعكسية 4. الزائدية 5. طرق التكامل 6. والمعادلات التفاضلية وطرق حلها
Indicative Contents المحتويات الإرشادية	يتضمن المحتوى الإرشادي ما يلي. عند العمل على مسألة التكامل، يجب اتباع بعض المحتويات الارشادية التالية: 1- دراسة الدالة المراد تكاملها وفهم خصائصها وارتباطها بالتكامل. 2- تحديد حدود التكامل، أي مدى التكامل من القيمة الصغرى إلى القيمة الكبرى. 3- اختيار طريقة التكامل المناسبة للمسألة المطروحة، سواء كانت طريقة التكامل بالأجزاء أو التكامل بالتعويض أو غيرها من الطرق المعروفة. 4- الانتباه لقواعد التكامل وتطبيقها بشكل صحيح، مثل قاعدة خطية التكامل وقاعدة التكامل بالتعويض وغيرها. 5- التأكد من صحة الإجابة بعد التكامل، وذلك عن طريق التحقق منها بواسطة التفريق والتدقيق. 6- في حالة عدم قدرة على حل المسألة، يمكن استخدام الحساب التفاضلي العددي لتقريب الإجابة. 7- يجب تجنب الأخطاء الشائعة في التكامل مثل الغفوة والتداخل في الحسابات. 8- لتطبيق التكامل في الحياة العملية، يجب فهم النتائج وتفسيرها بطريقة صحيحة وتطبيقها على المواقف الحقيقية.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	الإستراتيجية الرئيسية التي سيتم تبنيها في تقديم هذه الوحدة هي تشجيع الطلاب على المشاركة في التمارين، مع تحسين مهارات التفكير النقدي وتوسيعها في نفس الوقت. سيتم تحقيق ذلك من خلال الفصول والبرامج التعليمية التفاعلية ومن خلال النظر في أنواع التجارب البسيطة التي تتضمن بعض أنشطة أخذ العينات التي تهم الطلاب.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	34	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	41	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 التقييم التكويني	Quizzes	2	15% (10)	5 and 12	LO #1, #2 and #10, #11
	Assignments	2	15% (10)	5 and 12	LO #3, #4 and #6, #7
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment التقييم التلخيصي	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	مفهوم التكامل + قوانين التكامل
Week 2	التكامل المحدد والغير المحدد
Week 3	خواص التكامل
Week 4	تكامل الدوال الجبرية
Week 5	تكامل الدوال الاسية واللوغاريتمية
Week 6	تكامل الدوال المثلية
Week 7	تكامل الدوال الزائدية
Week 8	تكامل الدوال المثلية العكسية
Week 9	طرق التكامل / طريقة التعويض
Week 10	طريقة التكامل بالتجزئة
Week 11	طريقة التكامل بتجزئة الكسور
Week 12	طريقة التكامل بالتعويض بالدوال المثلثية
Week 13	المعادلات التفاضلية
Week 14	حل المعادلات التفاضلية بطريقة فصل المتغيرات
Week 15	حل المعادلات التفاضلية المتجانسة
Week 16	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 النصوص المطلوبة	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 Performanceأداء مذهل
	B - Very Good	جيد جدا	80 - 89	Above average with some errors فوق المتوسط مع بعض الأخطاء
	C - Good	جيد	70 - 79	Sound work with notable errors العمل السليم مع أخطاء ملحوظة
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings عادل ولكن مع نواقص كبيرة
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria العمل يلبي الحد الأدنى من المعايير
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded مطلوب المزيد من العمل ولكن الائتمان الممنوح
	F – Fail	راسب	(0-44)	Considerable amount of work required قدر كبير من العمل المطلوب

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	**Electrochemistry and Surface chemistry**			**Module Delivery**	
Module Type	**Core**			☒Theory ☐ Lecture ☒Lab ☒Tutorial ☐Practical ☐Seminar	
Module Code	**CHE36132**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level		**UGIII**	**Semester of Delivery**		**6**
Administering Department		**CHE**	**College**	CoS	
Module Leader	**Firas Ahmed Thanon**		**e-mail**	firas.allolage@uomosul.edu.iq	
Module Leader's Acad. Title		**Lecturer**	**Module Leader's Qualification**		**Ph.D.**
Module Tutor	**Omar Adil Shareef** **Alaa Mohamadtayeb Hussien**		**e-mail**	omaradel75a@uomosul.edu.iq alaa.mt.allayla@uomosul.edu.iq	
Peer Reviewer Name		**Rabah Ali Khalil**	**e-mail**	rabahalikhalil@uomosul.edu.iq	
Scientific Committee Approval Date		13/06/2023	**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1. To Know the basic of ions, electrolyte, movement of ions, electrochemistry. 2. Describe the fundamentals of electrochemical reactions at a molecular-level description. 3. To recognize types of electrodes and types of electrochemical cells. 4. To provide students with basics of electrochemical processes under standard and non-standard conditions. 5. Apply knowledge of the principles of electrochemical reactions. 6. To familiarize students with the principles of some electrochemical techniques. 7. To explore the surface science,state of matter, surface tension and Adsorpttion 8. To explore the theories and laws associated with all the listed concepts.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Evaluate fundamentals of electrochemistry and recognize the electrochemical processes. 2. Evaluate electrodes and cells, and explains electrode materials. 3. Evaluate conductivity measurements and explain the conductivity. 4. Evaluate electrolysis, electrolytic cells and explain Faraday's laws and solve relevant problems in electolysis. 5. Experimental basis and theoretical explanation of Kohlrausch law, Applications of Kohlrausch's law and discuss ionic theory. 6. Evaluate potentiometric methods and express the Nernst equation. 7. Discuss electrode potentials and cell thermodynamics. 8. Explain the type of electrodes. 9. Evaluate titration curves, and express the conductometric titration curves. 10. Explain the type of concentration cells 11. Explain the type of batteries and fuel cells. 12. Measuring of surface tension, cohesive and adhesive, capillary action forces, effect of temperature on the surface tension. 13. Explain surface free energy, interfacial energy , spreading coefficient , the work of cohesion and adhesion. 14. Explain amphiphiles, determination of hrdrophilic-lipophilic balance value, determination of HLB , attractive forces , Adsorpttion, types of adsorption. 15. Explain Gibbs adsorption equation.

Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Theoretical lectures 1. Introduction, Why scientists make electrochemical measurements, Why it is important to study the fundamental principles of electrode reactions, Electrochemical Cells, Electrode materials, Do we experimentally need electrochemical cells, Electro-neutrality, Types of electrochemical cells, Expressing the structures of cells. **[3 hrs]** 2. Conductivity theory and measurement, Introduction to conductivity, What is conductivity, How is conductivity measured, Electrolytes, Resistance, Conductance, Cell constant, Conductivity or specific conductance, Equivalent conductance**. [3 hrs]** 3. Electrolysis, Electrolytic cells, Comparing galvanic and electrolytic cells, Electrolysis of molten ionic compounds, Electrolysis of water, Electrolysis of aqueous solutions of ionic compounds, Commercial applications of electrolysis. **[5 hrs]** 4. Calculations in electrolysis - Faraday's laws, Faraday's first law of electrolysis, Faraday's second law of electrolysis. **[4 hrs]** 5. Kohlrausch's law, Weak and Strong Electrolytes, Effect of dilution on conductance, Experimental basis and theoretical explanation of Kohlrausch law, Applications of Kohlrausch's law, Factors affecting the conductance of electrolyte solutions. Conductivities of hydrogen and hydroxyl ions. **[4 hrs]** 6. Arrhenius theory, Ostwald's dilution law, Ostwald dilution law, Debye-Huckel-Onsager theory.**[3hrs]** 7. Taypes of electrodes, Standard reduction potential, Electrochemical series, What is a spontaneous electrochemical reaction, Nernst Equation, Thermodynamics and Equilibrium, Single Electrodes or Half Cells: Types. **[5hrs]** 8. Conductometric Titration, Strong Acid with a Strong Base, Strong Acid with a Weak Base, Weak Acid with a Strong Base, Weak Acid with Weak Base, Mixture of a Strong Acid and a Weak Acid vs. a Strong Base or a Weak Base, Transport number and Ionic conductance. **[3hrs]** 9. Concentration Cells, Types of concentration cells**. [2hrs]** 10. Batteries and Fuel Cells, Primary Batteries, Secondary Batteries, fuel cells**.[3hrs].** 11**.** Surface Chemistry, Introduction, place of colloid and surface science,state of matter, surface tension. **[2hrs]** 12. Measuring of surface tension, cohesive and adhesive, capillary action forces, effect of temperature on the surface tension.**[2hrs]** 13. Surface free energy, interfacial energy , spreading coefficient , the work of cohesion and adhesion.**[2hrs]** 14. Amphiphiles, determination of hrdrophilic-lipophilic balance value, determination of HLB , attractive forces , Adsorpttion, types of adsorption. **[2hrs]** Gibbs adsorption equation. **[2hrs]**. Part B – Practical labs 1. Equivalent conductance of strong electrolyte. 2. Dissociation constant of weak electrolytes from conductivity measurements. 3. Condutometric titration part 1, 2, 3 4 and 5 , 4. The quinhydron electrode. 5. The glass electrode. 6. Dissociation constant (Ka) of a weak acid from its neutralization. 7. Measurement of the E.M.F of a concentration cell part 1 and 2. 8. Thermodynamic of cell. **[45 hrs].**

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Teaching methods: Lectures, laboratory (experimental study),directed reading, Tutorial, online support. Learning methods: Independent study, student motivated peer group study, student driven tutor support.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	109	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	7
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	41	**Unstructured SWL (h/w)** الحمل الدراسي غير المنتظم للطالب أسبوعيا	3
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 #3, #4 and #8, #9
	Assignments	2	10% (10)	3 and 14	LO #1, #2 and #12, #13
	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 - #6
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week 1	Electrochemistry: Introduction
Week 2	Conductivity Theory and Measurement
Week 3	Electrolysis
Week 4	Calculations in electrolysis -Faraday's laws
Week 5	Kohlrausch's law
Week 6	Arrhenius theory of electrolytic dissociation or ionic theory
Week 7	Taypes of electrodes
Week 8	Conductometric Titration
Week 9	Concentration Cells
Week 10	Batteries and Fuel Cells
Week 11	Surface Chemistry, Introduction
Week 12	Measuring of surface tension
Week 13	Surface free energy
Week 14	Amphiphiles
Week 15	Gibbs adsorption equation

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Electrochemistry principles, what does electrochemistry rely on? What does student need to study the practical electrochemistry?
Week 2	Lab 2: Electrochemistry Lab Experience: Brief explanation of the next electrochemistry experiments.
Week 3	Lab 3: Equivalent conductance of strong electrolyte.
Week 4	Lab 4: Dissociation constant of weak electrolytes from conductivity measurements.
Week 5	Lab 5: Condutometric titration, Part 1: Strong Acid with a Strong Base.
Week 6	Lab 6: Condutometric titration, Part 2: Strong Acid with a Weak Base.
Week 7	Lab 7: Condutometric titration, Part 3: Weak Acid with a Strong Base.
Week 8	Lab 8: Condutometric titration, Part 4: Weak Acid with Weak Base.
Week 9	Lab 9:. Condutometric titration, Part 5: Mixture of a Strong Acid and a Weak Acid *vs.* a Strong Base or a Weak Base.
Week10	Lab 10: The quinhydron electrode.

Week 11	Lab 11: The glass electrode.
Week 12	Lab 12: Dissociation constant (Ka) of a weak acid from its neutralization.
Week 13	Lab 13: Measurement of the E.M.F of a concentration cell. Part 1 and 2
Week 14	Lab 14: Measurement of the E.M.F of a concentration cell. Part 3 and 4
Week 15	Lab 15: Thermodynamic of a galvanic cell.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	A.J. Bard ,L.R. Faulkner, Electrochemical Methods , Fundemental and Applications,2010 John Wiley & Sons. Handbook of Electrochemistry, Cynthia Zosk, Elsevier, 2011	Yes Yes
Recommended Texts	Atkins (physical chemistry) Eighth Edition 2006	Yes
Websites	https://www.studysmarter.co.uk/explanations/chemistry/physical-chemistry/electrochemistry/	

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	اللغة العربية Arabic Language			Module Delivery	
Module Type	S			☒ Theory ☐ Lecture ☐Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	UOM1106				
ECTS Credits	3				
SWL (hr/sem)	75				
Module Level	UGI		Semester of Delivery	1	
Administering Department	Medical physics		College	Science	
Module Leader	د. ايناس عطوان		e-mail		
Module Leader's Acad. Title	lecturer		Module Leader's Qualification	Ph.D.	
Module Tutor			e-mail	Enassatwam@uomosul.edu.iq	
Peer Reviewer Name			e-mail		
Scientific Committee Approval Date			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 Objectives أهداف المادة الدراسية	تعريف الطلاب بأساسيات اللغة الإنجليزية. كذلك كسر حاجز الخجل وزيادة ثقتهم داخل وخارج الفصل. هناك فرصة كبيرة لإشراكهم في مناقشات قصيرة حيث يمكنهم الكتابة أو التعبير عن أنفسهم شفهيًا. بالإضافة إلى ما سبق ، ستعمل الدورة على تحسين مهارات القراءة والكتابة والاستماع والتحدث كطلاب ، وتقوية ملكة الطلاب الأدبية لتذوق أساليب اللغة وإدراك مواطن الجمال فيها
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1- خلق وعي كامل بالاستخدام الصحيح لقواعد اللغة العربية في الكتابة والمحادثة. 2- إدراك أهمية اللغة العربية داخل وخارج الحياة الجامعية. 3- سيحسن الطلاب قدرتهم على التحدث باللغة العربية من حيث الطلاقة والاستيعاب. 4- سيقوم الطلاب بمراجعة الأشكال النحوية للغة العربية واستخدام هذه الأشكال في سياقات تواصلية محددة ، والتي تشمل: الأنشطة الصفية ، والواجبات المنزلية ، وقراءة النصوص ، والكتابة. 5- سيعزز الطلاب قدرتهم على كتابة فقرات قصيرة وملخصات باستخدام نهج العملية.
Indicative Contents المحتويات الإرشادية	مقدمة عن الاتصال بشكل عام واللغة العربية بشكل خاص ، مع مقدمة عن فئات الكلمات (أجزاء الكلام) في اللغة العربية [4 ساعات]. شرح كل جزء من الكلام في اللغة العربية مثل الأسماء والضمائر والأفعال والصفات والظروف وحروف الجر وحروف العطف والاقتران [16 ساعة]. المهارات الأساسية في تعلم اللغة الإنجليزية: القراءة والكتابة يتم تقديمها بشكل تدريجي خلال الأسابيع الماضية [6 ساعات]. الجزء الأخير مخصص لبعض جلسات تصحيح الأخطاء وردود الفعل [2 ساعة]. -جعل الطلبة على دراية بالعلاقة بين أساليب التعلم وأساليب التدريس. -تشجيع الطلبة على "توسيع" أساليبهم.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1. المحاضرة المصحوبة بالشرح والتحليل. 2. الحلقة النقاشية. 3. التقارير والبحوث. 4. عرض المادة عبر شرائح (بوربوينت) . 5. الاسئلة والاجوبة. 6. المشاركة الصفية .

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	49	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem)	26	Unstructured SWL (h/w)	2

الحمل الدراسي غير المنتظم للطالب خلال الفصل		الحمل الدراسي غير المنتظم للطالب أسبوعيا	
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	10% (10)	5 and 12	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	4 and 9	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 الأسبوعي النظري

	Material Covered
Week 1	**الكلام وأقسامه**
Week 2	**علامات الاسم**
Week 3	**علامات الفعل**
Week 4	**قواعد كتابة العدد**
Week 5	**قواعد كتابة العدد**
Week 6	**أنوع المفاعيل**
Week 7	**المبتدأ والخبر**
Week 8	**همزة القطع وهمزة الوصل**
Week 9	**الهمزة المتوسطة وهمزة السطر**
Week 10	**الفرق بين الضاد والضاء**
Week 11	**الفرق بين التاء المربوطة والتاء المفتوحة**
Week 12	**زيادة الحرف وحذفه**
Week 13	**زيادة الحرف وحذفه**
Week 14	**الأفعال الناقصة ، الحروف المشبه بالفعل**
Week 15	**اختبار**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	لا يوجد
Week 1	
Week 2	
Week 3	
Week 4	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	شرح ابن عقيل على الفية ابن مالك ، المرشد في الاملاء ، محمد شاكر سعيد	Yes Yes
Recommended Texts	الاسلوب ، احمد الشايب ، طرق تعليم التعبير ، محمد عبد القادر أحمد	Yes 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

Module Information					
Module Title	English Language			Module Delivery	
Module Type	S			☒ Theory ☒ Lecture ☐Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	UOM-12012				
ECTS Credits	3				
SWL (hr/sem)	75				
Module Level	1		Semester of Delivery	2	
Administering Department	Medical Physics		College	Science	
Module Leader	Younis Hamad Ahmed		e-mail	younis.h81@uomosul.edu.iq	
Module Leader's Acad. Title	Teaching Assistant		Module Leader's Qualification	MASTER	
Module Tutor			e-mail		
Peer Reviewer Name			e-mail		
Scientific Committee Approval Date	13/06/2023		Version Number	1.0	

Relation with other Modules			
Prerequisite module	none	Semester	
Co-requisites module	none	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	Familiarizing students with the basics of the English language. Also, breaking the barrier of shyness and increasing their confidence inside and outside the classroom. There is a big chance to get them engaged in short discussions where they can write or verbally express themselves. In addition to these above, the course will improve their reading, writing, listening and speaking skills as students where English language is the main medium of communication throughout their courses.

Module Learning Outcomes	1- Creating full awareness of correct usage of English grammar in writing and speaking. 2- Realizing the importance of the English language inside and outside of university life. 3- Students will improve their speaking ability in English both in terms of fluency and comprehensibility. 4- Students will review the grammatical forms of English and the use of these forms in specific communicative contexts, which include: class activities, homework assignments, reading of texts and writing. 5- Increasing their reading speed and comprehension of academic articles. 6- Students will improve their reading fluency skills through extensive reading. 7- Students will enlarge their vocabulary by keeping a vocabulary journal. 8- Students will strengthen their ability to write short paragraphs and summaries using the process approach.
Indicative Contents	Part A – Theoretical lectures Introduction about communication in general and especially the English language, with an introduction on the word classes (parts of speech) in the English language [4 hrs]. Explaining every part of speech in the English language such as nouns, pronouns, verbs, adjectives, adverbs, prepositions, conjunctions and interjections [16 hrs]. Moving on to Vocabulary teaching where students will study some strategies and learn new methods of memorizing any set of vocabulary [4 hrs]. Main skills in learning the English language: speaking, listening, reading and writing are also delivered gradually during the last weeks [6 hrs]. The last part is dedicated to some error correction and feedback sessions [2 hrs].

Learning and Teaching Strategies	
Strategies	1. Encourage Learners to 'Stretch' Their Styles. This is a very important point as learners are not 100 percent one type or another. For example, of the analytical/global learning styles. Analytical learners work more effectively alone and at their own pace. Global learners, on the other hand, work more effectively in groups. 2. Do Not Privilege Any One Style Over Another.

	The general consensus is that while styles differ, one is not necessarily superior to the other. In other words, learners who prefer to study alone will not necessarily be better learners than those who prefer to learn by listening. According to this view, analytical learners should be given the opportunity to spend more time studying alone than in groups, but they should also be given the chance to work in groups. 3. Be Aware of the Relationship Between Learning Styles and Teaching Styles. The reason is that if your style as a teacher is at odds with the learning styles of some of your students, then the effectiveness of your teaching may be limited. If you have a collaborative teaching style, then the way you run your classroom may not suit authority-oriented learners who want the teacher to tell them what to do. If your teaching style is authoritative, even authoritarian, then you may not be suited to students who value autonomous learning.

Student Workload (SWL)			
Structured SWL (h/sem)	49	Structured SWL (h/w	3
Unstructured SWL (h/sem)	26	Unstructured SWL (h/w	2
Total SWL (h/sem)	50		

Module Evaluation					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	15% (15)	2, 5, and 9	LO #2, #5, #8
	Assignments	2	10% (10)	4 and 8	LO #4 and #8
	Projects / Lab.				
	Report	3	15% (15)	3, 6 and 7	LO #3, #6 and #7
Summative assessment	Midterm Exam	2hr	10% (10)	7	ALL
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	**An introduction on communication and English language.**
Week 2	**Parts of Speech (word classes).**
Week 3	**Nouns & their types.**
Week 4	**Pronouns in English language.**
Week 5	**Verbs in the English language.**
Week 6	**Adjectives and their types.**
Week 7	**Adverbs and their uses.**
Week 8	**Prepositions in English language.**
Week 9	**Conjunctions in English Sentences.**
Week 10	**Interjections in English Sentences.**
Week 11	**Vocabulary Improving Skills.**
Week 12	**Basic Speaking Skills.**
Week 13	**Basic Reading Skills.**
Week 14	**Basic Writing Skills**
Week 15	**Basic Listening Skills**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	
Week10	

Week 11	
Week 12	

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	**Murphy, R. (1985). *English Grammar In Use*. CUP.**	Yes
Recommended Texts	**Sullivan, N. (2015). *Essential Grammar*. Routledge.**	No
Websites	https://www.pdfdrive.com/essential-grammar-for-todays-writers-students-and-teachers-e165838835.html	

Grading Scheme				
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

Module Information					
Module Title	**Thermodynamics**			**Module Delivery**	
Module Type	**Core**			☒**Theory** ☐ **Lecture** ☒**Lab** ☐**Tutorial** ☐**Practical** ☐**Seminar**	
Module Code	**CHE23015**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level	2		**Semester of Delivery**	3rd course	
Administering Department	Chemistry		**College**	Science	
Module Leader	Assist. Prof. Dr. Fanar Mohammed Ismael Assist. Prof. Dr. Shaymaa Hashim Abdulrahman		**e-mail**	fanarmohammd@uomosul.edu.iq Shaymaa.hashim@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Dr. Nada Bashir Amal Kazi		**e-mail**	basheer.nada@uomosul.edu.iq amalchem@uomosul.edu.iq	
Peer Reviewer Name	Dr.Rabah Ali Khalil		**e-mail**	rabahalikhalil@uomosul.edu.iq	
Scientific Committee Approval Date	11/06/2023		**Version Number**	1.0	

Relation with other Modules			
Prerequisite module	Phase diagram and equilibrium	**Semester**	4
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	To make students practice of thermodynamics, thermodynamics is concerned with ways energy is stored within a body and how energy transformations, which involve heat and work, Thermodynamics is important for both Chemistry and Physics as it deals with the study of energy, the conversion of energy between different forms and the ability of energy to do work. introduction to Thermodynamics: work, temperature, systems, 1st Law, heat, state and path functions,Second Low of Thermodynamic and Third low of thermodynamic.
Module Learning Outcomes	1-Introduction ntroduction to Thermodynamics, properties of Thermodynamic, 2-Dalton's law. 3-Graham's Law of Diffusion and Effusion. 4-Real gases, Deviation From Ideal gas Behavior. 5-Compressibility factor, Van der Waals Equation. 6- Zeroth law of thermodynamics. 7- First law of thermodynamics, Quantity of heat ,Work ,Internal energy Application ,Cyclic procures. 8- Reversible and Irreversible Processes. 9- Isobaric Process, Isochoric Process, Isothermal Process. 10- Heat Capacity, Relation In adiabatic process, Theoretical calculation of (Cp & Cv). 11- Endothermic and Exothermic process, The relation between ΔE and ΔH, Enthalpy of Combustion. 12- Heat of Formation (Hf), Heat of Solution, Bond energy. 13- Second Low of Thermodynamic. 14- Third low of thermodynamic. 15- Free energy ΔG, Criteria for spontaneity
Indicative Contents	Indicative content includes the following. Part A – Theoretical lectures 1-Introduction to Thermodynamics, properties of Thermodynamic, Dalton's law Graham's Law of Diffusion and Effusion. Real gases, Deviation From Ideal gas Behavior Compressibility factor ,Van der Waals Equation and Application.. [*10* hrs] 2- Zeroth law of thermodynamics, First law of thermodynamics, Quantity of heat ,Work ,Internal energy Application ,Cyclic procures. [8 hrs] 3- Reversible and Irreversible Processes, Isobaric Process, Isochoric Process, Isothermal Process, Heat Capacity, Relation In adiabatic process, Theoretical calculation of (Cp & Cv).. [10 hrs] 4-Endothermic and Exothermic process, The relation between ΔE and ΔH, Enthalpy of Combustion, Thermochemistry laws, Heat of Formation (Hf), Heat of Solution, Bond energy, Second Low of Thermodynamic, Third low of thermodynamic, Free energy ΔG, Criteria for spontaneity [3 hrs] Part B – Practical labs different experiments in thermodynamic of physical chemistry including the density, viscosity, surface tension, molecular weight determination (liquid and solid), enthalpy of neutralization, heat of solution, heat of vaporization. [36 hrs]. [18 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Expanding students' perceptions about this science and its contents it includes that help to understand the thermodynamic . In addition to the use of different mathematical equations to understand the effect of pressure, temperature in this prosses and Application. This will be achieved through lectures, labs, and tutorials.

Student Workload (SWL)			
Structured SWL (h/sem)	75	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	50	**Unstructured SWL (h/w)**	5
Total SWL (h/sem) ل	**125**		

Module Evaluation					
		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 الأسبوعي النظري	
	Material Covered
Week 1	Introduction ntroduction to Thermodynamics, properties of Thermodynamic,
Week 2	Dalton's law.
Week 3	Graham's Law of Diffusion and Effusion.
Week 4	Real gases, Deviation From Ideal gas Behavior.
Week 5	Compressibility factor, Van der Waals Equation.
Week 6	Zeroth law of thermodynamics.
Week 7	First law of thermodynamics, Quantity of heat, Work, Internal energy Application, Cyclic procures.
Week 8	Reversible and Irreversible Processes.
Week 9	Isobaric Process, Isochoric Process, and Isothermal Process.
Week 10	Heat Capacity, Relation In adiabatic process, Theoretical calculation of(Cp & Cv).
Week 11	Endothermic and Exothermic process, The relation between ΔE and ΔH, Enthalpy of Combustion.
Week 12	The heat of Formation (Hf), Heat of Solution, Bond energy.
Week 13	Second Low of Thermodynamic.
Week 14	Third low of thermodynamic.
Week 15	Free energy ΔG, Criteria for spontaneity

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Density and Viscosity
Week 2	Lab 2: Surface tension
Week 3	Lab 3: Molecular weight determination by the Victor Meyer method
Week 4	Lab 4: Determination of molecular weight of solid by Rast method
Week 5	Lab 5: Enthalpy of neutralization
Week 6	Lab 6: Heat of solution
Week 7	Lab 7: Vapor pressure of liquid (Part 1)
Week 8	Lab 8: Vapor pressure of liquid (Part 2)
Week 9	Lab 9: Heat of vaporization by calorimetry
Week 10	Lab 10: Determination the transition point of salt and finding the heat of solution ΔH (Part 1)

Week 11	Lab 11: Determination the transition point of salt and finding the heat of solution ΔH (Part 2)
Week 12	Lab 12: Determination of equilibrium constants
Week 13	Lab 13: Water-phenol miscibility diagram
Week 14	Lab 14: Three component system (Part 1)
Week 15	Lab 15: Three component system (Part 2)

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	**Physical Chemistry, F.Daniels, R.A.Alberty ,2nd edition, 1963,iohn wile&sones,inc.New York.London**	Yes Yes
Recommended Texts	**Physical Chemistry, K.Laidler, J.Meiser, B. Sanctuary Fourth edition,2003. WWW.cengagebrain.com.**	Yes 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	Chromatographic Methods			Module Delivery	
Module Type	Core			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	CHE48143				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	3		Semester of Delivery	5	
Administering Department	CHE		College	CoS	
Module Leader	Khalida Mohammed Omar		e-mail	Khalida.omer@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor	Enaam Ahmad Hamdoon Asmaa natiq abdulkader Safaa abdulaleem ahmed		e-mail	enaamahmad@uomosul.edu.iq asmaa-natic@uomosul.edu.iq safaa-ahmed2017@uomosul.edu.iq	
Peer Reviewer Name	Nabeel Sapeeh Othman		e-mail	nsn20002004@uomosul.edu.iq	
Scientific Committee Approval Date	13/06/2023		Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Classical Separation Methods	Semester	4
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 objective of a separation methods is usually to learn how we can separate one or more of the components as pure from original mixture by using the process of chemical separation (classical or advanced methods) because many industrial process such as chemical, medicine ,Clean water .safe food ..... etc. relay on chemical separation . Our module(Separation methods) covers the following topics during this semester 1- Introduction about separation and some definition deals with ,classification of separation methods ,general theories of separation and efficiency of separation 2- Chromatography include: History of chromatography. ,classification ,theory of column efficiency , Application of chromatography . 3- Gas chromatography , include: types of GC, Apparatus ,Principle of analysis by GC Types of detectors ad some application . 4- Liquid chromatography and HPLC , include : introduction a bout absorption and adsorption chromatography ,HPLC and principle , instrumentation , application And ion exchange with applications. 5- Electrophoresis include : Types of electrophoresis , principle ,application . Capillary electrophoresis ,principle and detectors in electrophoresis.
Module Learning Outcomes **مخرجات التعلم للمادة الدراسية**	1- Define the separation and explain the different between analyte substance and interferences .with explain how we deal with interferences . 2-classify the separation method according the phase . 3.- What are the relation between separation and analysis and explain the requirements of a good separation methods . 4-Explain the principle of separation by chromatography and what are its types According the mobile phase. 5.Explain the theories which discuss the efficiency of separation . 6.What is elution analysis , frontal analysis and displacement analysis . 7. Identify the aims of chromatography , its types and learn some application . 8. Explain the principle of GC and its types with drawing the apparatus . 9- understanding the important of HPLC in separation and mention some of application . 10-What is the important types of detector , explain that with drawing . 11- What is the principle of separation by electrophoresis , give an example for Its applications. 12- What is capillary electrophoresis and what is the difference from electrophoresis.
Indicative Contents	Indicative content includes the following.

المحتويات الإرشادية	Part A – Theoretical lectures General introduction about separation include: Some important definition , interferences and the methods for dealing with it ,classification of separation technique and separation methods , Separation factor with examples ,equilibrium constant , separation efficiency , the relationship Between separation and analysis . [4hrs] Introduction about chromatography , history, purpose of chromatography , theories , classification of chromatography types ,chromatogram, chromatographic resolution ,characterized of chromatographic peak and some examples . [6hrs] Gas chromatography ,introduction, types of GC , Apparatus for GC, components, principle, sample injection system, types of columns used, detectors ,application of GC (qualitative and quantitative) . [4hur] Liquid chromatography , introduction, types . [2hrs] High performance liquid chromatography (HPLC) developments and properties , Instrument , principle of operation , types of column , detectors , some application . [6hrs] Ion exchange chromatography . types of exchangers , principle of separation , application . [4hrs] Electrophoresis ,types , instrument and principle the separation , application .and Capillary electrophoresis, instruments .principle the separation , detectors .[4hur]. Part B – Practical labs Introduction to separation methods of analysis , [6hur] Extraction and determination of acetic acid , Extraction and determination of ammonia Introduction to ion exchange ,Determination of water regain and capacity Efficiency of exchange column [18hur] Introduction to chromatography. [3hur] Separation of iron (III) and copper(II)in mix.by ion exchange column. Determination the separated iron (III) and copper (II) Separation of MnO4- and Cr2 O7 -2 by adsorption chromatography. Determination of $MnO4^-$ and $Cr_2O_7^{-2}$. Separation of nickel and cobalt by partition chromatography Determination the separated nickel and cobalt. copper(II). [18hur]

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم	
Strategies	In order to simplify the explanation of the separation methods 1. Lectures: used to introduce and explain key concepts related to separation methods and trying to link it with examples from real life to make the student interact greatly with the lecture as well as trying to explain in simplified way. 2. Interactive discussions: used to engage students in critical thinking and problem-solving related to subject through group discussions, debates, case studies, and simulations. 3. Multimedia resources: used to enhance student engagement and understanding of complex concepts related to the separation methods through weight board, using data show to view pictures 4.: used to measure student learning and provide feedback on their progress through quizzes, exams, and projects 5- linking the lecture with practical experiments that enable the students to link information and understand it .with an explanation of the importance of separation methods from the scientific and practical point of view.

Student Workload (SWL) **الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا**			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	94	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	56	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					
As		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 10	LO #-, #4 and #11, #12
	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 - #6
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
Week	Material Covered
Week 1	General introduction about separation and Some important definition , interferences and the methods for dealing with it
Week 2	classification of separation technique and separation methods , Separation factor with examples equilibrium constant , separation efficiency , the relationship Between separation and analysis
Week 3	Introduction about chromatography , history, purpose of chromatography .
Week 4	Theories of chromatography, classification of chromatography types ,chromatogram, chromatographic resolution
Week 5	Characterized of chromatographic peak and some examples
Week 6	Gas chromatography ,introduction, types of GC , Apparatus for GC, components, principle of operation.
Week 7	Sample injection system, types of columns used, detectors ,application of GC (qualitative and quantitative)
Week 8	Liquid chromatography , introduction, types
Week 9	High performance liquid chromatography HPLC, developments and properties
Week 10	Instrument , principle of operation .
Week 11	Types of column , detectors , some application
Week 12	Ion exchange chromatography . types of exchangers .
Week 13	Principle of separation , application.
Week 14	Electrophoresis ,types , instrument and principle the separation , application .
Week 15	Capillary electrophoresis, instruments .principle the separation , detectors .
week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
Week	Material Covered
Week 1	Lab 1: Introduction to separation methods of analysis
Week 2	Lab 2:. Extraction and determination of acetic acid
Week 3	Lab 3: Extraction and determination of ammonia.
Week 4	Lab 4: Introduction to ion exchange , Determination of water regain and total capacity
Week 5	Lab 5: Efficiency of ion exchange column.
Week 6	Lab 6: Introduction to chromatography. Separation of iron (III) and copper(II)in mix.by ion exchange column
Week 7	Lab 7:. Separation of iron (III) and copper(II)in mix.by ion exchange column.
Week 8	Lab 8:. Determination the separated iron (III) and copper (II)
Week 9	Lab9:Separation of MnO4 -andCr2O7 -2. By adsorption chromatography
Week10	Lab 10: Determination of MnO4 -andCr2O7 -2.
Week 11	Lab 11: Separation of nickel and cobalt by partition chromatography
Week 12	Lab 12: Determination the separated nickel and cobalt.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	1-Fundamental of Analytical Chemistry:- by: Skoog & West . 9thed (2013) ,p. 889-999. 2-Fundamental of Analytical Chemistry:- by: Skoog & West . 8thed (2004) ,p.908-1118. 3-Analytical Chemistry :-An Introduction : by: Skoog ,West &Holler . 6thed ((1994), p.486-520.	Yes Yes Yes
Recommended Texts	Principles of Instrumental Analysis :- by: Skoog ,Holler & Grouch . 6th ed (2007) ,P.788-843.	Yes

Websites	https:// en.wikipedia.org/wiki/Gas_ chromatography https:// en.wikipedia.org/wiki/High-performance_ liquid _ chromatography

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 analytical chemistry			Module Delivery	
Module Type	Core			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	CHE1101				
ECTS Credits	7.00				
SWL (hr/sem)	175				
Module Level		UGI	Semester of Delivery		
Administering Department		CHE	College	SCI	
Module Leader	Hana Shuker Mahmood		e-mail	hanashukermahood@uomosul.edu.iq.	
Module Leader's Acad. Title		Assistant Professor	Module Leader's Qualification		Ph.D.
Module Tutor	1- Zinah Talal Shakir 2- Wael bdulqader A. Alqazzaz		e-mail	zenatalal@uomosul.edu.iq waelalkazzaz@uomosul.edu.iq.	
Peer Reviewer Name		Nabeel Subeeh Othman	e-mail	nsn20002004@uomosul.edu.iq	
Scientific Committee Approval Date		13/06/2023	Version Number		1.0

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives **أهداف المادة الدراسية**	1. Qualitative analysis determines the identity of the compound based on some of the chemical reactions that the compound exhibit 2. To solve an analytical problem, it is essential to look for the consistency between the chemical information by chemical reactions required 3. know what is expected from the laboratory, which is not an easy task sometimes. 4. To know the behavior of elements against chemical reagents 5. To select the best conditions of identification by precipitation or ignition or color formation 6. the increasing relevance of total indices that describe a group of compounds having similar structure and/or behavior, instead of the predominance of information discriminated by analytes. 7. develop new techniques and methods capable of satisfying the growing demands of in chemical information in many areas, such as the environmental, health, food and pharmaceutical industries by identify the component of these samples. 8. Explain the basic principles of analytical chemistry; concentration, equilibrium, solubility, acid-base theories, activity, and ionic strength.
Module Learning Outcomes **مخرجات التعلم للمادة الدراسية**	1- Qualitative and quantitative analysis 2- Classification of electrolyte. 3- Acid-Base theories 4- Equilibrium 5- Solubility 6-
Indicative Contents **المحتويات الإرشادية**	Indicative content includes the following. Part A – Theoretical lectures General introduction Some important definition Classification

	technique equilibrium and equilibrium constant The activity and ionic strength Solubility [4hrs] Part B – Practical labs Introduction to separation methods of analysis, [6hur] Classification of elements according to the precipitating agent and medium Separation of Group one-identification of each element Separation of Group two-identification of each element Separation of Group three-identification of each element (part one) Separation of Group three-identification of each element (part two) Identification by Flame Detection of carbonate, sulphate, phosphate, and sulfide [18hur]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	In order to simplify the explanation of the separation methods 1. Lectures: used to introduce and explain key concepts related to identification methods and trying to link it with examples from real life to make the student interact greatly with the lecture as well as trying to explain in simplified way. 2. Interactive discussions: used to engage students in critical thinking and problem-solving related to nuclear energy through group discussions, debates, case studies, and simulations. 3. Multimedia resources: used to enhance student engagement and understanding of complex concepts related to the identification methods through white board, using data show to view pictures and videos. 4.o In order to evaluate student learning and provide feedback on their progress through quizzes, exams, and projects 5- linking the lecture with practical experiments that enable the students to link information and understand it with an explanation.

Student Workload (SWL) **الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا**			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	109	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	7
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	66	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					
As		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 10	LO #1- #4 and #11, #12
	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 الأسبوعي النظري	
Week	Material Covered
Week 1	**General introduction** Classification of analytical chemistry. Terms employed in analytical chemistry. Electrolytes, conjugate acid and conjugate base, autoproteolysis, amphoteric solvents, salts
Week 2	**Acid-Base theories:** Arrhenius theory Bronsted theory Lewis theory
Week 3	**Chemical equilibrium:** Types of equilibrium
Week 4	Equilibrium constant Calculations
Week 5	Le-chatlair principle Factors affects the equilibrium
Week 6	**Methods of expressing concentrations** Definitions Laws and relations Calculations
Week 7	Molarity Formality molality
Week 8	W/W W/V V/V
Week 9	Ppm, ppb ,ppt Mole fraction
Week 10	Normality equivalent weight calculations
Week 11	**Solubility and solubility product constant** Definitions (saturation, super saturation) Ksp derivation

	problems
Week 12	Effect of common ion Effect of complex formation on solubility
Week 13	**Activity and activity coefficient:** Definitions Calculations.
Week 14	Activity and solubility
Week 15	Ionic strength. Examples and calculations
week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
Week	Material Covered
Week 1	Lab 1: Introduction to qualitative analysis
Week 2	Lab 2 : Definitions of Lab.class wears
Week 3	Analysis of group I cations
Week 4	Lab 4: Unknown of group I cations
Week 5	Lab 5: Analysis of group II cations
Week 6	Lab 6: Unknown of group II cations
Week 7	Lab 7:. Analysis of group III cations
Week 8	Lab 8:. Determination the separated iron (III) and copper (II)
Week 9	Lab9: Analysis of group III cations
Week10	Lab 10: Unknown of group III cations
Week 11	Lab 11: Flame test and detection of groups IV and V cations
Week 12	Lab 12: Detection of anions

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	1-Fundamental of Analytical Chemistry:- by: Skoog & West . 9th ed (2013) 2- Analytical Chemistry:- by: Christain, (2004) . 3-Analytical Chemistry :-An Introduction : by: Skoog ,West &Holler . 6th ed ((1994)	Yes Yes Yes
Recommended Texts	1-Fundamental of Analytical Chemistry:- by: Skoog & West . 9th ed (2013)	yes
Websites	https:// en.wikipedia.org/wiki/Gas_ chromatography https:// en.wikipedia.org/wiki/High-performance_ liquid _ chromatography	

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

(0 – 49)	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	Fundamental of Analytical Chemistry			Module Delivery	
Module Type	CORE			☒ TTheory ☐ Lecture ☐ Lab ☒ T Tutorial ☐Practical ☒ T Seminar	
Module Code	**CHE1102**				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	1		Semester of Delivery	2	
Administering Department	CHE		College	CoS	
Module Leader	Khansaa shakir Al-Nama Asem S.A.AL-Botani		e-mail	Khnsaash.al-nama@uomosul.edu.iq Asemalbotani@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor			e-mail		
Peer Reviewer Name	Khansaa shakir Al-Nama		e-mail	Khnsaash.al-nama@uomosul.edu.iq	
Scientific Committee Approval Date	13/06/2023		Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	N0ne	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	know about the discovery of electron, proton and neutron and their characteristics; •describe Thomson, Rutherford ,and Bohr atomic models; , •understand the important features of the quantum mechanical model of atom; •u n d e r s t a n d n a t u r e o electromagnetic radiation and Planck's quantum theory; •explain the photoelectric effect and describe features of atomic spectra; •Heisenberg uncertainty principle • define an atomic orbital in terms of quantum numbers; the meaning of the four quantum numbers (n, l, ml , ms) used to describe atomic orbitals and electron spin •recognizing the shapes of the s, p, and d orbitals •understand the difference between excited and ground states state aufbau principle, Pauli exclusion principle and Hund's rule of maximum multiplicity; and •write the electronic configurations of atoms
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	To explain the development of atomic models (from Dalton to Bohr) chronologically. To explain the periodical properties of atomic radii (covalent radius) and ionic radius of elements in periodic table. To explain the setbacks of each atomic model. To explain the concept of shielding effect and its relation to atomic and ionic radius. To explain the setbacks of Bohr's atomic model that triggers the development of quantum mechanic theory. To calculate the effective nuclear charges (Z*) and explain its relation to periodical properties of atomic and ionic radius.

	To explain how to determine four quantum numbers to locate the orbital of electrons. To explain the concept of ionization energy and its periodical properties. To write down electron configuration based on the Aufbau principle, Hund's rule, and Pauli's principle of exclusion. To explain the relationship between periodical properties of ionization energy of alkaline and earth alkaline group to their respective effective nuclear charges. To explain the anomaly of electron configuration of particular elements on the periodic table To explain the concept of electron affinity and its periodical properties. To explain the concept of electronegativity and it's periodical properties. Note: learning outcomes in italic are those meant to stimulate students' ability to propose a scientifi
Indicative Contents المحتويات الإرشادية	1. Fundamental Particales of an atom (4hr) 2-Atomic number, mass number and isotopes (4hr) 3-Unit of atomic mass number (4hr) 4-Isotopes (4hr) 5-The emission spectrum of atomic hydrogen (4hr) 6-Bohr's theory (4hr) 7-Atomic Orbital (4hr) 8-The term symbol (4hr) 9-Shelding and effective Nuclear charge: (4hr) 10-Effect of Z in atomic properties (4hr) 11-Covalent Compounds (5hr) 12-Lewis Structures: (5hr) 13-Hybridization of Atomic Orbitals: (5hr) 14-Molecular Orbital Theory "MOT" (5hr)

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Expanding students' perceptions about this science and its contents it includes that help in acquisition of skills in General Chemistry and Inorganic Chemistry. To develop the ability to correlate the chemical and physical properties of elements and their compounds with their positions in the periodic table and involving some examples 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	64	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	61	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 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	Midterm Exam	1hr	10% (10)	8	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الأسبوعي النظري	
	Material Covered
Week 1	1- Fundamental Particales of an atom
Week 2	2-Atomic number, mass number and isotopes
Week 3	3-Unit of atomic mass number
Week 4	4-Isotopes
Week 5	5-The emission spectrum of atomic hydrogen
Week 6	6-Bohr's theory
Week 7	7-Atomic Orbital
Week 8	8-The term symbol
Week 9	9-Shelding and effective Nuclear charge:
Week 10	10-Effect of Z in atomic properties
Week 11	11-Covalent Compounds
Week 12	12-Lewis Structures:
Week 13	13-Hybridization of Atomic Orbitals:
Week 14	14-Molecular Orbital Theory "MOT"
Week 15	Electronegativity: χ

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	

Week10	
Week 11	
Week 12	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Shriver and Atkins' Inorganic Chemistry, 5th Edition Inorganic Chemistry 5th Edition Miessler cotton-wilkinson-advanced-inorganic-chemistry	Yes yes Yes
Recommended Texts		Yes No
Websites	https://www.academia.edu/53328171/Inorganic_Chemistry_5th_ed_Miessler https://chemistlibrary.files.wordpress.com/2015/05/cotton-wilkinson-advanced-inorganic-chemistry.pdf	

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

Module Information					
Module Title	**Chemical Security and safety**			Module Delivery	
Module Type	**C**			☒ Theory	
Module Code	**CHE1104**				
ECTS Credits	5				
SWL (hr/sem)	**125**				
Module Level	UGI		Semester of Delivery	1	
Administering Department	Chemistry. CHE		College	College of Science. CoS	
Module Leader	Harith Mohammed Salman		e-mail	Harith-mahammed@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor	Harith Mohamed Salman		e-mail	Harith-mahammed@uomosul.edu.iq	
Peer Reviewer Name	Prof.Dr. Adnan Othman		e-mail	Adnana.hasska94@uomosul.edu.iq	
Scientific Committee Approval Date	13/06/2023		Version Number	1.0	

Relation with other Modules			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	Promoting chemical safety and security by providing tools and knowledge to mitigate the risks arising from chemical accidents and potential misuse of toxic chemicals , including the threat of terrorism.
Module Learning Outcomes	The training modules introduce safe use of chemicals at workplaces, present classification systems for the labelling and transport of dangerous goods, allow the reading and use of chemical safety cards, give a basic overview of toxicology and disseminate information on selected, widely used, hazardous substances.
Indicative Contents	1. Role of the employer. 2. Role of the employees. 3. Protecting communities. 4. What is chemical safety. 5. What is chemical security. 6. Why chemical safety and security are important for SMEs. 7. Performing a risk assessment. 8. Identifying assists, Hazards and threats. 9. Screening hazards and assets. 10. Information for security purposes. 11. Identifying security threats. 12. Safety and security measures. 13. Protection and control of hazards and assets. 14. Operating procedures for safety and assets. 15. Safe and secure work practices. 16. Ensuring the integrity and reliability of the facility. 17. Guaranteeing that the facility is safe and secure by design. 18. Providing medical surveillance programs. 19. Performers evaluation. 20. Drawing up emergency management plans.

Learning and Teaching Strategies

Strategies	Competitive Learning • Students work individually. • Students have common learning goals and tasks. • The instructor grades students using norm-referenced methods (e.g., curve-based grading). Individualistic Learning • Students work individually. • Students have individualized learning goals and tasks, different from those of other students. • The instructor grades students using criteria-referenced methods (e.g., rubric-based grading). Cooperative Learning • Students work in small groups. • Students have shared learning goals and tasks within a group which may be similar or different from other groups. • The instructor grades students both on their work as a group and on their individual work.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	64	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	61	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		

Module Evaluation					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 12	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	4 and 12	LO #3, #4 and #6, #7
	Projects / Lab.			Continuous	All
	Report				
Summative assessment	Midterm Exam	2hr	40% (10)		LO #1 - #7
	Final Exam	3hr	60% (50)		All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	STANDARD OPERATING PROCEDURES FOR CHEMICAL SAFETY.
Week 2	RISK ASSESSMENT FLOWCHART
Week 3	CHEMICAL STORAGE MATRIX
Week4	STANDARD OPERATING PROCEDURE FORMS
Week 5	APPLICATION OF THE GUIDE TO DEVELOPING STANDARD OPERATING PROCEDURES
Week6	FORMS
Week 7	STANDARD OPERATING PROCEDURE
Week 8	WHO IS RESPONSIBLE FOR DEVELOPING STANDARD OPERATING PROCEDURES
Week 9	GUIDE TO DEVELOPING STANDARD OPERATING PROCEDURES
Week 10	MANAGEMENT AND STORAGE
Week 11	PROCESS RISK MITIGATION
Week 12	Assessment of Chemicals
Week 13	Assessment of Process Conditions
Week 14	PRIMARY STORAGE REQUIREMENT
Week 15	SECONDARY STORAGE REQUIREMENT

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	National Academies of Sciences, Engineering, and Medicine. (2016). Chemical Laboratory Safety and Security: A Guide to Developing Standard Operating Procedures. Committee on Chemical Management Toolkit Expansion: Standard Operating Procedures. Washington, DC: The National Academies Press. doi: 10.17226/21918.	No No No

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	Volumetric Analytical chemistry			Module Delivery	
Module Type	Core			☒ Theory ☐ Lecture ☒ Lab ☐x Tutorial ☐ Practical ☐ Seminar	
Module Code	CHE1217				
ECTS Credits	7.00				
SWL (hr/sem)	175				
Module Level		UGI	Semester of Delivery		
Administering Department		CHE	College	SCI	
Module Leader	Hana Shuker Mahmood		e-mail	hanashukermahood@uomosul.edu.iq.	
Module Leader's Acad. Title		Assistant Professor	Module Leader's Qualification		Ph.D.
Module Tutor	1- Zinah Talal Shakir 2- Wael bdulqader A. Alqazzaz		e-mail	zenatalal@uomosul.edu.iq waelalkazzaz@uomosul.edu.iq.	
Peer Reviewer Name		Nabeel Subeeh Othman	e-mail	nsn20002004@uomosul.edu.iq	
Scientific Committee Approval Date		13/06/2023	Version Number		1.0

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	CHE1101	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**	1. To solve an analytical problem, it is essential to look for the consistency between the chemical information by chemical reactions required 2. know what is expected from the laboratory, which is not an easy task sometimes. 3. To know the behavior of chemical reagents, analyte and indicators 4. Explain the principle of volumetric analysis and titrations 5. To select the best conditions of determination by titration 6. develop methods capable of satisfying the growing demands of in chemical information in many areas, such as the environmental, health, food and pharmaceutical industries by identify the component of these samples. 7. Explain the types of volumetric analysis. 8. Give examples and explanations of each type of volumetric analysis
Module Learning Outcomes **مخرجات التعلم للمادة الدراسية**	1- Quantitative analysis; general principles 2- Types of volumetric methods. 3- Acid-Base 4- precipitations 5- oxidation reduction 6- complex formation
Indicative Contents **المحتويات الإرشادية**	Indicative content includes the following. Part A – Theoretical lectures General introduction, Some important definition, Quantitative analysis; general principles; Types of volumetric methods; Acid-Base; precipitations; oxidation reduction B – Practical labs Introduction / titration 1- Acid-Base 2- precipitations 3- oxidation reduction

	complex formation

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	In order to simplify the explanation of the separation methods 1. Lectures: used to introduce and explain key concepts related to identification methods and trying to link it with examples from real life to make the student interact greatly with the lecture as well as trying to explain in simplified way. 2. Interactive discussions: used to engage students in critical thinking and problem-solving related to nuclear energy through group discussions, debates, case studies, and simulations. 3. Multimedia resources: used to enhance student engagement and understanding of complex concepts related to the identification methods through white board, using data show to view pictures and videos. 4.o In order to evaluate student learning and provide feedback on their progress through quizzes, exams, and projects 5- linking the lecture with practical experiments that enable the students to link information and understand it with an explanation.

Student Workload (SWL) **الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا**			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	109	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	7
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	65	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	175		

Module Evaluation تقييم المادة الدراسية					
As		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 10	LO #1- #4 and #5, #9
	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 الأسبوعي النظري	
Week	Material Covered
Week 1	**Titration Process** Standard solution Primary and secondary standard solution
Week 2	Equivalent point End point Indicators Back titration
Week 3	Stoichiometric Calculations
Week 4	Theory of Neutralization Titrations

Week 5	pH calculation of water acids bases salts
Week 6	Buffers pH calculation of buffers
Week 7	Titration curve
Week 8	Theory of Precipitation Titration
Week 9	Detection of end point Mohr's method
Week 10	Volhard method Fajan method
Week 11	Titration curve problems
Week 12	**Theory of oxidation-reduction reactions**
Week 13	**Electrochemical cell** **Nurnest equation** Calculations.
Week 14	Titration curve Redox-indicators
Week 15 week 16	Theory of complex formation reactions Indicators Titration curve Final Exam

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
Week	Material Covered
Week 1	Lab 1: Introduction to quantitative analysis and some definitions
Week 2	Lab 2 : safety in lab. Glass wears used in volumetric analysis Classification of volumetric analysis.
Week 3	Lab 3: Acid- base titration Titration of HCl and sodium carbonate

Week 4	Lab 4: Titration of hydrochloric acid and sodium hydroxide Determination of mixture of carbonate and hydroxide.
Week 5	Lab 5: Precipitation titration Determination of chloride by Mohr's method
Week 6	Lab 6: Determination of chloride by Volhard method.
Week 7	Lab 7:. Oxidation -reduction titration Determination of iron (II)using potassium permanganate
Week 8	Lab 8:. Determination of iron (II)using potassium dichromate
Week 9	Lab9: Complex-formation Titrations
Week10	Lab 10: Determination of nickel with EDTA
Week 11	Lab 11: Determination of copper ion by iodometric method
Week 12	Lab 12: Unknown

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	1-Fundamental of Analytical Chemistry:- by: Skoog & West . 9th ed (2013) 2- Analytical Chemistry:- by: Christain, (2004) . 3-Analytical Chemistry :-An Introduction : by: Skoog ,West &Holler . 6th ed ((1994)	Yes Yes Yes

Recommended Texts	1-Fundamental of Analytical Chemistry:- by: Skoog & West . 9th ed (2013)	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	Ionic Compounds and Periodic table			Module Delivery	
Module Type	core			☒ Theory ☐ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☒ Seminar	
Module Code	CHE1218				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		1	Semester of Delivery		2
Administering Department		CHE	College	CoS	
Module Leader	Khansaa shakir Al-Nama Asem S.A.AL-Botani		e-mail	Khnsaash.al-nama@uomosul.edu.iq asemalbotani@uomosul.edu.iq	
Module Leader's Acad. Title		Assistant Professor	Module Leader's Qualification		Ph.D.
Module Tutor			e-mail		
Peer Reviewer Name		Khansaa shakir Al-Nama	e-mail	Khnsaash.al-nama@uomosul.edu.iq	
Scientific Committee Approval Date		13/06/2023	Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	CHE1102 Atomic structure	Semester	1
Co-requisites module		Semester	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	.Explain the ionic radii and describe the polarization of ionic compounds .Describe the molecular polarity, ion-dipole attractions and van der Waals forces .Explain the hydrogen bond and its types, describe the strength of the hydrogen bond, .Explain Chemistry of alkali metals and Alkaline earth metals .Explain Chemistry of group 13 and 14 elements
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	• Define ionic and molecular (covalent) compounds. • Predict the type of compound formed from elements based on their location within the periodic table. • Determine formulas for simple ionic compounds. • Define alkali metals. • Contrast alkaline earth metals and alkaline metals. • Describe the reactions of alkali metals. Describe the chemical properties of Hydrogen, the group 13, 14, elements.
Indicative Contents المحتويات الإرشادية	1- Ionic compounds (5hr) 2-Estimation of crystal lattice energy: (5hr) 3- How to calculate practically (5hr) 4- Polarization of Ionic Compounds (5hr) 5-Solubility of ionic compounds (5hr) 6-Crystal structure of homo atomic molecules: (5hr) 7-The Hydrogen (5hr) 8-Types of bonds (5hr) 9-Types of hydrogen bonding and their effects on physical and chemical properties (5hr) 10-Hydronium or Oxonium ion (5hr)

	11-Group (I): Alkali. Metals (5hr) 12- Group (II): Alkali earth metals (5hr) 13-Group (II): Alkali earth metals (5hr) 14-Group (III) (5hr) 15- Group (IV) (5hr)

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1-Face to face lecture 2-Group discussion 3-To evaluate the understanding of the subject we will make five quizes

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	79	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	71	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	13% (13)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	14% (14)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab				

	Report	1	13% (13)	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 الأسبوعي النظري	
	Material Covered
Week 1	Ionic compounds
Week 2	Estimation of crystal lattice energy:
Week 3	How to calculate U_0 practically
Week 4	Polarization of Ionic Compounds
Week 5	Solubility of ionic compounds
Week 6	Crystal structure of homo atomic molecules:
Week 7	The Hydrogen
Week 8	Types of bonds
Week 9	Types of hydrogen bonding and their effects on physical and chemical properties
Week 10	Hydronium or Oxonium ion
Week 11	Group (I): Alkali. Metals
Week 12	Group (II): Alkali earth metals
Week 13	Group (II): Alkali earth metals
Week 14	Group (III)
Week 15	Group (IV)

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	

Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	
Week10	
Week 11	
Week 12	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Shriver and Atkins' Inorganic Chemistry, 5th Edition Inorganic Chemistry 5th Edition Miessler cotton-wilkinson-advanced-inorganic-chemistry Alkali and Alkaline earth metals (Periodic Table of the Elements	Yes yes Yes
Recommended Texts		Yes No
Websites	https://www.academia.edu/53328171/Inorganic_Chemistry_5th_ed_Miessler https://chemistlibrary.files.wordpress.com/2015/05/cotton-wilkinson-advanced-inorganic-chemistry. https://www.pdfdrive.com/alkali-and-alkaline-earth-metals-periodic-table-of-the-elements-e185736496.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	**Organic Chemistry I**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**CHE-23016**				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	2		Semester of Delivery	3	
Administering Department	CHE		College	CoS	
Module Leader	Attallah Mohammad Sheat, Azzam Ahmed Mohammed, Shahla Ahmed Younus, Muna Sobhi Abdullah, Shimaa Younus Ibraheam		e-mail	attallah69@uomosul.edu.iq aam1n10@uomosul.edu.iq shahlaahmad@uomosul.edu.iq muna.sobhi@uomosul.edu.iq shaimaa.al1980@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor	Attallah Mohammad Sheat		e-mail	attallah69@uomosul.edu.iq	
Peer Reviewer Name	Azzam Ahmed Mohammed, Shahla Ahmed Younus, Muna Sobhi Abdullah, Shimaa Younus Ibraheam		e-mail	aam1n10@uomosul.edu.iq shahlaahmad@uomosul.edu.iq muna.sobhi@uomosul.edu.iq shaimaa.al1980@uomosul.edu.iq	
Scientific Committee Approval Date	13/06/2023		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	Teach the students the basics of organic chemistry and study the types of organic compounds as they showed in indicative contents in terms of naming, composition, physical properties. In addition, how to prepare those organic compounds and their chemical reactions. Furthermore, the students get well knowledge in lab in order to have the ability to deal with class wares, apparatus, simple instruments, safe chemicals and high lab skills. The teaching lab includes teaching of all types of class wares, determination of melting point and boiling point of organic compounds, purifications methods of solid and liquid compounds and preparation of some simple organic compounds. All teaching lab runs under the safety conditions.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1- Learning the basics of organic chemistry. 2- Understanding the field of organic chemistry 3- Developing and raising the abilities of the student to obtain the knowledge. 4- Teach the students how to be able to think and solve problems. 5- Teach the student to analyze and understand the chemistry of compounds that deal with it. 6- Developing the student's mental skills and improve the knowledge skills. 7- High labs skills with well understanding to the safety rules.
Indicative Contents المحتويات الإرشادية	Chapter 1 General Introduction [6 hrs] Chapter 2 Alkanes [6 hrs] Chapter 3 Alkenes [6 hrs] Chapter 4 Dienes [3hrs] Chapter 5 Alkynes [3 hrs] Chapter 6 Alkyl halides [6 hrs] Chapter 7 Alcohols [6 hrs] Chapter 8 benzene [6 hrs] Chapter 9 arenes [3 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The teaching used effective methods to achieve high level of understanding using modern references with techniques. It includes discussion and questions with answers during the class to help students to improve their ability to expand the knowledge. Home works with exams can help to improve the ability to solve problems and obtain more information about the chemistry of the field of the study.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	94	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	56	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	2	10% (10)	5 and 12	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	4and 12	LO #2, #3 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 الأسبوعي النظري	
	Material Covered
Week 1	A general introduction of organic chemistry
Week 2	Chemical bonds and hyperdization
Week 3	Chapter of Alkanes
Week 4	Chapter of Alkanes
Week 5	Chapter of Alkenes
Week 6	Chapter of Alkenes
Week 7	Chapter of Dienes
Week 8	Chapter of Alkynes
Week 9	Chapter of Alkyl halides
Week 10	Chapter of Alkyl halides
Week 11	Chapter of Alcohols
Week 12	Chapter of Alcohols
Week 13	Chapter of benzene
Week 14	Chapter of benzene
Week 15	Chapter of arenes

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Glass ware and the Safety in the Laboratory.
Week 2	Lab 2: Determination of melting point.
Week 3	Lab 3: Determination of Boiling point.
Week 4	Lab 4: Simple distillation.
Week 5	Lab 5: Simple distillation .
Week 6	Lab 6: Fractional distillation.
Week 7	Lab 7: Steam distillation.
Week 8	Lab 8: Recrystallization.
Week 9	Lab9: Sublimation.
Week10	Lab 10: preparation of methane.

Week 11	Lab 11: preparation of acetylene.
Week 12	Lab 12: Qualitative analysis ofe elements by sodium fusion test

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	1- Organic Chemistry, Sixth edition, Robert Thornton Morrison and Robert Neilson Boyd,(2002). 2- March's Advanced Organic Chemistry. Reactions, Mechanisms, and Structure, Michael B. Smith, Jerry March (2007). 3- Advanced Organic Chemistry Part B:,Reaction Mechanisms, Francis A. Carey and Richard J. Sundberg(2008). 4- organic Chemistry, 6th Edition, Paula Y. Bruice (2010). 5- Laboratory text for organic chemistry.4th.ed. by Roy and F.Bossert and Wallace .R.B.rode 6-Organic experments by Lois.F.Fieser and Kenneth.L.Williamson 5th .ed. and Vogel 2017. 4-	Yes Yes YES NO YES 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	**Organic Chemistry II**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**CHE-24122**				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	2		Semester of Delivery	4	
Administering Department	CHE		College	CoS	
Module Leader	Attallah Mohammad Sheat, Azzam Ahmed Mohammed, Shahla Ahmed Younus, Muna Sobhi Abdullah, Shimaa Younus Ibraheam		e-mail	attallah69@uomosul.edu.iq aam1n10@uomosul.edu.iq shahlaahmad@uomosul.edu.iq muna.sobhi@uomosul.edu.iq shaimaa.al1980@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor	Attallah Mohammad Sheat		e-mail	attallah69@uomosul.edu.iq	
Peer Reviewer Name	Azzam Ahmed Mohammed, Shahla Ahmed Younus, Muna Sobhi Abdullah, Shimaa Younus Ibraheam		e-mail	aam1n10@uomosul.edu.iq shahlaahmad@uomosul.edu.iq muna.sobhi@uomosul.edu.iq shaimaa.al1980@uomosul.edu.iq	
Scientific Committee Approval Date	13/06/2023		Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	NON	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	Teach the students the basics of organic chemistry and study the types of organic compounds as they showed in indicative contents in terms of naming, composition, physical properties. In addition, how to prepare those organic compounds and their chemical reactions. Furthermore, the students get well knowledge in lab in order to have the ability to deal with class wares, apparatus, simple instruments, safe chemicals and high lab skills. The teaching lab includes preparation of some organic compounds. All teaching lab runs under the safety conditions.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1- Learning the basics of organic chemistry. 2- Understanding the field of organic chemistry 3- Developing and raising the abilities of the student to obtain the knowledge. 4- Teach the students how to be able to think and solve problems. 5- Teach the student to analyze and understand the chemistry of compounds that deal with it. 6- Developing the student's mental skills and improve the knowledge skills. 7- High labs skills with well understanding to the safety rules.
Indicative Contents المحتويات الإرشادية	Chapter 1 aldehydes and ketones [6hrs] Chapter 2 carboxylic acids [6hrs] Chapter 3 amines [6hrs] Chapter 4 phenols [6hrs] Chapter 5 aryl halides [6hrs] Chapter 6 ethers and epoxides [6hrs] Chapter 7 stereochemistry [6hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The teaching used effective methods to achieve high level of understanding using modern references with techniques. It includes discussion and questions with answers during the class to help students to improve their ability to expand the knowledge. Home works with exams can help to improve the ability to solve problems and obtain more information about the chemistry of the field of the study.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	94	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	56	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	2	10% (10)	5 and 12	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	4 and 12	LO #2, #3 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 الأسبوعي النظري	
	Material Covered
Week 1	Chapter of Aldehydes and ketones
Week 2	Chapter of Aldehydes and ketones
Week 3	Chapter of Carboxylic acids and its derivatives
Week 4	Chapter of Carboxylic acids and its derivatives
Week 5	Chapter of Carboxylic acids and its derivatives
Week 6	Chapter of Carboxylic acids and its derivatives
Week 7	Chapter of amines
Week 8	Chapter of amines
Week 9	Chapter of amines
Week 10	Chapter of phenols
Week 11	Chapter of aryl halides
Week 12	Chapter of stereochemistry
Week 13	Chapter of stereochemistry
Week 14	Chapter of ethers and epoxies
Week 15	Problems with answers

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Recrystallization.
Week 2	Lab 2: Sublimation.
Week 3	Lab 3: Exam.
Week 4	Lab 4: preparation of Methane.
Week 5	Lab 5: preparation of Acetylene .
Week 6	Lab 6: Qualitative Analysis of Elements by Sodium fusion Test.
Week 7	Lab 7: preparation of cyclohexene from cyclohexanol.
Week 8	Lab 8: preparation of propionaldehyde from propanol.
Week 9	Lab9. Preparation of methyl m-Nitro benzoate:
Week10	Lab 10:preparation of Cyclohexanone .

Week 11	Lab 11:Preparation of Benzoic acid.
Week 12	Lab 12: Preparation of Benzoic acid.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	5- Organic Chemistry, Sixth edition, Robert Thornton Morrison and Robert Neilson Boyd,(2002). 6- March's Advanced Organic Chemistry. Reactions, Mechanisms, and Structure, Michael B. Smith, Jerry March (2007). 7- Advanced Organic Chemistry Part B:,Reaction Mechanisms, Francis A. Carey and Richard J. Sundberg(2008). 4- organic Chemistry, 6th Edition, Paula Y. Bruice (2010). 5- Laboratory text for organic chemistry.4th.ed. by Roy and F.Bossert and Wallace .R.B.rode 6-Organic experments by Lois.F.Fieser and Kenneth.L.Williamson 5th .ed. and Vogel 2017.	Yes Yes
Recommended Texts		
Websites		

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks %	Definition
Success Group	A - Excellent	امتياز	90 - 100	Outstanding Performance

(50 - 100)	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:				

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Gravimetric Analysis Chemistry**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐X Tutorial ☐ Practical ☐ Seminar	
Module Code	CHE23113				
ECTS Credits	5				
SWL (hr/sem)	**125**				
Module Level	1		Semester of Delivery	3	
Administering Department	Department of Chemistry		College	College of Sciences	
Module Leader	Imad Younus Hasan		e-mail	imad.younus@uomosul.edu.iq	
Module Leader's Acad. Title	Lecturer		Module Leader's Qualification	Ph.D.	
Module Tutor	Luma Taha Hanan Ali		e-mail	@uomosul.edu.iq @uomosul.edu.iq	
Peer Reviewer Name	Naneel Sabih		e-mail	@uomosul.edu.iq	
Scientific Committee Approval Date	13/06/2023		Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Fundamental of analytical chemistry	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 primary objective of this course is to acquire basic concepts, principles, and techniques of Gravimetric analysis methods that would empower students with an analytical mindset and the ability to solve different gravimetric problems efficiently and quantitatively that conveys the importance of accuracy and precision of the analytical results. The principle behind the gravimetric analysis is the mass of an ion in a pure compound can be determined and then used to find the mass percent of the same ion in a known quantity of an impure compound. In addition, Gravimetric analysis is applied to determine the mass or concentration of a substance by measuring a change in mass. The chemical we are trying to quantify is sometimes called the analyte. Gravimetric analysis methods might also use to answer questions such as: What is the concentration of the analyte in a solution? How pure is our sample? The sample here could be a solid or in solution. There are two common types of gravimetric analysis. Both involve changing the phase of the analyte to separate it from the rest of a mixture, resulting in a change in mass. First, Volatilization gravimetry involves separating components of our mixture by heating or chemically decomposing the sample. The heating or chemical decomposition separates any volatile compounds, that results in a change in mass that we can measure. The second is Precipitation gravimetry which uses a precipitation reaction to separate one or more parts of a solution by incorporating it into a solid. The phase change occurs since the analyte starts in the solution phase and then reacts to form a solid precipitate. The solid can be separated from the liquid components by filtration. The mass of the solid can be used to calculate the amount or concentration of the ionic compounds in solution.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Theoretical lectures Introduction, organisms groups , types of microfossils, taxonomic position , general characteristic of ostracoda, importance of ostracoda study (as microfossils), morphology of ostracoda, calcareous parts , outer lamella, inner lamella, description of margins, features and structures used for the orientation of the carapace, external feature, internal features, terminology of ostracode, dimorphism. [*10* hrs] ,Ecology, distribution of marine ostracoda, factors controlled of the distribution of ostracoda, distribution of environments according to the salinity levels, Paleoecology. [*8* hrs]

	Primary producers in the sea, primary Production, coccolithophores, coccolithophores and the biosphere coccoliths and coccolithogenesis, nannofossils, nannoplankton, coccolith morphology and formation, heterococcoliths, holococcoliths, nannoliths. [10 hrs] Ecology of coccolithophores, coccoliths and sedimentology, functions of coccoliths, geologic distribution, effect of global climate change on distribution, evolutionary responses, terminology of calcareous nannofossils. [8 hrs] Revision problem classes [3 hrs] Part B – Practical labs Shape, Overlap, measurements of carapace and valves, orientation, external features, external structures, internal features, internal structures, inner lamella, outer lamella, Hinge line, ornamentation, description of some index species. [18 hrs] coccolith shape, coccoliths orientation, Coccolith size, ultrastructure, types of ultrastructural component, element arrangement , structures spanning central-area, orientation in plan view, structures closing central-area, crystallography, systematic paleontology, description of some index species. [18 hrs

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies *يتم كتابة ملخص الاستراتيجية الرئيسية التي سيتم تبنيها في تقديم هذه المادة*	Expanding students' perceptions about this science and its contents it includes that help in stratigraphic, paleoecologic, and paleoclimatic analysis. In addition to the use of different microscopes in distinguishing the types of microfossils through observations of the external and internal structures and their diagnosis. This will be achieved through lectures, labs, and interactive tutorials and by types of practical diagnostic methods for microfossils and 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	75	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	50	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 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 الأسبوعي النظري	
	Material Covered
Week 1	Groups and kingdoms of organisms and types of microfossils.
Week 2	An introduction to ostracode, its definition, taxonomic status and importance.
Week 3	General characteristics of ostracode, morphology, soft and calcareous parts.
Week 4	Features and structures used in directing shields and shells.
Week 5	External features and structures.
Week 6	Internal features and structures.
Week 7	Important terms (terminology).
Week 8	Ecology and palaeoenvironment of ostracode.
Week 9	Distribution of marine ostracode.
Week 10	Introduction to limestone nannofossils.
Week 11	Terminology related to the cocosphere, Terminology related to coccoliths.
Week 12	coccolithophoate environment.
Week 13	Coccolith and sedimentation.
Week 14	coccolith function.

Week 15	systematic paleontology.

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Shape, measurements of carapace and valves.
Week 2	Lab 2: Orientation of carapace and valves.
Week 3	Lab 3: External features, external structures.
Week 4	Lab 4: Internal features, internal structures.
Week 5	Lab 5: inner lamella, outer lamella.
Week 6	Lab 6: Hinge line.
Week 7	Lab 7: Description of some index ostracode species.
Week 8	Lab 8:.Preparing of Calcareous nannofossils slides.
Week 9	Lab9: Coccolith shape description.
Week10	Lab 10: coccoliths orientation.
Week 11	Lab 11: element arrangement.
Week 12	Lab 12: Description of some index nannofossils species

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Armstrong, H. and Brasier, M. (2005). Microfossils Black well publishing , p. 296. Young , J. R. and Bown , P. R. (1997). Cenozoic calcareous nannoplankton classification. Journal of Plankton Researches, 19, 36-47.	Yes Yes
Recommended Texts	Haq, B.U., Boersma, A., (1978). Introduction to marine micropaleontology. micropaleontology, Elsevier, New York, 376 p. Perch-Nielsen, K. (1977). Albian to Pleistocene calcareous nannofossils from the western South Atlantic. Initial Rep. Deep Sea drill. Proj., Vol. 39, pp. 699-823.	Yes No
Websites	https://shop.elsevier.com/books/introduction-to-marine-micropaleontology/haq/978-0-444-82672-5 https://www.ucl.ac.uk/GeolSci/micropal/ostracod.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	**Chemistry of Representative Element**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**CHE23114**				
ECTS Credits	6				
SWL (hr/sem)	**150**				
Module Level	2		Semester of Delivery	4	
Administering Department	CHE		College	CoS	
Module Leader	Sahbaa Ali Ahmed Ahmed Salim Mahmood		e-mail	sahbaa-ali@uomosul.edu.iq ahmedsalim@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor	Esraa Ali Hasan Kawakib Abdulaziz Mohammed Esraa Adnan Saeed Khalid Nadheer Hameed Saba Mumtaz Salih Alasali Luma Ahmed Mubarak Amenah Adnan Mohammed		e-mail	eseaaali@uomosul.edu.iq KawakibAbdulaziz@uomosul.edu.iq esraaadnan@uomosul.edu.iq kalsarraf05@uomosul.edu.iq sabaalasalli@uomosul.edu.iq lumaahmed@uomosul.edu.iq amenahadnan@uomosul.edu.iq	
Peer Reviewer Name	Assistant Professor Dr Khansaa Shakir AL nama		e-mail	Khnsaash.al-nama@uomosul.edu.iq	
Scientific Committee Approval Date	13/06/2023		Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	CHE1102,CHE1218	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	1. Identify solvents and what are type. 2. Learn about the most important scientific terms (Lewis acids and bases). 3. To understand the impact of these the element in the periodic table, atomic or ionic radius, Ionic potential, electro negativity, colour and the causes of colours. 4. To perform different halogens group and Nobel gases group applications. 5. Students will understand the group five (v) elements nitrogen properties, nitrogen compounds and nitrides. 6. Students will understand how these compounds prepare. 7. Students will understand the oxygen and elements of six group , characteristics of oxygen , oxides and hydroxide.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Explain the element in 15-18 group. 1. Define the various terms hard and soft acid –base 2. Discuss the elements in the periodic table. 3. Define Lewis acids and Lewis bases . 4. Explain the melting , boiling point of the solvents and dielectric constant . 5. Discuss group properties. 6. List and Describe the types of sulfur elements and isotope of oxygen. 7. Discuss the causes of the color in elements and compound .
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Theoretical lectures Introduction in predict table groups 15-18 , The element in the periodic table, Atomic or Ionic radius, Ionic potential, Electro negativity, Colour and The causes of colours, The Lewis compounds, Classification of Lewis acids, Classification of Lewis Bases, The strength of protonic acids, Hard and soft acid –base, Solvents , The melting and boiling point of the solvents, Dielectric constant, The acidic and basic properties of the

	solvent, Protonic –solvents, Inert solvent, The polar solvents. [10hrs] Group five (v) elements, Nitrogen properties, Nitrogen compounds, Nitrides, Compounds of nitrogen with hydrogen, Ammonia NH_3 , Ammonium salts , Hydrazine N_2H_4 , Hydroxylamine, Hydrazoic acid N_3H , Nitrogen and halogen compound (halides), Nitrogen trifluoride (NF3) , Nitrogen trichloride (NCl_3).[8hrs] Oxides of nitrogen , Oxa acidic nitrogen ,Group Properties , Phosphorus , Arsenic , Antimony and Bismuth, Compounds elements of fifth group , Hydrides, Halides , Oxides. Oxygen and elements of six group , Characteristics of oxygen , Oxides , Hydroxide The isotopes of oxygen, The physical properties, The chemical proprieties , Oxygen compounds. [8hrs] The elements of the group six , The group properties , Types of sulfur elements, Compounds of sulfur and Se,Te,Po , Oxides , Halogens VII group , The physical properties, Nobel gases group, The chemistry of Nobel gases. [4hrs] <u>Part B – Practical labs</u> Experimental No.1:preparation of sodium chloride (part 1) , Experimental No2:preparation of sodium chloride (part 2), Experimental No.3: Studying of some Nickel (Ni) compounds (part 1), Experimental No.4: Studying of some Nickel (Ni) compounds (part 2), Experimental No.5: Studying of some Nickel (Ni) compounds (part 3), Experimental No.6:Cupper chemistry (part 1) , [18hrs] Experimental No.7:Cupper chemistry (part 2), Experimental No.8: Cupper chemistry (part 3), Experimental No.9:preparation and studying some kinds of alum (part1), Experimental No.10: Preparation of potassium alum $KAl(SO_4)_2.12H_2O$ (part 2) , Experimental No.11:Preparation of chromium alum $KCr(SO_4)_2.12H_2O$ (part 3) , Experimental No.12: Preparation of ammonium alum $NH4Al(SO_4)_2.12H_2O$ (part 4). [18hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Competitive Learning • Students work individually. • Students have common learning goals and tasks. • The instructor grades students using norm-referenced methods (e.g., curve-based grading). Individualistic Learning • Students work individually. • Students have individualized learning goals and tasks, different from those of other students.

	• The instructor grades students using criteria-referenced methods (e.g., rubric-based grading). Cooperative Learning • Students work in small groups. • Students have shared learning goals and tasks within a group which may be similar or different from other groups. • The instructor grades students both on their work as a group and on their individual work.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	79	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	71	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 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 الأسبوعي النظري	
	Material Covered
Week 1	**The element in the periodic table, Atomic or Ionic radius, Ionic potential, Electro negativity, Colour and The causes of colours.**
Week 2	**The Lewis compounds, Classification of Lewis acids.**
Week 3	**Classification of Lewis Bases, The strength of protonic acids, Hard and soft acid –base.**
Week 4	**Solvents , The melting and boiling point of the solvents, Dielectric constant.**
Week 5	**The acidic and basic properties of the solvent, Protonic –solvents, Inert solvent, The polar solvents.**
Week 6	**Group five (v) elements, Nitrogen properties, Nitrogen compounds, Nitrides.**
Week 7	**Compounds of nitrogen with hydrogen, Ammonia NH_3**
Week 8	**Ammonium salts , Hydrazine N_2H_4 , Hydroxylamine, Hydrazoic acid N_3H**
Week 9	**Nitrogen and halogen compound (halides), Nitrogen trifluoride (NF_3) , Nitrogen trichloride (NCl_3).**
Week 10	**Oxides of nitrogen , Oxa acidic nitrogen.**
Week 11	**Group Properties , Phosphorus , Arsenic , Antimony and Bismuth, Compounds elements of fifth group , Hydrides, Halides , Oxides.**
Week 12	**Oxygen and elements of six group , Characteristics of oxygen , Oxides , Hydroxide**
Week 13	**The isotopes of oxygen, The physical properties, The chemical proprieties , Oxygen compounds.**
Week 14	**The elements of the group six , The group properties , Types of sulfur elements, Compounds of sulfur and Se,Te,Po , Oxides .**
Week 15	**Halogens VII group , The physical properties, Nobel gases group, The chemistry of Nobel gases**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Experimental No.1:preparation of sodium chloride (part 1).
Week 2	Lab 2: Experimental No2:preparation of sodium chloride (part 2).
Week 3	Lab3: Experimental No.3: Studying of some Nickel (Ni) compounds (part 1).
Week 4	Lab4: Experimental No.4: Studying of some Nickel (Ni) compounds (part 2).

Week 5	Lab 5: Experimental No.5: Studying of some Nickel (Ni) compounds (part 3).
Week 6	Lab6: Experimental No.6:Cupper chemistry (part 1).
Week 7	Lab 7: Experimental No.7:Cupper chemistry (part 2).
Week 8	Lab8: Experimental No.8: Cupper chemistry (part 3).
Week 9	Lab9:. Experimental No.9:preparation and studying some kinds of alum (part1).
Week10	Lab 10: Experimental No.10: Preparation of potassium alum $KAl(SO_4)_2.12H_2O$ (part 2).
Week 11	Lab 11: Experimental No.11:Preparation of chromium alum $KCr(SO_4)_2.12H_2O$ (part 3).
Week 12	Lab 12: Experimental No.12: Preparation of ammonium alum $NH4Al(SO_4)_2.12H_2O$ (part 4).

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	**Inorganic Chemistry,**Cotton and Wilkinson 1976 **Inorganic Chemistry** ,Noman Al Nuaimi (part 1 and part 2)1982. **Inorganic Coordination Chemistry**,Saad Al-Mukhtar and Ihsan Abdul Ghani 1988 Inorganic Chemistry ,EssamSaloome 1979 **Practical In Inorganic Chemistry Full-text July 2019/Coordination Chemistry Marei M El-Ajaily,Abdussalam Ali Maihub,T.H.Noor ,Omar Al-Obaidi practical inorganic chemistry**	Yes Yes No
Recommended Texts	**"Chemistry : The Molecular Nature of Matter and Chnge", Second Dition, (1996)** **Laboratory Manual of Practical Inorganic(II) Chemistry, By:** **M.Pranjoto Utomo, Department of Chemistry education faculty of Mathematics and Natural sciences Yogyakarta state university,2011**	Yes No

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	**Nanochemistry**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	CHE24023				
ECTS Credits	3				
SWL (hr/sem)	75				
Module Level	2		Semester of Delivery	4	
Administering Department	Chemistry		College	Science	
Module Leader	Ehab Salim Ahmed		e-mail	ehabmahal@uomosul.edu.iq	
Module Leader's Acad. Title	Lecturer		Module Leader's Qualification	Ph.D.	
Module Tutor	Ehab Salim Ahmed		e-mail	ehabmahal@uomosul.edu.iq	
Peer Reviewer Name			e-mail		
Scientific Committee Approval Date	13/06/2023		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. Illustrate how Nano-chemistry can participate in contribution to the knowledge in chemistry. 2. Justify the science of nano world and its importance to the future of the humanity. 3. Nano-chemistry deals with the fundamentals of nanoscience and its relation to the chemistry and technology. 4. Get firm knowledge about important definitions like nanoscience, nanotechnology and classification of nanomaterials. 5. Explain the approaches of the nanostructures preparations. 6. Examine selective applications of Nano-chemistry.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. What are nanoworld? 2. Was it known before? 3. What we call technology, science, chemistry and structures of nano? 4. How to classify NANOMATERIALS. 5. Does Nanomaterials have different characteristics? 6. How to get nanomaterials? 7. How to analyze nanomatter? 8. Method to apply nanos in chemistry. 9. Impact of nanochemicals on the life and environment.
Indicative Contents المحتويات الإرشادية	Introduction, Short history, Definitions, classification. [8hrs.] Properties of nanomaterials, some odd effects. [4hrs.] Synthesis methods: 1-Top-down : Arc-discharge, laser ablations, ball milling. 2- bottom-up approach: CVD, Electrodeposition, sol-gel. Characterization techniques: SEM, TEM, AFM, Raman Spectroscopy. [14hrs.]. 8. Applications in different sectors. [4hrs.].

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Introducing students to the basics of nanochemistry and its connection to the progressive technologies and their current and future effects on science, the environment and the reality of people, in addition to the methods of dealing with nanomaterials and their applications.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	50	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	25	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	1
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	151		

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

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week 1	Introduction to the nanoworld, short history of the nanos,
Week 2	Definition of nanoscience, nanotechnology, nanostructures, nanochemistry,
Week 3	Types of Nanomaterials
Week 4	classification of nanomaterials, 0D, 1D, 2D, and 3D structures.
Week 5	Properties of nanomaterials: 1- Thermal properties, electrical properties, magnetic, chemical sensitivity,

Week 6	Properties of nanomaterials: 2- strength and hardness,
Week 7	gecko effect, lotus effect.
Week 8	Synthesis methods: 1-Top-down : Arc-discharge, laser ablations, ball milling.
Week 9	Synthesis methods: 1-Top-down : Arc-discharge, laser ablations, ball milling.
Week 10	Synthesis methods: 2- bottom-up approach: CVD, Electrodeposition, sol-gel.
Week 11	Synthesis methods: 2- bottom-up approach: CVD, Electrodeposition, sol-gel.
Week 12	Characterization techniques: 1- SEM, TEM.
Week 13	Characterization techniques: 2- AFM, Raman Spectroscopy.
Week 14	Applications in pharmacy, cosmetics, industry.
Week 15	Impact on the environment.

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	
Week10	
Week 11	
Week 12	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Suresh C. Ameta (2022). The Science of Nanomaterials, p. 401. Prabhakar M. (2015) Applied Spectroscopy and the Science of	No

	Nanomaterials, p.292.	No
Recommended Texts	C. N. R. Rao, Achim Müller, A. K. Cheetham, (2004) The Chemistry of Nanomaterials: Synthesis, Properties and Applications, p.761.	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

Module Information					
Module Title	**Chemistry Software**			Module Delivery	
Module Type	**Core**			☐Theory ☐ Lecture ☒ Lab ☒ Tutorial ☐ Practical ☐ Seminar	
Module Code	**CHE24024**				
ECTS Credits	3				
SWL (hr/sem)	75				
Module Level		UGII	Semester of Delivery		4
Administering Department		CHE	College	CoS	
Module Leader	Shaymaa Hashim Alaa Hussein Ala Aldin Darghouth		e-mail	aladarghouth@uomosul.edu.iq	
Module Leader's Acad. Title		Asst. Prof. Lecturer Lecturer	Module Leader's Qualification		Ph.D.
Module Tutor			e-mail		
Peer Reviewer Name		Rabah Ali Khalil	e-mail	E-mail	
Scientific Committee Approval Date		11/06/2023	Version Number	1.0	

Relation with other Modules			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	ChemDraw is a tool to enable students to communicate chemical structures. It is designed to work according to conventions the designer's found most intuitive for such users. The designer's goal has been to make ChemDraw as easy to use as possible while providing superior drawing quality
Module Learning Outcomes	1. Identify the parts of the ChemDraw interface. 2. Teach the students the fundamental drawing techniques. 3. Drawing Chemical Structures. 4. Teach the students Advanced Drawing Techniques
Indicative Contents	Indicative content includes the following. 1. General Introduction, ChemDraw Basics. [4 hrs] 2. The ChemDraw Graphical User Interface. [4 hrs] 3. The Main Tools Palette. [4 hrs] 4. Teach the students the fundamental drawing techniques available in ChemDraw. [4 hrs] 5. Reaction Schemes. [4 hrs] 6. How to use rings. [4 hrs] 7. Show stereochemistry. [4 hrs] 8. Drawing Chemical Structures [4 hrs] 9. Drawing Bonds, [4 hrs] 10. Drawing Rings, [4 hrs] 11. Drawing Acyclic Chains [4 hrs] 12. Advanced Drawing Techniques [4 hrs] 13. Using Nicknames, Applying Nicknames [4 hrs] 14. Drawing Orbitals, Symbols Drawing Arrows, Arcs, and Other Shapes[4 hrs] 15. Working With Structures Viewing Analysis Information, Viewing Chemical Properties. [4 hrs]

Learning and Teaching Strategies	
Strategies	ChemDraw is a standalone application within ChemOffice. The program can integrate with other programs such as: 1. Chem3D: So, the student can perform molecular modeling and analysis, 2. BioAssay: So, the students can obtain biological data retrieval and visualization, 3. Inventory: So, the students can manage and search reagents, 4. E-Notebook: So, the student can get information for electronic journals 5. ChemFinder which enables students to search and information integration, 6. ChemInfo: This enables students to access chemical and reference databases.

Student Workload (SWL)			
Structured SWL (h/sem)	49	Structured SWL (h/w)	3
Unstructured SWL (h/sem)	26	Unstructured SWL (h/w)	1.5
Total SWL (h/sem)	75		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	General Introduction, **ChemDraw Basics**.
Week 2	The ChemDraw Graphical User Interface.
Week 3	The Main Tools Palette.
Week 4	Teach the students the fundamental drawing techniques available in ChemDraw.
Week 5	Reaction Schemes.
Week 6	How to use rings.
Week 7	Show stereochemistry.
Week 8	Drawing Chemical Structures
Week 9	Drawing Bonds ,
Week10	Drawing Rings,
Week 11	Drawing Acyclic Chains
Week 12	Advanced Drawing Techniques
Week 13	Using Nicknames, Applying Nicknames
Week 14	Drawing Orbitals, Symbols Drawing Arrows, Arcs, and Other Shapes
Week 15	Working With Structures Viewing Analysis Information , Viewing Chemical Properties
Week 16	1st course Final Term Examination

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	1. User's Guide CS ChemDraw 9.0 for Windows and Macintosh	Yes
Recommended Texts	2. Cambridge Software, ChemDraw Chemical Structure Drawing Standard for Windows and Macintosh , 9.0th Edition; Cambridge University, 2004.	Yes
Websites	https://www.cambridgesoft.com/	

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	Classical Separation Methods			Module Delivery	
Module Type	Core			☒ Theory ☐ Lecture ☒ Lab ☐x Tutorial ☐ Practical ☐ Seminar	
Module Code	CHE24119				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	2		Semester of Delivery	4	
Administering Department	CHE		College	CoS	
Module Leader	Imad Younus Hasan		e-mail	imad.younus@uomosul.edu.iq	
Module Leader's Acad. Title	Lecturer		Module Leader's Qualification	Ph.D.	
Module Tutor	Luma Taha Hanan Ali		e-mail	@uomosul.edu.iq @uomosul.edu.iq	
Peer Reviewer Name	Nabeel Sabeeh		e-mail	@uomosul.edu.iq	
Scientific Committee Approval Date	/06/2023		Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	1- Principle of Analytical Chemistry and Qualitative analysis	Semester	1
	2- Volumetric analysis	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 primary objective of this course is to acquire basic concepts, principles, and techniques of Classical separation methods to learn how the students can separate one or more of the components as pure from original mixture by using the classical separation methods.
Module Learning Outcomes	At the end of the semester, the students must be able to 1. Identify the different separating techniques of a mixture. 2. Determine the appropriate separating techniques for the given mixture.

مخرجات التعلم للمادة الدراسية	3. distinguish between analyte substance and interferences .with explain how we deal with interferences . 4. classify the separation method according the basis of separation parameter. 5. Explain the theories which discuss the efficiency of separation. 6. Students have knowledge of the concepts of chemical separation techniques in terms of chemical structure, energetics and chemical analysis including distillation, extraction, and chromatography techniques. 7. Skilled students use tools in carrying out chemical separation techniques including distillation, extraction, and chromatography techniques. 8. Students have the ability to collaborate and are responsible for carrying out chemical separation including distillation, extraction, and chromatography techniques.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Theoretical lectures contents: • Introduction to the purpose, benefits, and basics of separation in general • Explain the separations based on size techniques such as filtration, dialysis and size exclusion chromatography. • Explain the separations based on mass or density • Explain the separations based on Complexation Reactions (Masking) • Explain the separations based on changing state techniques such as sublimation, recrystallization and distillation . • Explain the separations by precipitation. • Explain the separation by extraction techniques such as liquid-liquid extraction, solid-liquid extraction and solid phase extraction. Part B – Practical labs: In this course, different experiments in classical separation methods are applied to separate different types of mixtures [36 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	This module will be offered as a contact module, as students will be required to attend learning opportunities and lectures using the traditional timetable. That is mean the teaching methods depend directly on face to face lectures, groups discussion, tutorials, problems solving, etc). The working groups, each group consist of five students, they must work together the practical work, answer the report and working sheets, and finally do the practical exam. Additionally, at throughout each theme, a variety of online quizzes will be made available to student. These will be used mainly for formative assessment purposes to assist students in determining whether they have understood and internalised the knowledge included in the theme. These online quizzes will provide immediate and sustainable feedback, to enhance students' learning. To encourage students to complete these quizzes, the marks for 5 completed quizzes (the best 5) will be used for summative purposes. All learning material and additional support material will be made available via Google classroom . This will include uploaded (pre-recorded) narrated PowerPoints and interactive training videos.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	94	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	56	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)	3,5,8,11 and 13	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	8	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 الأسبوعي النظري	
	Material Covered
Week 1	Introduction to the purpose, benefits, and basics of separation in general
Week 2	Explain the separations based on size techniques such as filtration, dialysis and size exclusion chromatography.
Week 3	Explain the separations based on mass or density and also explain the separations based on Complexation Reactions
Week 4	Explain the separations based on changing state techniques such as sublimation, recrystallization and distillation .
Week 5	Explain the separations by precipitation including Separations Based on Control of Acidity, Sulfide Separations and separation by using organic and inorganic regents.
Week 6	Midterm exam

Week 7	Introduction in liquid- liquid extraction
Week 8	Relative distribution and extraction efficiency
Week 9	Single and Multiple Extraction
Week 10	Modification solvent extractions
Week 11	Solid-liquid extraction and their application
Week 12	Solid phase extraction and their application
Week 13	
Week 14	Thin layer chromatography and paper chromatography
Week 15	

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	General introduction in classical separation methods laboratories
Week 2	Separating mixture by Evaporation
Week 3	Dialysis Tubing Experiment
Week 4	Gel Filtration Chromatography
Week 5	Separation of mixtures by centrifugation- Plasma Separation From Blood Centrifugation
Week 6	Isolation of caffeine from natural products by Liquid-Lquid Extraction 1
Week 7	Isolation of caffeine from natural products by Liquid-Lquid Extraction 2
Week 8	Separation of Colors using paper chromatography
Week 9	Performing Thin Layer Chromatography (TLC)
Week10	Separation by solid phase extraction
Week 11	Separation by solid liquid extraction
Week 12	Separation of natural oil

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts		Yes Yes
Recommended Texts		Yes 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	Classical Separation Methods			Module Delivery	
Module Type	Core			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code					
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	2		Semester of Delivery	4	
Administering Department	Department of Chemistry		College	College of Sciences	
Module Leader	Imad Younus Hasan		e-mail	imad.younus@uomosul.edu.iq	
Module Leader's Acad. Title	Lecturer		Module Leader's Qualification	Ph.D.	
Module Tutor	Luma Taha Hanan Ali		e-mail	@uomosul.edu.iq @uomosul.edu.iq	
Peer Reviewer Name	Nabeel Sabeeh		e-mail	@uomosul.edu.iq	
Scientific Committee Approval Date	/06/2023		Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	1- Principle of Analytical Chemistry and Qualitative analysis	Semester	1
	2- Volumetric analysis	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 primary objective of this course is to acquire basic concepts, principles, and techniques of Classical separation methods to learn how the students can separate one or more of the components as pure from original mixture by using the classical separation methods.
Module Learning Outcomes	At the end of the semester, the students must be able to 1. Identify the different separating techniques of a mixture. 2. Determine the appropriate separating techniques for the given mixture.

مخرجات التعلم للمادة الدراسية	3. distinguish between analyte substance and interferences .with explain how we deal with interferences . 4. classify the separation method according the basis of separation parameter. 5. Explain the theories which discuss the efficiency of separation. 6. Students have knowledge of the concepts of chemical separation techniques in terms of chemical structure, energetics and chemical analysis including distillation, extraction, and chromatography techniques. 7. Skilled students use tools in carrying out chemical separation techniques including distillation, extraction, and chromatography techniques. 8. Students have the ability to collaborate and are responsible for carrying out chemical separation including distillation, extraction, and chromatography techniques.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Theoretical lectures contents: • Introduction to the purpose, benefits, and basics of separation in general • Explain the separations based on size techniques such as filtration, dialysis and size exclusion chromatography. • Explain the separations based on mass or density • Explain the separations based on Complexation Reactions (Masking) • Explain the separations based on changing state techniques such as sublimation, recrystallization and distillation . • Explain the separations by precipitation. • Explain the separation by extraction techniques such as liquid-liquid extraction, solid-liquid extraction and solid phase extraction. Part B – Practical labs: In this course, different experiments in classical separation methods are applied to separate different types of mixtures [36 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	This module will be offered as a contact module, as students will be required to attend learning opportunities and lectures using the traditional timetable. That is mean the teaching methods depend directly on face to face lectures, groups discussion, tutorials, problems solving, etc). The working groups, each group consist of five students, they must work together the practical work, answer the report and working sheets, and finally do the practical exam. Additionally, at throughout each theme, a variety of online quizzes will be made available to student. These will be used mainly for formative assessment purposes to assist students in determining whether they have understood and internalised the knowledge included in the theme. These online quizzes will provide immediate and sustainable feedback, to enhance students' learning. To encourage students to complete these quizzes, the marks for 5 completed quizzes (the best 5) will be used for summative purposes. All learning material and additional support material will be made available via Google classroom . This will include uploaded (pre-recorded) narrated PowerPoints and interactive training videos.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	75	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	50	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125		5

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	5	10% (10)	3,5,8,11 and 13	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	8	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 الأسبوعي النظري	
	Material Covered
Week 1	Introduction to the purpose, benefits, and basics of separation in general
Week 2	Explain the separations based on size techniques such as filtration, dialysis and size exclusion chromatography.
Week 3	Explain the separations based on mass or density and also explain the separations based on Complexation Reactions
Week 4	Explain the separations based on changing state techniques such as sublimation, recrystallization and distillation .
Week 5	Explain the separations by precipitation including Separations Based on Control of Acidity, Sulfide Separations and separation by using organic and inorganic regents.
Week 6	Midterm exam

Week 7	Introduction in liquid- liquid extraction
Week 8	Relative distribution and extraction efficiency
Week 9	Single and Multiple Extraction
Week 10	Modification solvent extractions
Week 11	Solid-liquid extraction and their application
Week 12	Solid phase extraction and their application
Week 13	
Week 14	Thin layer chromatography and paper chromatography
Week 15	

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	General introduction in classical separation methods laboratories
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	
Week10	
Week 11	
Week 12	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts		Yes Yes
Recommended Texts		Yes 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	Solid state chemistry			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**CHE24120**				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	3		Semester of Delivery	2	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Sahbaa Ali Ahmed Farah Tariq Saeed		e-mail	sahbaa-ali@uomosul.edu.iq farah-t-s@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor	Esraa Ali Hasan Kawakib Abdulaziz Mohammed Esraa Adnan Saeed Khalid Nadheer Hameed Saba Mumtaz Salih Alasali Luma Ahmed Mubarak Amenah Adnan Mohammed		e-mail	eseaaali@uomosul.edu.iq KawakibAbdulaziz@uomosul.edu.iq esraaadnan@uomosul.edu.iq kalsarraf05@uomosul.edu.iq sabaalasalli@uomosul.edu.iq lumaahmed@uomosul.edu.iq amenahadnan@uomosul.edu.iq	
Peer Reviewer Name	Assistant Professor Dr Khansaa Shakir AL nama		e-mail	Khnsaash.al-nama@uomosul.edu.iq	
Scientific Committee Approval Date	10/06/2023		Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Solid state chemistry	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	1. Identify solid state chemistry and what are type. 2. Learn about the most important scientific terms (the crystal lattice, crystalline solid). 3. To understand the impact of these the unit cell and the important . 4. To perform different Braives lattice and Millar indices . 5. Students will understand how X-ray diffraction instruments . 6. Students will understand how the different between the ESR and EPR . 7. Students will understand the applications of ESR , inorganic point of view to the standard electro potential and Half-cell or half-cell potential. 8. Identify Born-Haber cycle and pH of the solution. 9. Students will understand the relative between pH & E.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Explain the solid state chemistry and anther application in inorganic chemistry. 1. Define the various terms unit cell. 2. Discuss the Miller indices and all shape. 3. Define crystalline solid and amorphous solid . 4. Explain the X-ray diffraction instruments. 5. Discuss the applications of ESR. 6. List and Describe the half-cell or half-cell potential . 7. Discuss the Nernst equation and the electrode potential .
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Theoretical lectures Introduction solid state chemistry, the crystal lattice, crystalline solid, amorphous solid, space lattice, unit cell, lattice constants, System length angles space lattice , Miller indices , X-ray diffraction instruments, x-ray production, ESR or EPR (electron spin resonance)(ESR) or (electron paramagnetic resonance) (EPR) , Origin of an ESR signal. [10 hrs] Electromagnetic spectrum , Hyperfine coupling , Applications of ESR ,

	Inorganic point of view to the standard electro potential , Half-cell or half-cell potential [8 hrs] Electro potential , Born-Haber cycle , pH of the solution, Nernst equation , The electrode potential , Relative between pH & E. [10 hrs] Electromotive force. [2 hrs] <u>Part B – Practical labs</u> [Experimental No.1: The first group (Alkali metals) Preparation of aqueous potassium sulfate (part1), Experimental No.2: Preparation of anhydrous potassium sulfate (part 2), Experimental No.3: Second group Preparation of Barium tartarate , Experimental No4:The Elements of Group(III) Preparation of Barium borate , Experimental No.5: the elements Group(IV) Preparation of the $PbCrO_4$ (part1) , Experimental No6: the elements Group(IV) Preparation of the $PbCrO_4$ (part 2). [18 hrs] Experimental No.7: The Elements of Fifth Group Preparation of silver ortho phosphate (Ag_3PO_4) (part1), Experimental No.8: Preparation of silver ortho phosphate (Ag_3PO_4) (part2), Experimental No.9: Oxygen group Preparation Sodium ThioSulphate (part1), Experimental No.10: Oxygen group Preparation Sodium ThioSulphate (part2), Experimental No11: Halogen group (part1), Experimental No12: Preparation of potassium periodate (part 2).[18 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Competitive Learning • Students work individually. • Students have common learning goals and tasks. • The instructor grades students using norm-referenced methods (e.g., curve-based grading). Individualistic Learning • Students work individually. • Students have individualized learning goals and tasks, different from those of other students. • The instructor grades students using criteria-referenced methods (e.g., rubric-based grading). Cooperative Learning

	• Students work in small groups. • Students have shared learning goals and tasks within a group which may be similar or different from other groups. • The instructor grades students both on their work as a group and on their individual work.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	94	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	56	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 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 الأسبوعي النظري

	Material Covered
Week 1	**Solid state chemistry, The crystal lattice, Crystalline solid.**
Week 2	**Amorphous solid, Space lattice, Unit cell, Lattice constants.**
Week 3	**System length angles space lattice , Miller indices.**
Week 4	**X-ray diffraction instruments, x-ray production.**
Week 5	**ESR or EPR (electron spin resonance)(ESR) or (electron paramagnetic resonance) (EPR) , Origin of an ESR signal.**
Week 6	**Electromagnetic spectrum , Hyperfine coupling.**
Week 7	**Applications of ESR.**
Week 8	**Inorganic point of view to the standard electro potential.**
Week 9	**Half-cell or half-cell potential.**
Week 10	**Electro potential**
Week 11	**Born-Haber cycle .**
Week 12	**pH of the solution**
Week 13	**Nernst equation , The electrode potential .**
Week 14	**Relative between pH & E.**
Week 15	**Electromotive force.**

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Experimental No.1: The first group (Alkali metals) Preparation of aqueous potassium sulfate (part1)
Week 2	Lab 2: Experimental No.2: Preparation of anhydrous potassium sulfate (part 2).
Week 3	Lab3: Experimental No.3: Second group *Preparation of Barium tartarate*.
Week 4	Lab4: Experimental No4:The Elements of Group(III) Preparation of Barium borate .
Week 5	Lab 5: Experimental No.5: the elements Group(IV) Preparation of the $PbCrO_4$ (part1).
Week 6	Lab6: Experimental No6: the elements Group(IV) Preparation of the $PbCrO_4$ (part 2).
Week 7	Lab 7: Experimental No.7: The Elements of Fifth Group Preparation of silver ortho phosphate (Ag_3PO_4) (part1)..
Week 8	Lab8: Experimental No.8: Preparation of silver ortho phosphate (Ag_3PO_4) (part2).
Week 9	Lab9:. Experimental No.9: Oxygen group Preparation Sodium ThioSulphate (part1).

Week10	Lab 10: Experimental No.10: Oxygen group Preparation Sodium ThioSulphate (part2).
Week 11	Lab 11: Experimental No11: Halogen group (part1).
Week 12	Lab 12: Experimental No12: Preparation of potassium periodate (part 2).

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Coordination Chemistry ,Mehdi Naji Al Zukoum,1981 X-Ray Patient Positioning Manual, Dr. Naveed Ahmad ,2003 Solid State Chemistry and its Applications ,Anthony R. West,2014 Magnetostatic Principles in Ferromagnetism ,Brown, Jr., WilliamFuller, 1962.	Yes No Yes
Recommended Texts	Silberg, "Chemistry The Molecular Nature of Matter and Chnge " Second Dition,(1996) The Golden Book of Chemistry Experiments Jonuary 16,2016 , by Anne Helmenstine. The Periodic Table Septenber, 2017, Sean Collery , Miranda Smith (chemistry Experiments)Pamela Walker Elaine Wood 2011 by Infobase Publishing, Facts On File Science Experiments	Yes No

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks %	Definition
Success Group	A - Excellent	امتياز	90 - 100	Outstanding Performance

(50 - 100)	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

Module Information

Module Title	**Phase equilibrium**		Module Delivery	
Module Type	**Core**		☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**CHE24121**			
ECTS Credits	6			
SWL (hr/sem)	**150**			
Module Level	2		Semester of Delivery	4
Administering Department	Chemistry		College	Science
Module Leader	**Assist. Prof. Dr. Ammar Abdulsattar Ibrahim** **Dr. Rana Hasan Ahmed**		e-mail	ammar74@uomosul.edu.iq ranahasan@uomosul.edu.iq
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.
Module Lab	Dr. Nada Bashir Amal Ghazi		e-mail	basheer.nada@uomosul.edu.iq amalchem@uomosul.edu.iq
Peer Reviewer Name	Dr. Rabah Ali Khalil		e-mail	rabahalikhalil@uomosul.edu.iq
Scientific Committee Approval Date	13/06/2023		Version Number	1.0

Relation with other Modules

Prerequisite module	Thermodynamics	Semester	4
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

Module Objectives	This course gives information about the phase equilibrium with examples of components and degree of freedom. Besides that, used Clapeyron, Classius-Clapeyron, Trouton and Henrey laws with examples. Also, explaining solutions, azeotropic and freezing or boiling point with examples. Finally, chemical equilibrium and Le-Chatlier principle are explain with examples.
Module Learning Outcomes	1. Conceptually understand Solid-Liquid, Solid-Vapour and Liquid-Liquid Equilibrium. 2. Identify which equilibrium is present in different processes. 3. Utilize densities and fractional compositions of liquid-liquid mixtures to determine masses before and after separation. 4. Understand the difference between the physical and chemical equilibrium cases for the 3 equilibrium cases. 5. Discuss the difference between ideal and real gases. 6. Use mathematical procedures for problem solving. 7. Present and discuss the solution of problems.

Indicative Contents	Part A – Theoretical lectures 1. Introduction, Phase equilibria , Component , Independent Component , Degree of freedom, Phase rule , Uses of of Phase Rule , examples of phase rule, Triple point , [10 hrs] 2. Clapeyron equation with Examples. Classius – Clapeyron equation with Examples 3. The Trouton's Rule with Examples , [8 hrs] 4. Raoult's Law , Ideal solutions , Deviation from Raoult's law , Positive and negative deviation , examples Solutions, Mole fraction, vapour pressure, Henrey's Law , Boiling point and freezing point [10 hrs] 5. Azeotropic, Minimum & maximum boiling azeotropic , Elevation of boiling point , examples , Freezing point , Fractional Distillation , Chemical equilibrium , relation between , examples with solutions (Kc, Kp and Kx) [8 hrs] 6. Le-Chatlier Principle , effect of (Temp, Pressure and Conc.) , Relation between K and ΔG, examples [3 hrs] Part B – Practical labs different experiments in thermodynamic of physical chemistry including the density, viscosity, surface tension, molecular weight determination (liquid and solid), enthalpy of neutralization, heat of solution, heat of vaporization. [36 hrs]

Learning and Teaching Strategies	
Strategies	Expanding students' perceptions about this science and its contents it includes that help to understand the phase equilibrium solution. In addition to the use of different mathematical equations to understand some idea about the pressure, temperature, solubility and equilibrium reaction. This will be achieved through lectures, labs, and tutorials.

Student Workload (SWL)			
Structured SWL (h/sem)	94	Structured SWL (h/w)	6
Unstructured SWL (h/sem)	56	Unstructured SWL (h/w)	4
Total SWL (h/sem)	150		

Module Evaluation					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 12	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	5 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)	
	Material Covered
Week 1	Introduction of phase equilibrium, Component , Independent Component ,
Week 2	Degree of freedom , Phase rule , Uses of of Phase Rule , Triple point
Week 3	Quize, solution for the problem
Week 4	Clapeyron equation, Classius – Clapeyron equation
Week 5	Trouton's Rule, Examples
Week 6	Quize, solution for the problem
Week 7	Raoult's Law , Examples , Ideal solutions
Week 8	Deviation from Raoult's law , Positive and negative deviation
Week 9	Solutions, Mole fraction, vapour pressure,
Week 10	Henrey's Law , Boiling point and freezing point
Week 11	Azeotropic, Minimum & maximum boiling azeotropic, Elevation of boiling point
Week 12	Freezing point , examples , Fractional Distillation
Week 13	Chemical equilibrium , relation between (Kc, Kp and Kx)
Week 14	Le-Chatlier Principle , effect of (Temp, Pressure and Conc.) ,
Week 15	Relation between K and ΔG

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Density
Week 2	Viscosity
Week 3	Surface tension
Week 4	Molecular weight determination by the Victor Meyer method
Week 5	Determination of molecular weight of solid by Rast method
Week 6	Enthalpy of neutralization
Week 7	Heat of solution
Week 8	Vapor pressure of liquid
Week 9	Heat of vaporization by calorimetry
Week10	Determination the transition point of salt and finding the heat of solution ΔH
Week 11	Determination of equilibrium constants
Week 12	Water-phenol miscibility diagram
Week 13	Determination the heat of reaction between magnesium and sulfuric acid

Week 14	Determination of the molecular weight by measuring the elevation of boiling point
Week 15	Three component system

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	1. Physical Chemistry, Farrington Daniels and Robert A. Alberty, 2nd ed. 1963. 2. Physical Chemistry, Keith J. Laidler, John H. Meiser, Bryan C. Sanctuary, 4th ed., 2003. 2. Atkin's Physical Chemistry, Peter Atkins, Eleventh Edition, 2018.	Yes No
Recommended Texts	1. Physical Chemistry, (4th ed.), Robert J. Sillbey et al, 2005.	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	**Industrial Chemistry and Pollution**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	CHE35029				
ECTS Credits	**4**				
SWL (hr/sem)	**100**				
Module Level	2		Semester of Delivery	5	
Administering Department	Chemistry		College	Science	
Module Leader	Shaymaa Sultan Abbo		e-mail	shaymaalmutlaq@uomosul.edu.iq	
Module Leader's Acad. Title	Lecturer		Module Leader's Qualification	Ph.D.	
Module Tutor			e-mail		
Peer Reviewer Name			e-mail		
Scientific Committee Approval Date	13/06/2023		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 ***يتم كتابة اهم الأهداف التي تغطيها هذه المادة الدراسية بشكل جمل او فقرات توضح المواضيع التي سيتم التطرق اليها و دراستها و معالجتها)***	1. Illustrate how industrial chemistry can participate in contribution to the knowledge in chemistry. 2. Justify the technology and industry and their importance to the future of the humanity. 3. Industrial chemistry deals with the fundamentals of Industrial processes and its relation to the chemistry and engineering. 4. Get firm knowledge about important definitions like chemical processes, unit operations. 5. Explain the chemical processes and physical processes. 6. Examine selective industries.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية ***يتم كتابة اهم المُخرجات او الناتج و الكَم العلمي الذي يتم استخدامه للتدريس في هذه المادة على شكل أسئلة أساسية تخص منهاج المادة بأكمله و يجب ان لا تقل هذه المُخرجات من ناحية العدد عن 6 مُخرجات و يفضل ان تكون بعدد أسابيع الدراسة.***	1. What are industrial chemistry? 2. Was it important? 3. What is the types of chemical processes? 4. How to classify chemical and physical processes. 5. Does industrial chemistry has alternative? 6. How to get materials manufactured? 7. How to prepare raw materials? 8. corrosion of materials. 9. Impact of industrial chemistry on the life and environment.
Indicative Contents المحتويات الإرشادية ***يتم كتابة اهم العناوين الرئيسية للمواضيع بشكل متسلسل و التي تشمل كافة الفقرات التي تحتويها مع إدراج عدد الساعات المطلوبة لتنفيذ كل فقرة.***	Introduction, Short history, Definitions, classification. [4hrs.] Physical processes and chemical processes. [8hrs.] Corrosion principles, water industry. [12hrs.]. 8. Fetilizers, green chemistry, composites [6hrs.].

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies ***يتم كتابة ملخص الاستراتيجية الرئيسية التي سيتم تبنيها في تقديم هذه***	Introducing students to the basics of industrial chemistry and its connection to the progressive technologies and their current and future effects on science, the environment and the reality of people, in addition to the methods of manufacturing chemical products and their applications.

المادة	

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	50	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	51	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	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.	-	-	-	-
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	Midterm Exam	2hr	20% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week 1	Chemical technology
Week 2	Important considerations for chemical industry
Week 3	Operations, Apparatus and materials used in chemical technology

Week 4	Physical processes
Week 5	Chemical processes
Week 6	Corrosion principles
Week 7	Corrosion principles
Week 8	Corrosion principles
Week 9	Water in industry and for human usage
Week 10	Water in industry and for human usage
Week 11	Water in industry and for human usage
Week 12	chemical reactions and technology
Week 13	fertilizers
Week 14	composites
Week 15	Green chemistry

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	
Week10	
Week 11	
Week 12	

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

Required Texts	Sharma, Shanta S.; Pal, Arpita P., (2009) A Textbook of Applied Chemistry , p.183. Chris A. Clausen, Guy C. Mattson, (1979) Principles of Industrial Chemistry, p.412.	No No
Recommended Texts	Moulijn J.A., Makkee M. van Diepen A.E. , (2013) Chemical Process Technology, p. 571.	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

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MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Coordination Chemistry			**Module Delivery**	
Module Type	Core			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	CHE35125				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	3		**Semester of Delivery**	5	
Administering Department	CHE35125		**College**	COS	
Module Leader	Amera Faris Mohammed Sameer Saadallah Ezzat		**e-mail**	Amera.alsarraj@uomosul.edu.iq sameer.ezzat@uomosul.edu.iq	
Module Leader's Acad. Title	Assist. Prof. Lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Esraa Ali Hasan Saba Mumtaz Salih Alasalli Amenah Adnan Mohammed Lana Abdalhameed Luma Ahmed Mubarak Esraa Adnan Saeed Kawakib Abdulaziz Mohammed Khalid Nadheer Hameed		**e-mail**	esraaali@uomosul.edu.iq Sabaalasalli@uomosul.edu.iq amenahadnan@uomosul.edu.iq lanaabdalhameed@uomosul.edu.iq Lumaahmed@uomosul.edu.iq esraaadnan@uomosul.edu.iq kawakibAbdulaziz@uomosul.edu.iq kalsarraf05@uomosul.edu.iq	
Peer Reviewer Name	Khansaa shakir AL-nama		**e-mail**	Khnsaah.alnama@uomosul.edu.iq	
Scientific Committee Approval Date	13/ 6 /2023		**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Atomic structure Molecular and Ionic Compounds Solid state chemistry Periodic table: G15_G18	**Semester**	CHE1102 CHE1218 CHE23114 CHE24120
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1. To understand the basic concepts of coordinate chemistry, bonding theories of complex compounds, Colour and Magnetic properties, Isomerism in coordination compounds. 2. To study about colour and spectral properties of complex compounds and to learn about magnetic behaviour of different complexes. 3. In order to study transition metals to understand the trends in properties and reactivity of the d-block elements. 4. To explain the typical physical and chemical properties of the transition metals. 5. To identify simple compound classes for transition metals and describe their chemical properties.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. To understand the key features of coordination compounds, including: - the variety of structures - oxidation numbers and electronic configurations - coordination numbers - ligands, chelates - bonding, stability of complexes. 2. To be able to write electronic configuration of given atomic number. 3. To be able to use Crystal Field Theory to understand the magnetic properties (and in simple terms the colour) of coordination compounds. 4. To be able to describe the shapes and structures of coordination complexes with coordination numbers ranging from 4 to 12. 5. To be able to describe the stability of metal complexes by the use of formation constants and to calculate thermodynamic parameters from them. 6. To be able to recognize the types of isomers in coordination compounds. 7. To be able to name coordination compounds and to be able to draw the structure based on it's name. 8. To become familiar with some applications of coordination compounds. 9. To be able to tell the name of orbitals by recognizing shapes of orbitals. 10. To be able to calculate bond order of different molecules.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Theoretical lectures **1.** Transition elements, definition, physical properties, characteristic properties. [2hr] **2.** d-block elements, f-block elements ,coordination chemistry, important of complexes. [4hr] **3.** Chain theory ,Werner's theory ,type of ligands, classification of metal complexes. [4hr] **4.** Nomenclature of coordination compounds, Bonding theories for coordination compounds, and isomerism. [4hr] **5.** EAN rules, valence bond theory [4hr] **6.** Crystal field theory. [4hr] **7.** CFSE for octahedral ,tetrahedral, and square planer. [4hr] **8.** Jan-teller distortion ,M. O.T theory. [2 hrs]

	Part B – Practical labs Exp.1 Ggeometrical Isomerism (Part 1 and 2) [6hr] Exp.2 Preparation of Cobalt (lll) Complex with bidentate ligand (Part 1 and 2) [6hr] Exp.3Aluminium complexes (Part 1 and 2) [6hr] Exp.4 Aluminium complexes (Part 1 and 2) [6hr] Exp.5 Preparation of Cobalt (III) Complex (Part 1 and 2) [6hr] Exp.6 Acetylaceton Complexes (Part 1 and 2) [6hr]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Reviewing and recalling key terms, Effective Questioning Techniques, Using a visual image, using a model, using a periodic table.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	94	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	56	**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	
	Assignments	2	10% (10)	2 and 9	
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	
Summative assessment	**Midterm Exam**	2hr	10% (10)	7	
	Final Exam	3hr	50% (50)	16	All

Total assessment	100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week 1	Transition elements, definition, physical properties, characteristic properties.
Week 2	d-block elements, f-block elements
Week 3	Coordination chemistry, important of complexes
Week 4	Chain theory ,Werner's theory
Week 5	Type of ligands, classification of metal complexes
Week 6	Nomenclature of coordination compounds, Bonding theories for coordination compounds
Week 7	Isomerism
Week 8	**Midterm exam**
Week 9	EAN rules
Week 10	Valence bond theory
Week 11	Crystal field theory
Week 12	Crystal field theory
Week 13	CFSE for octahedral ,tetrahedral, and square planer
Week 14	CFSE for octahedral ,tetrahedral, and square planer
Week 15	Jan-teller distortion ,M. O.T theory

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Elucidate the experimental 1, 2, and 3
Week 2	Elucidate the experimental 4, 5, and 6
Week 3	Exp.1 Ggeometrical Isomerism (Part 1)
Week 4	Exp.1 Ggeometrical Isomerism (Part 2)
Week 5	Exp.2 Preparation of Cobalt (lll) Complex with bidentate ligand (Part 1)
Week 6	Exp.2 Preparation of Cobalt (lll) Complex with bidentate ligand (Part 2)
Week 7	Exp.3Aluminium complexes (Part 1)
Week 8	Exp.3Aluminium complexes (Part 2)
Week 9	Exp.4 Aluminium complexes & Estimation of the of oxalate Ion theoretically and practically by an analytical method**.** (Part 1)

Week 10	Exp.4 Aluminium complexes & Estimation of the of oxalate Ion theoretically and practically by an analytical method**.** (Part 2)
Week 11	Exp.5 Preparation of Cobalt (III) Complex with Hexadentate Ligand **(EDTA)** (Part 1)
Week12	Exp.5 Preparation of Cobalt (III) Complex with Hexadentate Ligand **(EDTA)** (Part 2)
Week 13	Exp.6 Acetylaceton Complexes (Part 1)
Week 14	Exp.6 Acetylaceton Complexes (Part 2)
Week 15	Review the course experiences and prepare and get ready for the final exam

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	**Available in the Library?**
Required Texts	1. Coordination Chemistry by Fred Basolo and Ronald Johnson 1986 2. Coordination Chemistry by D.Banerjea, Third Edition 2009 3. Coordination Chemistry by Ajai Kumar Seconde Edition 2014	Yes Yes No
Recommended Texts	Inorganic Chemistry 5th Edition Miessler	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	Organic Chemistry 3			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	CHE35127				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	UGIII 3		Semester of Delivery	5	
Administering Department	CHE		College	CoS	
Module Leader	Said Abdelqader Said		e-mail	saidabdelqader75@uomosul.edu.iq	
	Salih Owaid Abbood			Salsbio46@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor Lecturer		Module Leader's Qualification	Ph.D.	
Module Tutor	Shaimaa Younus Ibraheam		e-mail	Shaimaa.al1980shaimaa@uosul.edu.iq	
	Dr. Hiba Amen Ibraheem Al*alaaf			Hiba.ameen80@uomosul.edu.iq	
	Dr. Harith Mohammed Salman Abd			Harith-mohammed@uomosul.edu.iq	
	Dr. Amira Mohammed Faraj Salih			Amerra-mohammed@uomosul.edu.iq	
	Shahla ahmed Younus abd			Shahlaahmad@uomosul.edu.iq	
Peer Reviewer Name	Prof. Dr. Adnan Othman Omer		e-mail	Adnana.hasaka94@uomosul.edu.iq	
Scientific Committee Approval Date			Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Organic Chemistry 1	Semester	3
	Organic Chemistry 2		4
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives	1. Developing a base of knowledge of the most fundamental organic reactions in the field of organic synthesis. 2. Explain the acidic nature of α-hydrogens that used to generate carbanions. 3. Describing α-carbon reactions (condensations and other related reactions, i.e. formation of new C-C bonds) that used to synthesize important organic compounds (from simple starting materials) and their mechanisms. 4. Showing the formation and reactions (both electrophilic and nucleophilic addition and their related mechanisms) of α,β-unsaturated carbonyl compounds as an important class of carbonyl compounds. 5. Studying the stereochemistry of Diels-Alder addition reaction. 6. To develop fundamental concepts related to rearrangement reactions and neighboring group effects with specific mechanisms and migratory aptitude of different groups. 7. Studying the structure, properties, synthetic methods and reactions of the some important polynuclear aromatic compounds (naphthalene, anthracene and phenanthrene).
Module Learning Outcomes	1. To study structure, formation, stability and related name reaction of carbanions. 2. Understanding the role of carbanions (as reactive intermediates) in organic reactions 3. Learning possible mechanisms of some known name reactions involving carbanions. 4. Development of reverse thinking skill (back thinking) and the student's acquiring the training skill to choose the suitable method for the formation of C-C bonds. 5. Changing the connectivity of an existing organic backbone by using reactions that result in skeletal rearrangement. 6. Understanding the structure, properties, synthetic methods and reactions of the some important polynuclear aromatic compounds. 7. Ability to work in a team to perform specific experimental tasks. 8. Ability to communicate results of work to classmate and participation in class or laboratory discussions. 9. The use of modern library search tools to locate and retrieve scientific information about a topic, organic chemical, chemical technique, or an issue relating to chemistry. 10. When conducting a laboratory experiment, the student will follow written procedures commonly used in the organic lab accurately and safely. When completing a lab report the student will apply the scientific method correctly by being able to state a hypothesis, take careful measurements and draw appropriate conclusions based on gathered data and scientific principles.
Indicative Contents	Indicative content includes the following. <u>Part A – Theoretical lectures</u> Carbanion I, that involves: introduction, properties, acidity of α-hydrogen and reactions, Aldol condensation, dehydration of aldol products, use of aldol condensation in synthesis and crossed aldol condensation, Claisen condensation,

	crossed Claisen condensation, Reformatsky reaction, reactions related to aldol condensation that include: The Knoevenagel condensation, Perkin reaction, Cope reaction and Wittig reaction. [8 hrs] Carbanions II, that involves: Malonic ester and Acetoacetic ester synthesis, Decarboxylation of β-ketoe acids and malonic acids, Synthesis of acids and esters via 2-oxazoline, alkylation of carbonyl compounds via anamines. [6 hrs] Midterm exam. [2hrs] α,β-Unsaturated carbonyl compounds, that involves: structure and properties, preparation, interaction of functional groups, electrophilic addition, nucleophilic addition, Michael addition, Diels-Alder reaction, stereochemistry of the Diels-Alder reaction and quinones. [6hrs] Rearrangements, that involves: types of rearrangements, pinacol-pinacolone rearrangement, Hofmann rearrangement, rearrangement of hydroperoxides and neighboring group effects. [4 hrs] Polynuclear aromatic compounds, that involves: fused ring system, (Naphthalene structure, properties, reactions and synthetic methods), (Anthracene, properties, structure, synthetic methods and reactions) and (Phenanthrene, properties, structure, synthetic methods and reactions). [4 hrs] Part B – Practical labs Cannizaro reaction (Synthesis of benzyl alcohol and benzoic acid, separation of benzyl alcohol and benzoic acid, purification of benzoic acid). [9 hrs] Perkin reaction (Synthesis of sodium cinnamate, separation of cinnamic acid, purification of cinnamic acid, determination of cinnamic acid purity). [12 hrs] Diazonium salts reaction (Synthesis of azo dye and phenol, Purification of phenol). [6 hrs] Synthesis of Sulphanilic acid, purification of sulphanilic acid, determination of product purity. [9 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Organic chemistry is the study of the structure, properties, composition, reactions, and preparation of carbon-containing compounds. Most organic compounds contain carbon and hydrogen, but they may also include any number of other elements like (nitrogen, oxygen or sulfur). Originally limited to the study of compounds produced by living organisms, organic chemistry has been broadened to include human-made substances. Expanding students perceptions about this science and its contents it includes that help in explaining the importance of organic chemistry. This will be achieved through lectures, power point programs, labs, interactive tutorials and by types of practical diagnostic methods of organic chemistry lab. That is interesting to the students.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	94	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا + Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	56		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	2	10% (10)	5 and 10	LO #1, #2 and #11, #12
	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 - #6
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week 1	Carbanion I, (introduction, properties, acidity of α-hydrogen and reactions)
Week 2	Carbanion I, (Aldol condensation, dehydration of aldol products, use of aldol condensation in synthesis and crossed aldol condensation).
Week 3	Carbanion I, (Claisen condensation, crossed Claisen condensation, Reformatsky reaction).
Week 4	Carbanion I, (Reactions related to aldol condensation that include: The Knoevenagel condensation, Perkin reaction, Cope reaction and Wittig reaction).
Week 5	Carbanions II, (Malonic ester and Acetoacetic ester synthesis).

Week 6	Carbanion II, (Decarboxylation of β-ketoe acids and malonic acids).
Week 7	Carbanion II, (Synthesis of acids and esters via 2-oxazoline, alkylation of carbonyl compounds via enamines).
Week 8	Midterm Exam.
Week 9	α,β-Unsaturated carbonyl compounds, structure and properties, preparation, interaction of functional groups, electrophilic addition.
Week 10	α,β-Unsaturated carbonyl compounds (Nucleophilic addition, Michael addition, Diels-Alder reaction).
Week 11	α,β-Unsaturated carbonyl compounds (Stereochemistry of the Diels-Alder reaction, Quinones).
Week 12	Rearrangements, (Types of rearrangements, pinacol-pinacolone rearrangement, Hofmann rearrangement).
Week 13	Rearrangements, (Rearrangement of hydroperoxides, neighboring group effects).
Week 14	Polynuclear aromatic compounds, fused ring system, (Naphthalene structure, properties, reactions and synthetic methods).
Week 15	Polynuclear aromatic compounds, (Anthracene, properties, structure, synthetic methods and reactions), (Phenanthrene, properties, structure, synthetic methods and reactions).

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Cannizaro reaction (Synthesis of benzyl alcohol and benzoic acid).
Week 2	Lab 2: Cannizaro reaction (Separation of benzyl alcohol and benzoic acid).
Week 3	Lab 3: Cannizaro reaction (Purification of benzoic acid).
Week 4	Lab 4: Perkin reaction (Synthesis of sodium cinnamate).
Week 5	Lab 5: Perkin reaction (Separation of cinnamic acid).
Week 6	Lab 6: Perkin reaction (Purification of cinnamic acid)
Week 7	Lab 7: Perkin reaction (Determination of cinnamic acid purity)
Week 8	Lab 8: Diazonium salts reaction (Synthesis of azo dye and phenol).
Week 9	Lab 9: Diazonium salts reaction (Purification of phenol).
Week10	Lab 10: Synthesis of Sulphanilic acid.
Week 11	Lab 11: Synthesis of Sulphanilic acid (Purification of sulphanilic acid).
Week 12	Lab 12: Synthesis of Sulphanilic acid (Determination of product purity).

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	R. T. Morrison and R. N. Boyd, (2011) Organic Chemistry, 7th Edn.	Yes
	R. L. Madan, (2007), Organic Chemistry, McGraw-Hill Education.	No
	J. March and M. B. Smith, (2013), March's Advanced Organic Chemistry, Reactions, Mechanisms and Structure, 7th Edn.	Yes
	B. S. Furniss, A. J. Hannaford, P. W. G. Smith and A. R. Tatchell, (2008), A Text book of practical organic chemistry, 5th Edn. Pearson Education.	No
	L. F. Fieser and K. L. Williamson, (1992), Organic Experiments, 7th. Edn.	Yes
	H. Hart, (1987), Laboratory Manual organic chemistry a short course.	No
Recommended Texts	J. Clyden , N. Greeves , S. Warren and P. Wothers , (2001), Organic Chemistry , Oxford University Press .	Yes
	J. McMurry, (2004), Organic Chemistry, 6th Edn., Brooks / Cole.	Yes
	I.L.Finar, (1963), Organic Chemistry, Vol.1, 4th Edn. Longmans.	Yes
Websites	https://chem.libretexts.org	

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

Module Information

Module Title	Principles of Biochemistry		Module Delivery	
Module Type	**Core**		☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	CHE35128			
ECTS Credits	6			
SWL (hr/sem)	150			
Module Level	3	Semester of Delivery	5	
Administering Department	CHE	College	CoS	
Module Leader	Saba Zeki Al- Abachi	e-mail	saba-alabachi@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor	Module Leader's Qualification	Ph.D.	
Module Tutor	Dr. Omar Ismaeel Mohammed Mafaz Khalid	111	Oaldanoon2012@gmail.com mzfazkhalid@uomosul.edu.iq	
Peer Reviewer Name	Thikra Ali Allwsh	e-mail	thekraliallwsh@uomosul.edu.iq	
Scientific Committee Approval Date	13/ 6/ 2023	Version Number	1.0	

Relation with other Modules

Prerequisite module	Cytology CoS23017	Semester	3
Co-requisites module		Semester	

Module Aims, Learning Outcomes and Indicative Contents

Module Objectives	1- To provide a basic knowledge of the biochemistry, structure, and function of the major classes of molecules found in living organisms. 2- To equip students for more detailed studies of biochemistry in advanced courses, and to establish a foundation in the subject for those who may study no further biochemistry. 3- Study of biological molecules such as carbohydrate and know their chemical composition and benefits for the human body.

	4- Know what is meant by amino acids and peptides and what are their medicinal uses. 5- Study the protein structures and how to distinguish between them. 6- Know the proteins in blood plasma. 7- Study the lipids of all kinds and know their uses.
Module Learning Outcome	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. 1- To provide a basic knowledge of the biochemistry, structure, and 2- function of the major classes of molecules found in living organisms. 3- To equip students for more detailed studies of biochemistry in advanced courses, and to establish a foundation in the subject for those who may study no further biochemistry. 4- Study of biological molecules such as carbohydrate and know their chemical composition and benefits for the human body. 5- Know what is meant by amino acids and peptides and what are their medicinal uses. 6- Study the protein structures and how to distinguish between them. 7- Know the proteins in blood plasma. 8- Study the lipids of all kinds and know their uses.
Indicative Contents	Indicative content includes the following. Part A – Theoretical lectures Introduction of biochemistry, the importance of biochemistry, what are macromolecules? Monomers and polymers of macromolecules, Types of living cells. The water molecule, polarity of water, Properties of water, Solutions, Hydrogen bonds, Solubility of non-polar compounds, Dissociation of water, Buffer solution, Buffer systems of blood. Carbohydrates, Importance, Classification, Stereoisomerism of monosaccharaides, Isomers of monosaccharaides, Mutarotation, Glycosides formation. [8 hrs] Amino acids, Structure, Functions, Stereochemistry, Classification, Rare amino acids, non-protein amino acids, Essential and non-essential amino acids. Peptides, Glutathione, Bradykinin, Oxytocin, Vasopressin, Gramicidin S, Hydrolysis of peptides, Determination of amino acids sequence. Protein, Functions, Classification, Structure, Plasms proteins, Determination of protein, Denaturation of proteins, [12 hrs] Lipids, Functions, Classification, Fats and oils, Solubilization of lipids, Fatty acids. Bioenergetic, Role of high phosphate, [8 hrs] Part B – Practical labs Carbohydrates (Quantities test), Molish test, Benedict test, Barfoed test. Selivanoff test, Bial test. Iodine test. (4hrs) Hydrolysis of disaccharides. Acid hydrolysis of starch. Osazone test. Unknown. (6 hrs) Determination lactose in milk. (2hrs)

	Quantitative test of proteins, heat coagulation, elements test, test of sulfur. (4hrs) Biuret test, Ninhydrin test, Millon test. Sakaguchi test, Xanthoprotic test. Hopkin cole test, Cystine test. (4hrs) Precipitation of proteins, precipitation by heavy metals, by alcohol, by neutral salts. (4hrs) Precipitation by alkaloidal reagent, by acidic reagent. Unknown of amino acids and proteins. (4hrs)

Learning and Teaching Strategies	
Strategies	Expanding students' perceptions about this science and its contents it includes that helps in knowing the types of biological molecules that make up the body of the organism, how to obtain energy resulting from eating nutrients, metabolic pathways that take place within the body cells. This will be achieved through lectures, labs, educational films, power point programs and interactive tutorials and by types of practical diagnostic methods and involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	94	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	56	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 10	LO #1- #3 and #11, #12
	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 - #6
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction of biochemistry
Week 2	Water molecule
Week 3	Carbohydrates, Importance of carbohydrates, Classification of carbohydrates.
Week 4	Stereoisomerism of monosaccharides, Optical activity of monosaccharides.
Week 5	Functions of monosaccharides, Glycosides formation, Sugar acids, di and poly saccharides.
Week 6	Amino acids and Peptides
Week 7	Midterm exam
Week 8	Proteins, Structure and function
Week 9	Classification of proteins
Week 10	Determination of protein content, denaturation of protein
Week 11	Lipids
Week 12	Functions of lipids
Week 13	Classification of lipids
Week 14	Enzymatic hydrolysis of phospholipids
Week 15	Fats and oils

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Exp 1: Carbohydrates (Quantities test), Molish test, Benedict test, Barfoed test.
Week 2	Exe 2: Selivanoff test, Bial test.
Week 3	Exe 3: Iodine test.
Week 4	Exe 4: Hydrolysis of disaccharides.
Week 5	Exe 5: Acid hydrolysis of starch.
Week 6	Exe 6: Osazone test.
Week 7	Exe 7: Unknown.
Week 8	Exe 8: Determination lactose in milk.
Week 9	Exe 9: Quantitative test of proteins, heat coagulation, elements test, test of sulfur.
Week10	Exe 10: Biuret test, Ninhydrin test, Mllon test.
Week 11	Exe 11: Sakaguchi test, Xanthoprotic test.
Week 12	Exe 12: Hopkin cole test, Cystine test.
Week 13	Exe 13: Precipitation of proteins, precipitation by heavy metals, by alcohol, by neutral salts.
Week 14	Exe 14: Precipitation by alkaloidal reagent, by acidic reagent.
Week 15	Exe 15: Unknown of amino acids and proteins

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	**David L. Nelson and Micgael M. Cox (2017)**. Lehninger, Principle of biochemistry, seventh edition. WH Freeman New York. Harper·s illustrated biochemistry 31st edition by Victor W. Rodwell, David A. Bender, Kathleen M. Botham, Peter J. Kennelly and P. Anthony Weil.	Yes Yes
Recommended Texts	Mark Lorch (2021). Biochemistry: A Very Short Introduction. Oxford University Press.	No
Websites	https://www.edx.org/course/principles-of-biochemistry https://www.ncbi.nlm.nih.gov/books/NBK545161	

Grading Scheme				
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 Kinetics**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**CHE35126**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level		3	Semester of Delivery		5
Administering Department		CHE	College	CoS	
Module Leader	**Omar adil shareef**		e-mail	omaradel75a@uomosul.edu.iq	
Module Leader's Acad. Title		Assistant Prof.	Module Leader's Qualification		Ph.D.
Module Tutor	Omar Adil Shareef		e-mail	omaradel75a@uomosul.edu.iq	
Peer Reviewer Name		Rabah Ali Khalil	e-mail	rabahalikhalil@uomosul.edu.iq	
Scientific Committee Approval Date		13/06/2023	Version Number	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1. To Know the basic reaction mechanism, pathway of reactions, principles of kinetic 2. Describe the fundamentals of kinetic reaction for any chemical reactions 3. To know the reaction rate and typs 4. To recognize the Factors that effect on the Reaction rate 5. To explaine what the rate constant of reaction means 6. To familiarize students the order of reactions , half life 7. To explane the integration and differentiation metods to calculate the rate constants . 8. To explore the theories and laws associated with all the listed concepts.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Evaluate fundamentals of chemical kinettc, express the chemical kinetic and recognize the types of reactions. 2. Discuss the different between the stoichiometry and molecularity. 3. Explain the rate of reaction. And knowing the methods by which we can determine the reaction rate. 4. Explain the type of reaction rates and express the pathway of reactions 5. Explaine the rate constant of reaction means and knowing the integration and differentiation methods. 6. Evaluate the factores that effect on the rate and rate constans for any reactions 7. Explain the orders of reactions. 8. Explain the half life of reaction and know how to find it. 9. Clarify the theory of reaction rate . 10. Explain the type reaction rate 11. Explain the properties of collossion theory , activation theory And how can it be used to know and determine the rate of reaction. 12. Discuss some important concepts related to knowing the properties of some reactions, such as: Steady state , pre-equilibrium, Rate determining step 13. Explain the types of complex reaction and determine the rate constant for this type of reaction include , reversible reaction ,parallel reaction,consecutive reaction , ionic reaction, chain reaction 14. Explain the photochemistry. 15. Explaine the Arrhenius equation.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Theoretical lectures 1. Introduction, Why scientists make reaction rate, Why it is important to study the fundamental principles of chemical kinetic, reaction rate, types of reaction rate. **[3 hrs]** 2. the different between the stoichiometry and molecularity, Introduction to type of reaction rate, What is low, How is reaction rate measured, rate constant and the integration ,differentiation method ,isolation method and the principles of them**. [3 hrs]** 3. The factors that effect on the reaction rate ,order of reaction. **[5 hrs]** 4. Calculations order of reaction. **[4 hrs]** 5. Half life and condition that effecting ob the half life and the low to calculate it . **[4 hrs]** 6. Theories of reaction rate and explaine the many theorie to clarify how the reaction occure .**[3hrs]** 7. Taypes of Theories of reaction rate and clarife the different between them, Explain the properties of collossion theory , activation theory And how can it be used to know and determine the rate of reaction , **[5hrs]** 8. some important concepts related to knowing the properties of some reactions, such as: Steady state , pre-equilibrium, Rate determining step. **[3hrs]** 9. Arrhenius theory to explaine the effect of temperatute on the reaction rate**. [2hrs]** 10. Methods of integration to calculate the rate constsnt. **[2hrs]** 12. Methods of integration to calculate the rate constsnt.**[2hrs]** 13. the types of complex reaction and determine the rate constant for this

	type of reaction.**[2hrs]** 14. Finding appropriate methods for calculating the reaction rate constant using complex reactions **. [2hrs] ,** 15. the photochemistry and its usefulness in measuring the rate of some reactions . [2hrs]. Part B – Practical labs 1. Catalytic decomposition of hydrogen peroxide Part 1 & part 2 , discussion the results that obtained. 2. Hydrolysis of methyl ester. Part 1 & part 2 , discussion the results that obtained . 3. Saponifcation of ethyl acetate by titration method, , 4. Catalytic salt effect, Part 1 & part 2 , discussion the results that obtained. 5. The determination of the order,rate and activation energy of chemical reaction . 6. The effect of temperature on the rate of a reaction. 7. Visible absorption spectroscopy, the ferric thiocyanate.Ion equilibrium 8. Saponifcation of ethyl acetate by electrical method. [45 hrs].

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Teaching methods: Lectures, laboratory (experimental study),directed reading, Tutorial, online support. Learning methods: Independent study, student motivated peer group study, student driven tutor support.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	94	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	56	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	2	10% (10)	5 and 10	LO #3, #4 and #8, #9
	Assignments	2	10% (10)	3 and 14	LO #1, #2 and #12, #13
	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 - #6
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week 1	Types of Chemical Reactions
Week 2	Kinetic of simple reactions , Stoichiometry & Molecularity
Week 3	Rate of chemical reactions
Week 4	Factors that effect on the Reaction rate
Week 5	Rate constant reaction,
Week 6	Order of reactions, (differential method, integration method, initial rate method, isolation method.
Week 7	Half life of reaction
Week 8	Theory of reaction rate Collision theory, Activation theory,
Week 9	Arrhenius equation and effect the temperature on the reaction rate.
Week 10	Steady state , pre-equilibrium, Rate determining step
Week 11	Principle of Complex reactions
Week 12	Concept of reversible reaction and parallel reaction, consecutive reaction
Week 13	Concept of Ionic reaction , Chain reaction
Week 14	Explain the properties of collossion theory , activation theory, a
Week 15	Principles of photochemistry

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Chemical reactions kinetics principls , what does chemical kinetic rely on ? what does students need to study the peactical chemical kinetics.
Week 2	Lab 2: : Chemical kinetics Lab Experience: Brief explanation of the next chemical kinetics experiments.
Week 3	Lab 3: Catalytic decomposition of hydrogen peroxide
Week 4	Lab 4: discussion the results that obtained.
Week 5	Lab 5 Hydrolysis of methyl ester part 1
Week 6	Lab 6: Hydrolysis of methyl ester part 2
Week 7	Lab 7: Saponifcation of ethyl acetate by titration method.
Week 8	Lab 8:.Disscution What is meaning the ionc Reactions and explanation the factores that affecting on the reaction rate
Week 9	Lab9: Catalytic salt effect
Week10	Lab 10: The determination of the order,rate and activation energy of chemical reaction
Week 11	Lab 11: The effect of temperature on the rate of a reaction
Week 12	Lab 12: discussion the results that obtained. From the effect of temperature on the reaction rate and explanation of Arrunious equation
Week 13	Lab 13: explanation of Ion equlibrim and principils of spectroscopy.
Week 14	Lab 14: Visible absorption spectroscopy, the ferric thiocyanate.Ion equilibrium
Week 15	Lab 15: Saponifcation of ethyl acetate by electrical method

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Atkins (physical chemistry) Eighth Edition 2006 2-Kinetic of chemical reaction (Second completely revised and enlarged Edition 2011) 3-CHEMISTRY 10th edition (Raymond Chang) 2010 4-Physical Chemistry 3 th edition (Robert G.Mortimer) 2008	Yes Yes
Recommended Texts	Chemical kinetic, A.M.Dabbagh 2022 Chemistry , the molecular nature of matter , eight edition , Neil D.Jespersen, Alison Hyslop, Wiley 2022	Yes No
Websites	https://www.khanacademy.org/science/chemistry/chem- https://www.sciencedirect.com/topics/neuroscience/chemical-kinetics	

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

Module Information					
Module Title	**Scientific Research Methodology**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**CHE36036**				
ECTS Credits	**2**				
SWL (hr/sem)	**50**				
Module Level		UGIII	Semester of Delivery		6
Administering Department		CHE	College	CoS	
Module Leader	Amer Thanon Abdul Rahman		e-mail		
Module Leader's Acad. Title			Module Leader's Qualification		Ph.D.
Module Tutor			e-mail		
Peer Reviewer Name			e-mail		
Scientific Committee Approval Date		02/06/2023	Version Number		1.0

Relation with other Modules			
Prerequisite module		Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	This module is designed to introduce postgraduate students to research methods and statistical analysis. Theoretical, historical and statistical concepts are taught in lectures with hands on practical lab sessions using both quantitative and qualitative techniques that allow students to put theory into practice.
Module Learning Outcomes	By the end of this module the student should be able to: 1. Critically review current knowledge in a specified area, and establish its status and limitations 2. Identify, conceptualize and define a research question(s) and justify its relevance to practice and its significance as a potential contribution to existing knowledge. 3. Select and justify a research methodology to meet specified research aims and objectives. 4. Critically analyze and interpret primary/secondary research data (quantitative and/ or qualitative), testing for validity and reliability of the results.
Indicative Contents	1 Introduction to Research The nature and purpose of research; different types of research (quantitative qualitative, mixed methods, developmental, practice based) and their mapping within different philosophical paradigms (positivism, interpretivism, pragmatism); strengths and weaknesses. 2 Dealing with Practical Issues, Ethics The research process; identifying a research topic and setting research objectives; developing a research strategy; characteristics of a good research project; ethical issues in conducting research. 3 Searching and Reviewing the Literature The purposes and main steps of a literature review; searching, evaluating, organizing and synthesizing the relevant literature; and, writing a literature review and managing bibliographic records. In addition, developing research questions for qualitative and quantitative research; and identifying characteristics/attributes 4 Data Collection and Analysis Approaches to data collection and analysis (quantitative, qualitative, mixed-methods, iterative); questionnaire design; populations, samples, and sampling methods; data Mining. 5 Writing your Research Proposal

	Identifying a research problem or issue, the purpose of the research and the main research question(s); choosing the research strategy and methods; writing a research proposal. In addition: discussing findings, formulating conclusions, making recommendations, and reporting; planning, executing, writing up, and submitting a dissertation. 6 Descriptive Statistics for Quantitative and Qualitative D Summarizing and visualizing data sets; finding trends in data and formulating a research hypothesis. 7 Introduction to Probability and Statistical Inference Basic concepts of probability and probability distribution; discrete and continuous random variables; basic probability distributions; introduction to the hypothesis testing procedure. 8 The Hypothesis Testing Procedure Parametric and non-parametric tests; Chi-squared Test for Association; Independent Sample t-Test; One and Two Way Analysis of Variance ANOVA; power calculation and sample size estimation. 9 Correlation and Regression Relationship between two numeric variables, dependent and independent variable; Pearsons Correlation Coefficient; Simple Linear Regression. 10 Multiple Regression Multiple Regression Analysis and introduction to the General Linear Model.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The aim of this module is to provide the student with a critical understanding of theories, concepts and principles of research methodology and the range of methods used in conducting research in different disciplines; and, to give the student the skills and knowledge necessary to undertake an original in-depth investigation in those fields

Student Workload (SWL)			
Structured SWL (h/sem)	19	Structured SWL (h/w)	1
Unstructured SWL (h/sem)	31	Unstructured SWL (h/w)	2
Total SWL (h/sem)	75		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 12	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 الأسبوعي النظري	
	Material Covered
Week 1	principles of research methodology
Week 2	define a research question(s)
Week 3	Writing your Research Proposal
Week 4	Testing Procedure
Week 5	practice based
Week 6	calculation and sample size estimation
Week 7	discussing findings
Week 8	reporting
Week 9	formulating conclusions
Week 10	quantitative techniques
Week 11	qualitative techniques
Week 12	statistical concepts
Week 13	interpret primary/secondary research data
Week 14	Correlation Coefficient
Week 15	Multiple Regression Analysis

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

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MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Coordination Chemistry 2**			**Module Delivery**	
Module Type	**Core**			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**CHE36131**				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level			**Semester of Delivery**	5	
Administering Department	CHE		**College**	COS	
Module Leader	Layla Jumeah Najem		**e-mail**	Layla7najem@uomosul.edu.iq	
Module Leader's Acad. Title	Assist. Prof. Lecturer		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Esraa Ali Hasan Saba Mumtaz Salih Alasalli Amenah Adnan Mohammed Lana Abdalhameed Luma Ahmed Mubarak Esraa Adnan Saeed Khalid Nadheer Hameed		**e-mail**	esraaali@uomosul.edu.iq Sabaalasalli@uomosul.edu.iq amenahadnan@uomosul.edu.iq lanaabdalhameed@uomosul.edu.iq Lumaahmed@uomosul.edu.iq esraaadnan@uomosul.edu.iq kalsarraf05@uomosul.edu.iq	
Peer Reviewer Name	Khansaa shakir AL- nama		**e-mail**	Khnsaah.al-nama@uomosul.edu.iq	
Scientific Committee Approval Date	13/11/2023		**Version Number**	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	CHE24120,CHE35120	**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	• Teach students ways to describe complexes. • To study spectral properties of complex compounds and to learn about the magnetic behavior of different complexes . • Study methods of preparing complexes • Explain the types of chemical reactions of complexes • Identify and understand the types of ligands and prepare the consistency of chemical compounds.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. To understand and learn some of the methods used in describing a chemical complex 2. Being able to know the magnetic properties of the complex . 3. The student should be able to extract the number of spectral bands from chemical complexes 4. To be able to describe the shapes and structures of coordination complexes with coordination numbers 5. The student should be aware of the interaction mechanisms of these complexes. 6. Understanding the complexities in terms of the speed of replacement (inert or labile). . 7. Learn about orbital shapes, atomic weights, and types of bonds 8. That the student be able to correctly draw the final shape of the complex
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Theoretical lectures **1.** The Method used in characterization of complexes, U.V (Electronic spectra) ,Magnetic measurement, **2.** Type of electronic transition, d-d spectra transition., ligand transition. Charge transfer transition, important of complexes. [4hr] **3.** Preparation of coordination compounds. ,type of reactions complexes . [4hr] **4.** Trans effect , and types of catalysis . [4hr] **5.** Kinetic and Mechanism of Inorganic Reactions [4hr] **6.** Lability and Inertness in Octahedral complex [4hr] **7.** Factors affecting the stabilities of complexes [2 hrs]

	Part B – Practical labs Shape, Overlap, measurements of carapace and valves, orientation, external features, external structures, internal features, internal structures, inner lamella, outer lamella, Hinge line, ornamentation, description of some index species. [18 hrs] coccolith shape, coccoliths orientation, Coccolith size, ultrastructure, types of ultrastructural component, element arrangement , structures spanning central-area, orientation in plan view, structures closing central-area, crystallography, systematic paleontology, description of some index species. [18 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	In order to simplify the explanation of the coordination chemistry 1. Lectures: used to introduce and explain key concepts related to coordination chemistry and trying to link it with examples from real life to make the student interact greatly with the lecture as well as trying to explain in simplified way. 2. Interactive discussions: used to engage students in critical thinking and problem-solving through group discussions, case studies, and simulations 3. Multimedia resources: used to enhance student engagement and understanding of complex concepts through , using Periodic Table 4.: quizzes, exams used to measure student learning and provide feedback on their progress 5- linking the lecture with practical experiments that enable the students to link information and understand it .with an explanation of the importance of coordination chemistry from the scientific and practical point of view.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	94	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	56	**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**	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 الأسبوعي النظري	
	Material Covered
Week 1	The Method used in characterization of complexes
Week 2	Electronic spectra of complexes
Week 3	Preparation of coordination compounds and types of reactions
Week 4	Trans effect Chemistry of platin (II) as a square planar
Week 5	Catalysis and types of catalysis
Week 6	Kinetic of Inorganic Reactions
Week 7	Factors influencing how fast ligand are exchange Lability and Inertnes in Octahedral complex
Week 8	Midterm exam
Week 9	Octahedral Substitution Mechanisms SN^1 SN^2
Week 10	Thermodynamic stability of coordination compounds
Week 11	Factors affecting the stabilities of complexes
Week 12	Metal class and ligand preference (Hard and soft)
Week 13	Chelate Effect and Chelate Ring size For ligands
Week 14	The Number of chelate rings and affecting the stabilities of complexes
Week 15	Coordination Number and Shapes

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Ggeometrical Isomerism (Part 1)
Week 2	Lab 2: Ggeometrical Isomerism (Part 2)
Week 3	Lab 3: Preparation of Cobalt (lll) Complex with bidentate ligand (Part 1)
Week 4	Lab 4: Preparation of Cobalt (lll) Complex with bidentate ligand (Part 2)
Week 5	Lab 5: Aluminium complexes (Part 1)
Week 6	Lab 6: Aluminium complexes (Part 2)
Week 7	Lab 7: Aluminium complexes & Estimation of the of oxalate Ion theoretically and practically by an analytical method. (Part 1)
Week 8	Lab 8: Aluminium complexes & Estimation of the of oxalate Ion theoretically and practically by an analytical method. (Part 2)
Week 9	Lab9: Preparation of Cobalt (III) Complex with Hexadentate Ligand (EDTA) (Part 1)
Week10	Lab 10: Preparation of Cobalt (III) Complex with Hexadentate Ligand (EDTA) (Part 2)
Week 11	Lab 11: Acetylaceton Complexes (Part 1)
Week 12	Lab 12: Acetylaceton Complexes (Part 2)

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1. Coordination chemistry by Basalo basic pr .inorg.chem. 2. Coordnation chemistry by D.Banerjea Third Edition 2009 3. Coordnation chemistry by Ajai Kumar Seconde Edition 2014	Yes
Recommended Texts	Inorganic Chemistry 5th Edition Miessler	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
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MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Biomolecules			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	CHE 36134				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	3		Semester of Delivery	6	
Administering Department	CHE		College	CoS	
Module Leader	Safaa Abdulazeez Al-Ameen		e-mail	safaalameen@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor	Dr.Omar Esmael Mafaz Khalid		e-mail	Oaldanoon2012@gmail.com Mzfazkhalid@uomosul.edu.iq	
Peer Reviewer Name	Pro.Dr.Thikra Ali Allwsh		e-mail	thekraliallwsh@uomosul.edu.iq	
Scientific Committee Approval Date	13\6\2023		Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Cytology (CoS23017) Principles of Biochemistry (CHE35128)	Semester	3,5
Co-requisites module	,	Semester	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives	- To teach students about important biomolecules essential to life processes. - To discuss aspects of the principles of organic chemistry in the structure and function of important biomolecules. - Define the basic structure of biomolecules. - Define the meaning and significance of hormones - Understand the function of enzymes. - Define the basic structure of ribonucleic acid (RNA) and deoxyribonucleic acid (DNA). - To teach students the biological role of vitamins and classify it according to solubility. - Furthermore , diseases results by more consumption of vitamins.
Module Learning Outcomes	The outcomes of biomolecules learning include: - • The relationship between the properties of macromolecules and cellular activities. • Debate the definition and function of enzyme. • Explain the types of enzymes, nomenclature. • Illustrate the inhibition of enzyme studies. • Explain the structure of nucleic acids • Explain the structure and classification of hormones, receptors and glands. • Happiness hormones, types, structure and functions • Explain the structure and classification of vitamins, structure and functions.
Indicative Contents	Part A – Theoretical lectures Introduction, Bioenergetics, types of reactions, thermodynamics functions, exergonic and endergonic reactions, characteristic of reactions, study importance of these reactions, metabolism, types, anabolism and catabolism, high energy compounds, features and structures used for the cell, functions of high energy compounds for the cell [3 hrs.] Nucleic Acids, introduction, nucleotides, chemical structure, classification of N. A., functions [6 hrs.]. Enzymes, introduction, classification, chemical structure, functions, nomenclature, inhibition and types of it [9 hrs.]. Hormones, chemical structure, classifications, receptors, types of it, producing glands, locations of receptor and glands,,, happiness hormones [12 hrs.]. Vitamins, classification, chemical structures, functions, sources, deficiency, diseases [9 hrs.] Vitamin B17, sources, chemical structure, overload, toxicity, diseases [3 hrs.]. Mid Exam [2 hrs.].

	Part B – Practical labs - Determination of protein concentration (follin method) - Test of lipids - Solubility test - Emulsification test - Acrolein test, unsaturated test - Acid value + rancidity test - Iodine number - Enzymes (effect of substrate concentration on reaction velocity on enzymatic reaction) 2 weeks - Effect of enzyme concentration - Effect of temperature - Effect of Ph - Effect of inhibitors - Determination of vitamin C by colorimetric method - Nucleic acids (determination of nucleotide concentration) - Extraction the RNA from the yeast.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Biomolecules, important part of biochemistry , it has become the foundation for understanding all biology- and chemistry-related disciplines such as bioinorganic chemistry, clinical biochemistry, medicine and pharmacy. Also, expanding students' perceptions about this science and its contents it includes that help in explaining the importance and functions of biomolecules in the cell and human body. This will be achieved through lectures, educational films, power point programs, labs, and interactive tutorials and by types of practical diagnostic methods of abiochemistry lab. 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	94	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	56	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	2	10% (10)	5 and 10	LO #1-#4 and #11, #12
	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 - #6
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week 1	Bioenergetics
Week 2	Nucleic Acids, definition, nucleotides and nucleosides, primary structure of N A.
Week 3	Secondary str. Of DNA , Double helix, storage of DNA....RNA, Types, genetic code, reading the genetic code.
Week 4	Enzymes, introduction, nomenclature, structure of enzymes, co-factors, substrate.
Week 5	Classification of enzymes, mechanism of enzyme action, lock and key model, induced fit model.
Week 6	Enzyme kinetics, factors affecting rate of enzyme, inhibition of enzyme action, types of inhibition.
Week 7	Mid exam
Week 8	Hormones, definition, hormone characteristics, types of receptors, receptors location.
Week 9	Classification of hormones, regulation of hormone secretion.
Week 10	Types of glands and their hormones.
Week 11	Happiness hormones.
Week 12	Vitamins , introduction, definition classification, fat soluble vitamins(A, E, D, K).
Week 13	Water soluble vitamins, B complex (B1, B2, B3, B5)
Week 14	Vitamins (B6, B7, B9, B12)
Week 15	Vitamin C, chemical structure, characteristics & Vitamin B 17, names, chemical structure, toxicity.

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Determination of Protein concentration
Week 2	Lab 2: Test of lipids, Solubility test, Emulsification test
Week 3	Lab 3: Acrolein test, unsaturated test
Week 4	Lab 4: Acid value, rancidity test
Week 5	Lab 5: Iodine number
Week 6	Lab 6: Enzymes (effect of substrate concentration on reaction velocity on enzymatic reactions)
Week 7	Lab 7: Effect of enzyme concentration
Week 8	Lab 8: Effect of temperature
Week 9	Lab9: Effect of pH
Week10	Lab 10: Effect of inhibitors
Week 11	Lab 11: Determination of vitamin C by colorimetric method
Week 12	Lab 12: Nucleic acids (determination of nucleotide concentration

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	**David L. Nelson and Micgael M. Cox (2017)**. Lehninger, Principle of biochemistry, seventh edition. WH Freeman New York.	Yes
	Stryer, L.(2002). Biochemistry. (5 th ed.)New York. : W.H. Freeman and Company.	Yes
	Stryer, L. Berg, J. M. and Tymoczko, J. L.(2002). Biochemistry. San Francisko : W.H. Freeman.	Yes
Recommended Texts	- Ashis Banerjee (Clinical physiology)/ Cambridge 2005 - Martin A. Crook (Clinical biochemistry and metabolic pathways)- CRC press 2012	Yes No
Websites	https://books.google.com/books/about/Hormones.html?id=_renonjXq68C&source=kp_cover	

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 4			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	CHE36133				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	UGIII		Semester of Delivery		
Administering Department	CHE		College	CoS	
Module Leader	Said Abdelqader Said		e-mail	saidabdelqader75@uomosul.edu.iq	
	Salih Owaid Abbood			Salsbio46@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor Lecturer		Module Leader's Qualification		Ph.D.
Module Tutor	Shaimaa Younus Ibraheam		e-mail	Shaimaa.al1980shaimaa@uosul.edu.iq	
	Dr. Hiba Amen Ibraheem Al*alaaf			Hiba.ameen80@uomosul.edu.iq	
	Dr. Harith Mohammed Salman Abd			Harith-mohammed@uomosul.edu.iq	
	Dr. Amira Mohammed Faraj Salih			Amerra-mohammed@uomosul.edu.iq	
	Shahla ahmed Younus abd			Shahlaahmad@uomosul.edu.iq	
Peer Reviewer Name	Prof. Dr. Adnan Othman Omer		e-mail	Adnana.hasaka94@uomosul.edu.iq	
Scientific Committee Approval Date	13\62023		Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Organic Chemistry 1	Semester	3
	Organic Chemistry 2		4
	Organic Chemistry 3		5

Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives	1. Understanding molecular structure of five and six membered aromatic heterocyclic compounds. 2. Studying the nomenclature (IUPAC naming) of five and six membered aromatic heterocyclic compounds. 3. Studying their reactivity against different chemical reagents. 4. Showing the different methods for the synthesis of five and six membered aromatic heterocyclic compounds. 5. To develop fundamental concepts related to alicyclic compounds. In particular, to understand nomenclature, stereochemistry, methods of preparation and reactions of some important compounds of this type. 6. Studying the nomenclature and the stereochemistry of some important bicyclic systems. 7. To make the students aware of various named reactions in organic chemistry.
Module Learning Outcomes	1. Recognize the nomenclature, structure, physical properties and chemical reactions of Heterocyclic and alicyclic Compounds. 2. Development of reverse thinking skill (back thinking) and the student's acquiring the training skill to choose the suitable method for heterocyclic or alicyclic compounds preparation. 3. Making the student acquire the skill of naming heterocyclic and alicyclic compounds. 4. Design of different ways to nomenclature the heterocyclic compounds. 5. Ability to work in a team to perform specific experimental tasks. 6. Ability to communicate results of work to classmate and participation in class or laboratory discussions. 7. The use of modern library search tools to locate and retrieve scientific information about a topic, organic chemical, chemical technique, or an issue relating to chemistry. 8. When conducting a laboratory experiment, the student will follow written procedures commonly used in the organic lab accurately and safely. When completing a lab report the student will apply the scientific method correctly by being able to state a hypothesis, take careful measurements and draw appropriate conclusions based on gathered data and scientific principles.
Indicative Contents	Indicative content includes the following. Part A – Theoretical lectures Introduction, structure of five and six membered aromatic heterocyclics , systematic nomenclature, five membered aromatic heterocycles and their reactivity, pyrrole, physical properties, reactions of pyrrole (ring opening, addition reactions and substitution reactions both on nitrogen and carbon atoms), pyrrole synthetic methods, furan and its physical properties, reactions of furan, ring opening, addition reactions, substitution reactions, synthetic methods, thiophene and its physical properties, reactions of thiophene, addition reactions, substitution reactions and

	synthetic methods. [14 hrs] Six membered aromatic heterocycles, pyridine compounds and their source, reactions of pyridine, electrophilic addition at nitrogen atom, electrophilic substitution, nucleophilic substitution, synthetic methods for pyridine, fused rings (quinoline and isoquinoline), quinoline properties, electrophilic substitution reactions of quinoline ,nucleophilic substitution reactions of quinoline, synthetic methods, properties of isoquinoline, electrophilic substitution reactions of isoquinoline ,nucleophilic substitution reactions of isoquinoline and synthetic methods. [8 hrs] Alicyclic compounds, nomenclature, stereochemistry, preparation, reactions, bicyclic systems, nomenclature and stereochemistry. [6 hrs] Named reactions. [2 hrs] Part B – Practical labs Synthesis of luminol, (synthesis of 3-nitrophthalic acid,purification of 3-nitrophthalic acid, convertion of 3-nitrophthalic acid to luminol, Purification and detection of luminol). [12 hrs] Pinacol-pinacolone rearrangement, (Preparation of pinacol hexahydrate, conversion of pinacol hexahydrate to pinacolone, detection of pinacolone). [9 hrs] Grignard reagent reaction, (synthesis of triphenyl methanol, separation of bi phenyl by steam ditillation, Purification of the product). [9 hrs] Diels-Alder reaction, (Synthesis of 9,10-dihydroanthracene endo- α,β-succinic anhydride, Determination of product purity). [6 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Organic chemistry is the study of the structure, properties, composition, reactions, and preparation of carbon-containing compounds. Most organic compounds contain carbon and hydrogen, but they may also include any number of other elements like (nitrogen, oxygen or sulfur). Originally limited to the study of compounds produced by living organisms, organic chemistry has been broadened to include human-made substances. Expanding students perceptions about this science and its contents it includes that help in explaining the importance of heterocyclic and alicyclic compounds. This will be achieved through lectures, power point programs, labs, interactive tutorials and by types of practical diagnostic methods of organic chemistry lab. That is interesting to the students.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	94	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا + Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	54		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	2	10% (10)	5 and 10	LO #1- #4 and #11, #12
	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 الأسبوعي النظري	
	Material Covered
Week 1	An introduction to heterocyclic chemistry with systematic nomenclature for five and six membered rings.
Week 2	Structure of five and six membered heterocyclic compounds.
Week 3	Five membered heterocyclic compounds, (Properties and reactions of pyrrole).
Week 4	Five membered heterocyclic compounds, (Synthesis of pyrrole).
Week 5	Five membered heterocyclic compounds, (Properties and reactions of furan).
Week 6	Five membered heterocyclic compounds, (Synthesis of furan).

Week 7	Five membered heterocyclic compounds, (Properties and reactions of thiophene).
Week 8	Midterm Exam.
Week 9	Six membered heterocyclic compounds, (Properties and reactions of pyridine).
Week 10	Six membered heterocyclic compounds, (Synthesis of pyridine).
Week 11	Six membered heterocyclic compounds, (Properties, synthesis and reactions of quinoline).
Week 12	Six membered heterocyclic compounds, (Properties, synthesis and reactions of isoquinoline).
Week 13	Alicyclic compounds, (Introduction, nomenclature and synthesis).
Week 14	Alicyclic compounds, (Reactions and stereochemistry).
Week 15	Named reactions.

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Synthesis of luminol, (Synthesis of 3-nitro phthalic acid).
Week 2	Lab 2: Synthesis of luminol, (purification of 3-nitro phthalic acid).
Week 3	Lab 3: Synthesis of luminol, (Conversion of 3-nitro phthalic acid to luminol).
Week 4	Lab 4: Synthesis of luminol, (Purification and detection of luminol).
Week 5	Lab 5: Pinacol-pinacolone rearrangement, (Preparation of pinacol hexahydrate).
Week 6	Lab 6: Pinacol-pinacolone rearrangement, (Conversion of pinacol hexahydrate to pinacolone).
Week 7	Lab 7: Pinacol-pinacolone rearrangement, (Detection of pinacolone).
Week 8	Lab 8: Grignard reagent reaction, (Synthesis of triphenyl methanol).
Week 9	Lab 9: Grignard reagent reaction, (Separation of bi phenyl by steam ditillation).
Week10	Lab 10: Grignard reagent reaction, (Purification of the product).
Week 11	Lab 11: Diels alder reaction, (Synthesis of 9,10-dihydroanthracene endo- α,β-succinic anhydride).
Week 12	Lab 12: Diels alder reaction, (Determination of product purity).

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	R. T. Morrison and R. N. Boyd, (2011) Organic Chemistry, 7th Edn.	Yes
	R. L. Madan, (2007), Organic Chemistry, McGraw-Hill Education.	No
	J. March and M. B. Smith, (2013), March's Advanced Organic Chemistry, Reactions, Mechanisms and Structure, 7th Edn.	Yes

	B. S. Furniss, A. J. Hannaford, P. W. G. Smith and A. R. Tatchell, (2008), A Text book of practical organic chemistry, 5th Edn. Pearson Education.	No
	L. F. Fieser and K. L. Williamson, (1992), Organic Experiments, 7th. Edn.	Yes
	H. Hart, (1987), Laboratory Manual organic chemistry a short course.	No
Recommended Texts	J. Clyden , N. Greeves , S. Warren and P. Wothers , (2001), Organic Chemistry , Oxford University Press .	Yes
	J. McMurry, (2004), Organic Chemistry, 6th Edn., Brooks / Cole.	Yes
	I.L.Finar, (1963), Organic Chemistry, Vol.1, 4th Edn. Longmans.	Yes
Websites	https://chem.libretexts.org	

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

Module Information معلومات المادة الدراسية					
Module Title	**Quantum chemistry**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☐Lab ☒ Tutorial ☐ Practical ☐ Seminar	
Module Code	**CHE47041**				
ECTS Credits	4				
SWL (hr/sem)	**100**				
Module Level	UGIV		Semester of Delivery	7	
Administering Department	CHE		College	Type College Code	
Module Leader	Ibrahim Mohammed Haies Ala Aldin Darghouth		e-mail	aladarghouth@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant lecturer Lecturer		Module Leader's Qualification	Ph.D.	
Module Tutor			e-mail		
Peer Reviewer Name	Rabah Ali Khalil		e-mail	E-mail	
Scientific Committee Approval Date	11/06/2023		Version Number	1.0	

Relation with other Modules			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. Quantum chemistry uses high-level mathematics as a tool to understand atomic and molecular structure and properties, as well as chemical reactivity. The purpose of this course is to provide an introduction to the mathematical foundations of quantum chemistry, as well as a practical, hands-on experience with a quantum mechanics examples 2. We will derive the Schrödinger Eq. for one quantum mechanical particle (electron) in one dimension. Over the next few weeks, we will learn how to solve the Schrödinger Eq. rigorously for model systems and for atoms. There will not be sufficient time to give a detailed description of the quantum mechanical treatment of molecules.
Module Learning Outcomes	1. Learn what is Classical Mechanics. 2. Learn what is the main concept of quantum theory 3. Learn what is quantum chemistry. 4. Understanding the principles of quantum Mechanics. and how to use it. 5. Understanding how the quantum mechanics explain some chemical behaviors. 6. Do some computational chemistry and get important information
Indicative Contents	Indicative content includes the following. 1. General introduction (the definition of quantum chemistry, classical mechanics). [6 hrs] 2. Quantum theory (photoelectric effect, Bohr atom, Sommerfeld quantization, the dual nature of light). [6 hrs] 3. Quantum mechanics (Postulates of quantum mechanics, Schrödinger wave equation, hermitian operator, normalization and orthogonality, orthonormality). [6 hrs] 4. Applications of quantum mechanics for some simple systems (particle in a box, two-particle rigid-rotor, simple harmonic oscillator, the hydrogen atom, the problem of Schrödinger equation with nonhydrogen like atoms). [6 hrs] 5. Approximate Methods (the variation principle, perturbation theory). [6 hrs]

	6. The atoms (uncertainty principle, the helium atom, electron spin, Pauli exclusion principle, First excited state of helium atom, Slater determinant, Hartree and Hartree-Fock SCF methods for atoms). [6 hrs] 7. The molecules (Born-Oppenheimer approximation, valance bond theory (VBT), molecular orbital theory (MOT), Hückel molecular orbital theory (HMOT)). [6 hrs] A brief sight to computational chemistry (molecular mechanical calculations, quantum mechanical calculations, semi-empirical methods, ab initio methods, density functional theory (DFT)). [3 hrs]

Learning and Teaching Strategies	
Strategies	1. One of the essential strategies that will be used is providing examples from everyday observations and simple real-world examples that are easy to understand to make complex concepts of quantum chemistry more understandable.. 2. Trying to use what is visual, such as the image and the graphic curves, to enable the student to visualize the atomic and molecular systems, which are infinitesimal in nature. 3. Simplify complex mathematical and physical concepts such as velocity, momentum, derivation and integration with practical examples.

Student Workload (SWL)			
Structured SWL (h/sem)	64	Structured SWL (h/w)	4
Unstructured SWL (h/sem)	36	Unstructured SWL (h/w)	2.5
Total SWL (h/sem)	100		

Module Evaluation					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	20% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	4 and 12	LO #3, #4 and #6, #7
	Projects / Lab.				
	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)	
	Material Covered
Week 1	General Introduction, Classical Mechanics and Newtonian Mechanics,
Week 2	Hamiltonian Mechanics, Lagrangian Mechanics and Example: Simple Harmonic Oscillator
Week 3	Quantum Theory, Introduction, Black body or Cavity Radiation, Photoelectric effect.
Week 4	Mass–energy equivalence, Bohr atom, Sommerfeld Quantization, The dual nature of light
Week 5	Quantum mechanics (Postulates of quantum mechanics)
Week 6	Schrödinger wave equation, Hermitian operator, normalization and orthogonality, orthonormality)
Week 7	Applications of quantum mechanics for some simple systems (particle in a box, two-particle rigid-rotor,
Week 8	simple harmonic oscillator
Week 9	The Hydrogen Atom. The problem of Schrödinger equation with not hydrogen-like atoms
Week 10	Approximate Methods: The Variation Principle and Perturbation Theory
Week 11	The Atom: Uncertainty Principle, Pauli Exclusion Principle, Slater determinant
Week 12	The molecules (Born-Oppenheimer approximation
Week 13	Valance bond theory (VBT),
Week 14	Molecular orbital theory (MOT)
Week 15	Hückel molecular orbital theory (HMOT).
Week 16	1st course Final Term Examination

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	4. Rabah Ali Khalil. (2005). A Simple Approach to Quantum Chemistry	Yes
Recommended Texts	5. Peter Atkins, Julio de Paula, James Keeler Physical Chemistry, 11th Edition; Oxford University Press, Oxford, 2018. 6. Atkins, P and Friedman R. Molecular Quantum Mechanics, 4th Edition; Oxford University Press, Oxford, 2005. 7. Engel T. Quantum Chemistry and Spectroscopy, 3rd Edition; Pearson; 2013.	Yes No
Websites		

Grading Scheme				
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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	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	**Instrumental Analysis**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**CHE47137**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level		UGIV	Semester of Delivery		7
Administering Department		CHE	College	CoS	
Module Leader	Saad Hsani Sultan		e-mail	saad.hasani@uomosul.edu.iq	
Module Leader's Acad. Title		Assistant Professor	Module Leader's Qualification		Ph.D.
Module Tutor	Saad Hsani Sultan		e-mail	saad.hasani@uomosul.edu.iq	
Peer Reviewer Name		Name	e-mail	E-mail	
Scientific Committee Approval Date		13/06/2023	Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Instrumental Analysis	Semester	7
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 deals with explanation principles of instrumental techniques in analytical chemistry**
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Advantages of instrumental analysis and its application for the analysis using different techniques
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Theoretical lectures Introduction to instrumental analysis Optical methods of analysis Electrchemical method of analysis [30hrs] Part B – Practical labs . To get knowledge in experimental analysis using modern techniques

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	. All means available

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	94	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	56	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	2	10% (10)	5 and 10	LO #1- #4 and #11, #12
	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 - #6
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week 1	General introduction, Advantages of instrumental analysis ,Optical methods of analysis
Week 2	Beer-Lambert law, Instrumentation, Exercises, Limitation of beer law,
Week 3	Chemical deviations ,Instrumental deviations, Application of absorption spectrophotometry
Week 4	Qualitative analysis, Some terms used in spectrophotometry
Week 5	Molecular luminescence spectroscopy, Fluorescence and phosphorescence, Quantum yield Factors affected on quantum yield
Week 6	Turbidimetry and nephelometry, Applications of turbidimetry and nephelometry
Week 7	Atomic spectroscopy
Week 8	Flame atomic absorption spectrophotometers
Week 9	Atomic emission spectroscopy
Week 10	Electrochemical methods of analysis, Potentiometry
Week 11	Types of indicator electrodes
Week 12	Potentiometric titrations
Week 13	Voltametry
Week 14	Instrument (Polarograph)
Week 15	Conductometry

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Introduction to instrumental methods of analysis
Week 2	Lab 2: Spectrophotometric determination of iron
Week 3	Lab 3: Spectrophotometric determination of nitrite
Week 4	Lab 4: Photometric determination of zinc.
Week 5	Lab 5: Photometric determination of benzoic acid.
Week 6	Lab 6: Potentiometric determination of acid mix.($HCl+H_3PO_4$).
Week 7	Lab 7: Nephelometric determination of sulphate.
Week 8	Lab 8:. Determination of potassium by flam photometry.
Week 9	Lab9: Determination of sodium by flam photometry.
Week10	Lab 10: Determination of calcium by flam photometry
Week 11	Lab 11: Determination of aspirin by spectrophotometric method.
Week 12	Lab 12: Determination of the acetic acid in vinegar by potentiometric titration.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	**Principles of Instrumental Analysis", by: Douglas A. Skoog, 6th edn.,2007.**	Yes
Recommended Texts	The introductory course in **analytical chemistry**,	Yes
Websites	https://gtu.ge/Agro-Lib/Harvey%20D.%20Modern%20analytical%20chemistry%20(MGH,%202000)(816s).pdf	

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	**Metabolism of Carbohydrates**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	CHE47139				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	4		Semester of Delivery	7	
Administering Department	CHE		College	CoS	
Module Leader	Dr. Wasan Khariallah Ali Dr. Sukayna Hussain Rashed		e-mail	wasankhariallahali@uomosul.edu.iq Sukaynarashed@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor Assistant Professor		Module Leader's Qualification	Ph.D. Ph.D.	
Module Tutor	Nuha Abdelkader shareef Sana Abdlillah Ahmed		e-mail	nuha-abdelkader@uomosul.edu.iq sana.a.a@uomosul.edu.iq	
Peer Reviewer Name	Prof.Dr.Thikra Ali Allwsh		e-mail	thekraaliallwsh@uomosul.edu.iq	
Scientific Committee Approval Date	13/6/2023		Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Cytology CoS23017 Principles of biochemistry CHE35128 Biomolecules CHE36134	Semester	3,5,6
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives	The study of biochemistry aims to study the metabolism of molecules such as carbohydrates, proteins, fats, and nucleotides with the help of enzymes and hormones present in the human body to produce the energy that the body needs to carry out daily vital functions, as well as calculating the energy resulting from metabolism in the form of ATP
Module Learning Outcomes	1. Learn Some life molecules and studied the metabolism in terms of how to build and catabolize carbohydrates, for example, as well as calculate the amount of energy consumed and produced in the metabolism process. 2. Learn how the glycogen biosynthesizes in the liver and when liver glycogen is catabolized in case of carbohydrate deficiency in food to compensate for the deficiency and provide the energy needed for the body. 3. Learn about energy compounds and how to store energy in the form of compounds, such as ATP. 4. calculate the amount of energy resulting from the catabolism of one glucose molecule. 5. Learn to students the most important enzymes that carry out metabolic processes and how the body regulates them. 6. Learn the most important hormones that carry out metabolic processes and how the body regulates them according to its needs.
Indicative Contents	Indicative content includes the following. Part A – Theoretical lectures Introduction to metabolism, Stages of essential metabolism process, Regulation of metabolism pathways, and the enzymes in metabolism pathways. [*3* hrs.] Glycolysis pathway. [*6* hrs.] Krebs cycle. [*6* hrs.]

	Phosphogluconate pathway. [*3* hrs.] Electron transport and oxidative phosphorylation. [*3* hrs.] Glycogenolysis (Glycogen catabolism). [*3*hrs] Cascade reactions. [*3* hrs.] Glycogenesis pathway (Glycogen anabolism). [*3* hrs.] Gluconeogenesis pathway (Glucose anabolism). [*3* hrs.] Substrate cycle, Photosynthesis. [3 hrs.] Revision problem classes [3 hrs.] Part B – Practical labs Introduction, GUE, In organic constituent of urine, nitrogenous substances in the urine. [18 hrs.] Abnormal constituent of urine, Microscopical examination, Calculus, Gallstones [18 hrs.]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1-Explanation of the lectures in the classroom and Lectures are given in PDF format. 2-The clarify the scientific material is done by displaying it as a Microsoft PowerPoint presentation. 3- View explanatory films about the article. 4- Writing mathematical questions and answering them on the board inside the classroom. 5. Assign students to do homework. 6- Assign students to make scientific reports related to the study tool individually and collectively as well

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	94	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	56	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	2	10% (10)	5 and 10	LO #1- #4 and #11, #12
	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 الأسبوعي النظري

	Material Covered
Week 1	Introduction for metabolism, Stages of the essential metabolism process.
Week 2	Regulation of metabolism pathways, The enzymes in metabolism pathways
Week 3	Carbohydrate metabolism-Glycolysis pathway
Week 4	Complement the glycolysis pathway.
Week 5	Krebs cycle.
Week 6	Complement the Krebs cycle.
Week 7	Electron transport and oxidative phosphorylation.
Week 8	Glycogenolysis (Glycogen catabolism).
Week 9	Cascade reactions.
Week 10	Glycogenesis pathway (Glycogen anabolism).
Week 11	Gluconeogenesis pathway (Glucose anabolism).
Week 12	Substrate cycle.
Week 13	Photosynthesis.
Week 14	Mide exam.

Week 15	A comprehensive review of the study material with mathematical questions.

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Introduction.
Week 2	Lab 2: GUE
Week 3	Lab 3: In organic constituent of urine
Week 4	Lab 4: Complete the Inorganic constituent of urine.
Week 5	Lab 5: Nitrogenous substances in the urine.
Week 6	Lab 6: Complete nitrogenous substances in urine
Week 7	Lab 7: Abnormal constituent of urine part one.
Week 8	Lab 8: Abnormal constituent of urine part two.
Week 9	Lab9: Microscopical examination
Week10	Lab 10: Complete Microscopical examination
Week 11	Lab 11: Anon exam
Week 12	Lab 12: Gallstones.

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	1. Principle of Biochemistry by Lehniger. 2. Harper's Illust Rated Biochemistry by Rolerk Murrar.	Yes Yes
Recommended Texts	Principle of Biochemistry Lehniger 1992 3 Fundamentals of Biochemistry - Sami Al-Muzaffar Basics of Biochemistry book (practical + theoretical)	Yes Yes
Websites	https://itunes.apple.com/us/course/introductory-biochemistry/id556383540 http://ocw.mit.edu/courses/chemistry/5-111-principles-of-chemical-science-fall-2008/index.htm http://ocw.mit.edu/courses/chemistry/5-36-biochemistry-laboratory-spring-2009/lecture-notes/	

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 isrequired but credit awarded
	F – Fail	راسب	(0-44)	A 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 Chemistry and Petrochemicals**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	CHE47140				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	4		Semester of Delivery	5	
Administering Department	CHE		College	CoS	
Module Leader	Abdelrahman Basil Fadhil		e-mail	abdelrahmanbasil@uomosul.edu.iq	
Module Leader's Acad. Title	Professor		Module Leader's Qualification	Ph.D.	
Module Tutor			e-mail		
Peer Reviewer Name			e-mail		
Scientific Committee Approval Date	13/06/2023		Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Industrial Chemistry and Pollution	Semester	5
	Application of industrial chemistry	Semester	6
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. Illustrate how petroleum and petrochemicals industries can participate in contribution to the knowledge in chemistry. 2. Justify the technology and industry and their importance to the future of the humanity. 3. Petroleum and petrochemicals industries deal with the fundamentals of petroleum refining and processes that are used in their upgrading and to valuable products and petrochemicals. 4. Get firm knowledge about important definitions, refining processes chemical processes, upgrading processes, and transformation operations. 5. Explain the importance of chemistry of petroleum and petrochemicals to our daily life.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. What is Petroleum? 2. Chemical composition of crude oil? 3. How Petroleum is recovered? 4. How to classify Petroleum? 5. Evaluation of petroleum and its fractions. 6. Refining processes and fractionation of Petroleum. 7. Conversion processes of Petroleum.
Indicative Contents المحتويات الإرشادية	Introduction, Short history, Definitions, classification. [4hrs.] Chemical composition and recovery methods. [8hrs.] Classification and evaluation methods of petroleum and fractionation methods. [10 hrs.]. 8. Conversion processes of Petroleum. [8 hrs.].

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Teaching students the basics of petroleum chemistry and how to recover petroleum from underground. It also aims to fractionate and classify petroleum. Evaluation of petroleum and its fractions will be also covered. Finally, teaching students about the most important transformation processes that utilized at refineries to refining petroleum, upgrading it, and how to transform heavy distillates into more valuable fractions.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	109	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	7
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	41	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- #4 and #11, #13
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	-	-	-	-
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	Midterm Exam	2hr	20% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week 1	Petroleum, definition and history.
Week 2	Chemical composition of Petroleum.
Week 3	Classification methods of Petroleum
Week 4	Classification methods of Petroleum
Week 5	Classification of Petroleum
Week 6	Fractionation methods of Petroleum

Week 7	Fractionation methods of Petroleum
Week 8	Evaluation of Petroleum and its fractions.
Week 9	Evaluation of Petroleum and its fractions.
Week 10	Transformation methods of Petroleum.
Week 11	Thermal cracking and its types.
Week 12	Catalytic Reforming
Week 13	Hydrogenation and its types
Week 14	Isomerization and Alkylation processes
Week 15	Petroleum fractions.

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	
Week10	
Week 11	
Week 12	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	The chemistry and Technology of Petroleum by James G. Speight (5th Edition,2014);	No No

Recommended Texts	Petroleum Science and Technology by Chang Samuel Hsu and Paul R. Robinson (2018)	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

Module Information					
Module Title	**Application of Organic spectrum**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**CHE48144**				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		UGIV	Semester of Delivery		8
Administering Department		CHE	College	CoS	
Module Leader	Tahani Waleed Jihad		e-mail	tahani.waleed@uomosul.edu.iq	
Module Leader's Acad. Title		Lecturer	Module Leader's Qualification		Ph.D.
Module Tutor	Mohammed A. M. Ali		e-mail	mamqupa@uomosul.edu.iq	
Peer Reviewer Name		Adnan Othman Omer	e-mail	adnana.hasska94@uomosul.edu.iq	
Scientific Committee Approval Date		13/06/2023	Version Number	1.0	

Relation with other Modules			
Prerequisite module	CHE47138	Semester	7
Co-requisites module		Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. Know how nuclear spins are affected by a magnetic field, and be able to explain what happens when radiofrequency radiation is absorbed. 2. Be able to predict the number of proton NMR signals expected from a compound given its structure. 3. Be able to predict the splitting pattern in the proton NMR spectrum of a compound given its structure. 4. With the aid of a chart of chemical shifts from ^{1}H NMR, be able to assign peaks in an NMR spectrum to specific protons in a compound. 5. Be able to interpret integration of NMR spectra. 6. Be able to use NMR spectra to determine the structures of compounds, given other information such as a molecular formula. 7. Be able to calculate coupling constants from ^{1}H NMR spectra, and utilize the coupling constants for determining compound structure. 8. Typically, mass spectrometers can be used to identify unknown compounds via molecular weight determination, to quantify known compounds, in addition, it provides information on the positive ions formed in the ionization process, which is linked to the chemical structure of the molecule and the nature of the bonds and chemical properties of molecules. 9. IR spectroscopy is often used to identify functional groups within a molecule and can be used to quantitatively determine concentrations of molecules within a sample.
Module Learning Outcomes	1. Demonstrate an understanding of the fundamental aspects of NMR spectroscopy. 2. Explain the experimental NMR technique for the measurement of organic compounds. 3. Interpret and assign one dimensional NMR spectra and use the information to determine the structure of molecules. 4. Demonstrate an increased knowledge and understanding of chemical science. 5. Use investigative skills, critical thought and the ability to evaluate information and to analyse experimental data. 6. The ^{1}HNMR spectroscopy has great impact on the research in the organic lab. not only can it provide information on the structure of the molecule from positions and intensities of lines, it can also determine the content and purity of the sample, this allows chemists study their inner workings for drug discovery and other industries. 7. Explain how the protons present in the molecule will behave differently depending on the surrounding chemical environment, making it possible to elucidate their structure. 8. The principle on which this form of spectroscopy is based is simple. The nuclei of many kinds of atoms act like tiny magnets and tend to become aligned in a magnetic field. 9. For mass spectrometry the student be able to explain the theory behind mass

	spectrometry. 10. Describe how ionization of molecules can take place. 11. Explain how a mass spectrum should be used to identify unknown components. 12. Explain how quantitative and qualitative analysis can be performed with a GC-MS. 13. IR spectroscopy help to understand the position, intensity and shape of an absorption band and the effect of bond strength on absorption frequency. 14. to understand how h-bonding affect the absorption band and to know about the possible modes of vibration in aliphatic, aromatic hydrocarbons and their frequency values.
Indicative Contents	**^{1}HNMR Spectroscopy** **Introduction (2 hrs)** -Nuclear Spin and Resonance -Magnetic nuclei and nonmagnetic nuclei -Features lead to the nmr phenomenon **Taking a Spectrum (2 hrs)** -Solvent used in NMR -The machine -Chosen Tetramethylsilane as the reference point -The Chemical Shift -Shielded nucleus *vs* de-shielded nucleus **Factors Affecting the Chemical Shift (2hrs)** 1.The Inductive Effect 2. Anisotropy of Chemical Bonds 3. Polar Effects of Conjugation 4. Van der Waals Forces 5. Isotope Effects 6. Estimating a Chemical Shift 7. Hydrogen Bonds 8. Solvent Effects and Temperature **^{1}H–^{1}H Coupling: Multiplicity and Coupling Patterns (2 hrs)** ^{1}H–^{1}H Vicinal Coupling (^{3}JHH) **Multiplicity in Proton NMR (2 hrs)** -First order splitting and non-first order splitting patterns -Coupling constant **Pople Nomenclature for Coupled Spin Systems (2 hrs)** Two-seven spin systems with examples for each spin system **AB Systems** **Mass Spectrometry** **Introduction to mass spectrometry (2hr)** - ion production & ionization by electron Impact method -**Types of ions (2hr)** **Fragmentation (2hr)** - important factors for fragmentation & fragmentation pathways **Rearrangements accompanied by transfer of atoms (2hr)** **Fragmentation patterns of sorts organic compounds (2hr)**

	<u>IR spectroscopy</u> **Introduction to IR spectroscopy & instrument (2 hr)** **Position of an IR absorption band & intensity of absorption bands (2hr)** **Factors affecting vibrational frequencies (2hr)** 1. Bond order effect 2. resonance and inductive electronic effect 3. hydrogen bonding 4. bond angles **Characteristics absorption bands of sorts organic compounds (2hr)**

Learning and Teaching Strategies	
Strategies	Expanding students' perception about this science and its content: through which students learn how to use chart information to determine the chemical structure of organic compounds. It is also used for quantitative analysis of mixtures of compounds and to check the purity of sample. This will be achieved through lectures and labs that requires students to get trained on real problems. This involves solving exercises and incorporate them in group discussion to interpret others.

Student Workload (SWL)			
Structured SWL (h/sem)	97	Structured SWL (h/w)	6
Unstructured SWL (h/sem)	71	Unstructured SWL (h/w)	4.5
Total SWL (h/sem)	150		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	15% (15)	5, 9 and 13	LO #1, #2 and #11, #13
	Assignments	2	5% (5)	7 and 14	LO #3, #7 and #6, #7
	Projects / Lab.	1	10% (10)	4, 8, 11 and 15	All
	Report	1	10% (10)	3, 6, 9, 12 and 15	LO #4, #5 and #13
Summative assessment	Midterm Exam	1hr	10% (10)	8	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		100% (100 Marks)

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	**Introduction** -Nuclear Spin and Resonance -Magnetic nuclei and nonmagnetic nuclei -Features lead to the nmr phenomenon
Week 2	**Taking a Spectrum** -Solvent used in NMR -The machine -Chosen Tetramethylsilane as the reference point -The Chemical Shift -Shielded nucleus *vs* de-shielded nucleus
Week 3	**Factors Affecting the Chemical Shift** 1. The Inductive Effect 2. Anisotropy of Chemical Bonds 3. Polar Effects of Conjugation
Week 4	**Factors Affecting the Chemical Shift** 4. Van der Waals Forces 5. Isotope Effects 6. Estimating a Chemical Shift 7. Hydrogen Bonds 8. Solvent Effects and Temperature
Week 5	**^{1}H–^{1}H Coupling: Multiplicity and Coupling Patterns** ^{1}H–^{1}H Vicinal Coupling (^{3}JHH) & **Multiplicity in Proton NMR**
Week 6	**Pople Nomenclature for Coupled Spin Systems**

	& AB Systems
Week 7	**Introduction to mass spectrometry** ion production & ionization by electron Impact method
Week 8	**Types of ions**
Week 9	**Fragmentation** important factors for fragmentation & fragmentation pathways
Week 10	**Rearrangements accompanied by transfer of atoms**
Week 11	**Fragmentation patterns of sorts organic compounds**
Week 12	**Introduction to IR spectroscopy & instrument**
Week 13	**Position of an IR absorption band & intensity of absorption bands**
Week 14	**Factors affecting vibrational frequencies** 1. Bond order effect 2. resonance and inductive electronic effect 3. hydrogen bonding 4. bond angles
Week 15	**Characteristics absorption bands of sorts organic compounds**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	General Introduction to Magnetic Resonance
Week 2	**Chemical shifts & shielding and deshielding effects**
Week 3	Spin-Spin Coupling & Type of coupling
Week 4	Second order spectra & complex splitting patterns
Week 5	System types in NMR spectra
Week 6	AB system
Week 7	Introduction to spectroscopic method Mass spectrometry for identification of organic compound
Week 8	Spectrometry- Theory, Instrumentation, and Techniques
Week 9	Isotopic Masses, Isotopic Abundances
Week10	find chemical formula
Week 11	Fragmentation in EIMS- Alkanes, Alkenes, Heteroatom Compounds, Carbonyl Compounds
Week 12	Introduction to infrared spectroscopy
Week 13	The functional group, fingerprint region and number of vibrational modes
Week 14	Uses of the infrared spectrum & factors affecting absorption frequencies
Week 15	Bond properties and absorption trends & vibrational frequencies of functional groups with examples

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	RALPH L. SHRINER, CHRISTINE K. F. HERMANN, TERENCE C. MORRILL, DAVID Y. CURTIN, REYNOLD C. FUSON, (2004). The Systematic Identification of Organic Compounds, Eighth Edition. Ian Fleming & Dudley Williams (2019) Spectroscopic Methods in Organic Chemistry, Seventh Edition.	Yes
Recommended Texts	RALPH L. SHRINER, CHRISTINE K. F. HERMANN, TERENCE C. MORRILL, DAVID Y. CURTIN, REYNOLD C. FUSON, (2004). The Systematic Identification of Organic Compounds, Eighth Edition.	
Websites	(https://sdbs.db.aist.go.jp/sdbs/cgi-bin/cre_index.cgi).	

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	**Metabolism of Lipids and Proteins**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	CHE48145				
ECTS Credits	6				
SWL (hr/sem)	**150**				
Module Level	4		Semester of Delivery	8	
Administering Department	CHE		College	CoS	
Module Leader	Dr. Wasan Khariallah Ali Dr. Sukayna Hussain Rashed		e-mail	wasankhariallahali@uomosul.edu.iq Sukaynarashed@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor Assistant Professor		Module Leader's Qualification	Ph.D. Ph.D.	
Module Tutor	Nuha Abdelkader shareef Sana Abdlillah Ahmed		e-mail	nuha-abdelkader@uomosul.edu.iq sana.a.a@uomosul.edu.iq	
Peer Reviewer Name	Prof.Dr.Thikra Ali Allwsh		e-mail	thekraaliallwsh@uomosul.edu.iq	
Scientific Committee Approval Date	13/06/2023		Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Cytology	Semester	2

	Principles of biochemistry Biomolecules,		5
	Metabolism of Carbohydrates		7
Co-requisites module		Semester	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أ	The study of biochemistry aims to study the metabolism (catabolism and anabolism) of molecules such as lipids or fats, proteins, and nucleotides with the help of enzymes and hormones present in the human body to produce the energy that the body needs to carry out daily vital functions, as well as calculating the energy resulting from metabolism in the form of ATP
Module Learning Outcomes	Important: Write at least 6 learning outcomes, ideally equal to the number of weeks of study. 1. explained Some life molecules and studied the metabolism in terms of how to build and catabolize lipids, for example, as well as calculating the amount of energy consumed and produced in the metabolism process. 2. explained how the triglyceride biosynthesizes in the body and when liver glycogen is catabolized in case of carbohydrate deficiency in food to compensate for the deficiency and provide the energy needed for the body. 3. Explain and discussed energy compounds and how to store energy in the form of compounds that carry no energy bonds, such as ATP. 4. Explain the catabolism and anabolism process of amino acids and proteins in the body and calculate the amount of energy produced and consumed. 5. Explain to students the most important enzymes that carry out metabolic processes and how the body regulates them. 6. Explain the most important hormones that carry out metabolic processes and how the body regulates them according to its needs. 7. Explanation of beta-oxidation for the decomposition of fats within the body and the amount of energy resulting from it. 8. Eexplanation of the catabolism and anabolism of fats and fatty acids. 9. Eexplanation of the catabolism and anabolism of Nucleic acids and nucleotides.

Indicative Contents	Indicative content includes the following. Part A – Theoretical lectures Introduction to the metabolism of lipids. [*3* hrs.] Fatty acid synthesis (lipogenesis). [*6* hrs.] Catabolism of lipids& Lipolysis Regulation. [*6* hrs.] Catabolism of glycerol& Catabolism of fatty acids (β-Oxidation of fatty acids) or(Oxidation of fatty acids). [*3* hrs.] ATP Yield from Fatty Acid Oxidation. [*3* hrs.] Triglyceride biosynthesis. [*3*hrs] Ketone bodies& Ketone Body Oxidation. [*3* hrs.] Cholesterol biosynthesis. [*3* hrs.] Protein metabolism& Protein breakdown. [*3* hrs.] Catabolism of Amino Acids& The urea Cycle. [3 hrs.] Catabolism of Nucleic acids and nucleotides [3 hrs.] Digestion of food from entering the mouth to its exit. [3 hrs.] Part B – Practical labs Introduction In blood, blood coagulation, Introduction In blood, blood coagulation [18] hrs. Estimation of protein, Urea- Creatinine Estimation of uric acid Bilirubin, cholesterol Calcium, and phosphorous [18] hrs.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1-Lectures are given in PDF format. 2-It is a Microsoft PowerPoint presentation. 3- View explanatory films about the article. 4-Writing mathematical questions and answer them on the board inside the classroom

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	94	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	56	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	2	10% (10)	5 and 10	LO #1- #4 and #11, #12
	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 - #6
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week 1	Introduction to the metabolism of lipids
Week 2	Fatty acid synthesis (lipogenesis)
Week 3	Complete Fatty acid synthesis (lipogenesis)
Week 4	Catabolism of Lipids & Lipolysis Regulation
Week 5	Catabolism of glycerol& Catabolism of fatty acids (β-Oxidation of fatty acids) or(Oxidation of

	fatty acids)
Week 6	ATP Yield from Fatty Acid Oxidation
Week 7	Triglyceride biosynthesis
Week 8	Cholesterol biosynthesis
Week 9	Ketone Bodies & Ketone Body Oxidation
Week 10	Ketosis and ketoacidosis
Week 11	Protein metabolism& Protein breakdown
Week 12	Catabolism of Amino Acids& The urea cycle&Nucleic acids and nucleotides
Week 13	Digestion of food from entering the mouth to its exit
Week 14	Mide exam.
Week 15	A comprehensive review of the study material with mathematical questions.

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Introduction To Blood
Week 2	Lab 2: blood coagulation
Week 3	Lab 3: ESR,
Week 4	Lab 4: blood type
Week 5	Lab 5: Hemoglobin
Week 6	Lab 6: Estimation of Glu.
Week 7	Lab 7: Estimation of protein.
Week 8	Lab 8: Estimation of Urea
Week 9	Lab9:. Estimation of Creatinine
Week10	Lab 10: Estimation of uric acid, Bilirubin, cholesterol
Week 11	Lab 11: Estimation of Bilirubin.
Week 12	Lab 12: Estimation of cholesterol

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	1. Principle of Biochemistry by Lehniger.	Yes

	2. Harper's Illust Rated Biochemistry by Rolerk Murrar.	Yes
Recommended Texts	Principle of Biochemistry Lehniger 1992 3 Fundamentals of Biochemistry - Sami Al-Muzaffar Basics of Biochemistry book (practical + theoretical)	Yes yes
Websites	https://itunes.apple.com/us/course/introductory-biochemistry/id556383540 http://ocw.mit.edu/courses/chemistry/5-111-principles-of-chemical-science-fall-2008/index.htm http://ocw.mit.edu/courses/chemistry/5-36-biochemistry-laboratory-spring-2009/lecture-notes/	

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 is required but credit awarded
	F – Fail	راسب	(0-44)	A 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

Module Information معلومات المادة الدراسية					
Module Title	**Polymers: Fundamentals and applications**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☒ Tutorial ☐ Practical ☒ Seminar	
Module Code	CHE48146				
ECTS Credits	5				
SWL (hr/sem)	150				
Module Level		UGIV	Semester of Delivery		8
Administering Department		CHE	College	CoS	
Module Leader	Asaad Faisal Khattab		e-mail	asaadfaisal@uomosul.edu.iq	
Module Leader's Acad. Title		Professor	Module Leader's Qualification		Ph.D.
Module Tutor	Neamm Tayeb Hussein		e-mail	neam.allayla@uomosul.edu.iq	
Peer Reviewer Name		Asaad Faisal Khattab	e-mail	asaadfaisal@uomosul.edu.iq	
Scientific Committee Approval Date		13/06/2023	Version Number	1.0	

Relation with other Modules			
Prerequisite module	CHE47140	Semester	7
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. Give technical and chemical idea about polymer chemistry beside some applications and uses of engineering polymers commercial . 2. The course give idea about the classes and characterization of polymer as a material and their physical properties.
Module Learning Outcomes	The course applied on fourth year class students where it gives them good idea and experimental techniques to deal with industrial applications of polymers and monomers and their petrochemical industries.
Indicative Contents	Indicative content includes the following. Part A – Theoretical lectures Introduction, , Economical view , The relationship between petrol petrochemistry and polymers, Ecology, method and conditions of preparation. Study the physical and chemical properties of the polymers and their relation with the chemical structure Study the thermal and mechanical properties Part B – Practical labs Using different techniques for preparation the polymers. Measuring the molecular weight and the degree of crystallinity of the polymers Compression between the polymers by some physical properties Using physical and chemical methods for identifications

Learning and Teaching Strategies	
Strategies	Expanding students' perceptions about this science of polymers, it includes that help in chemical and physical methods of analysis. This will be achieved through lectures, labs, and interactive tutorials and by types of practical d methods involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	109	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	7
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	41	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	2	10% (10)	5 and 12	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	4 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	40% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week 1	Introduction , Economical view , The relationship between petrol petrochemistry and polymers
Week 2	Chemical structure of polymers , primary , secondary and super molecular structure :
Week 3	Classification of polymerization processes
Week 4	Nomenclature
Week 5	Polymerization methods and conditions
Week 6	Molecular weight of polymers Methods for determination of molecular weight

Week 7	Addition polymerization , basic concepts , mechanism and kinetics Ionic polymerization
Week 8	cationic and anionic polymerization , mechanism and kinetics
Week 9	Coordination polymerization , Zeigler-Natta catalysts , mechanism and kinetics of polymerization
Week 10	Copolymerization , kinetics of copolymerization , monomer – reactivity ratios.
Week 11	Condensation polymerization.
Week 12	Kinetics of polycodensation
Week 13	Physical and mechanical properties of polymer.
Week 14	Thermal analysis
Week 15	Industrial applications

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	preparation of poly methylmethacrelate polymerization
Week 2	Bulk polymerization. suspension polymerization solution polymerization
Week 3	Fractional precipitation of polymers.
Week 4	Determination of average molecular weight of polymer.
Week 5	Preparing of urea formaldehyde resins.
Week 6	Preparation of rayon by digestion of cellulose
Week 7	preparation of polyester by condensation polymerization
Week 8	Determination of degree of crystallinity in polymer: PVC, PE, PP, PS , PAN , PMMA.
Week 9	Preparing acrylonitrile by emulsion polymerization.
Week10	Identification of polymers.
Week 11	Identification of polymers
Week 12	Identification of polymers

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	Textbook of Polymer Science by Billmeyer F.W. Polymer Chemistry, An introduction by Stevens M.P.	Yes Yes
Recommended Texts	Report of polymer science by wafaa abbas	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	**Spectroscopy**			**Module Delivery**	
Module Type	**Core**			☒ **Theory** ☐ **Lecture** ☐ **Lab** ☒ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**CHE48147**				
ECTS Credits	4				
SWL (hr/sem)	**100**				
Module Level		4	**Semester of Delivery**		8
Administering Department		CHE	**College**	Type College Code	
Module Leader	Ala Hussein Ibrahim Mohammed Haies		**e-mail**	alaahussein@uomosul.edu.iq ibraheemhaies@uomosul.edu.iq	
Module Leader's Acad. Title		Lecturer Assistants Lecturer	**Module Leader's Qualification**		Ph.D.
Module Tutor	Ibrahim Mohammed Haies		**e-mail**	ibraheemhaies@uomosul.edu.iq	
Peer Reviewer Name		Rabah Ali Khalil	**e-mail**	E-mail	
Scientific Committee Approval Date		11/06/2023	**Version Number**		1.0

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	CHE47041	**Semester**	7
Co-requisites module	CHE47041	**Semester**	7

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	This module explores spectroscopic methods and further aspects of chemistry. The subject matter explored in this module is covered at a more advanced level compared to the foundations courses delivered as part earlier stages and serves to signal to the students how their understanding of chemistry will be expected to develop in its sophistication throughout the course. This course will overview of electromagnetic spectrum and its application to the study of chemical molecules. Students can learn about molecules and materials by shining light on them, including electronic, vibrational, rotational, and electron and nuclear spin states and energies. From this information, students can often deduce a great deal of additional insight, including: NMR • Principles of Nuclear Magnetic Resonance Spectroscopy. • Interpretation of Nuclear Magnetic Resonance Spectroscopy. • Instrumentation and Application of Nuclear Magnetic Resonance Spectroscopy. M.W. • Principles of Microwave Spectroscopy. • Interpretation of Microwave Spectroscopy. • Instrumentation and Application of Microwave Spectroscopy. IR. • Principle Infra-Red Spectroscopy. • Interpretation of Infra-Red Spectroscopy. • Instrumentation and Application of Infra-Red Spectroscopy. UV-Visible. • Principle of UV-Visible spectroscopy. • Interpretation of UV-Visible spectroscopy. • Instrumentation and Application of UV-Visible spectroscopy. Mass spectrometry • Mass spectrometry and the combined use of spectroscopic techniques for structure elucidation.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	***After the end of this course, the student:*** • Demonstrate a good understanding of the electromagnetic spectrum, f the various spectroscopy characterization techniques (Microwave Spectroscopy, IR Spectroscopy, UV-Visible Spectroscopy, NMR Spectroscopy, Mass Spectroscopy) and how this can be applied to the study of chemical molecules. • Interpret NMR spectroscopy, explain basic principles of NMR spectroscopy, explain sample preparation procedure in NMR spectroscopy, explain working principles, taking spectrum and outline of NMR spectroscopy device. • Recognize spectroscopy in Microwave, Rotational spectra of rigid diatomic molecules, selection rules, and interaction of spectral lines. • Interpret IR spectroscopy, explain basic principles of IR spectroscopy, arrange components of IR spectroscopy device, explain working principles and taking spectrum of IR spectroscopy device. • Explain the types of electronic radiation (Identify the types of radiation in the atomic and molecular electronics).

	• Explain the electronic spectra (examine the electronic spectra of diatomic molecules, and examine the electronic spectra of polyatomic molecules). • Interpret UV-Visible spectroscopy, explain basic principles of UV-Visible spectroscopy, explain relevant terms of UV-Visible spectroscopy, explain working principle, taking spectra and outline of UV spectroscopy device. • Identify the terms in and describe deviations to Beer's Law.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. 1. Introduction to Spectroscopy and Electromagnetic Radiation [6 hrs] 2. Interactions between matter and light, absorption and emission [6 hrs] 3. Introduction to nuclear spin and NMR spectroscopy. [6 hrs] 4. Chemical shift and peaks splitting. [6 hrs] 5. Rotational motion and the moment of inertia of a molecule. [6 hrs] 6. Rotational spectroscopy and its applications. [6 hrs] 7. Rotational motion and bond strength, Anharmonicity. [6 hrs] 8. IR spectroscopy, vibrational functional groups and IR spectroscopy applications [6 hrs] 9. Electronic transitions and molecular energy levels. [6 hrs] 10. UV-Vis spectroscopy, spectroscopy applications [6 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1. Trying to use what is visual, such as the image and the graphic curves, to enable the student to visualize the atomic and molecular systems, which are infinitesimal in nature. 2. Use spectra charts from literature to study molecular structure.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	64	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	36	**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	20% (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.				
	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 الأسبوعي النظري	
	Material Covered
Week 1	General Introduction light and spectroscopy (Basics of Spectroscopy).
Week 2	Interactions between matter and light, Spectroscopic transition between two stationary states, Transition probability and Selection Rules, Absorption and emission of a photon.
Week 3	NMR spectroscopy-I: Introduction of theory, ^{1}H and ^{13}C NMR, Spin-Spin Coupling.
Week 4	NMR spectroscopy-II: Theory of NMR, isotopes, Spinning nucleus, effect of an external magnetic field, precessional motion and precessional frequency, and the field strength, temperature effect.
Week 5	NMR spectroscopy-III: Boltzman distribution, origin of chemical shift and its implication in magnetic field strength, anisotropic effect.
Week 6	Rotational spectroscopy-I: Diatomic molecules, rigid rotor approximation, energy levels, selection rules, rotational lines with a constant gap and determination of bond length.
Week 7	Rotational spectroscopy-II: Population of energy levels and intensity of spectral lines, isotope effect, non-rigid rotor, energy levels and spectroscopic consequences, classification of polyatomic molecules, different top categories.
Week 8	Vibrational spectroscopy-I: Molecular vibrational motion, Anharmonicity. IR selection rules.
Week 9	Vibrational spectroscopy-II: Application of IR spectroscopy to study molecular structure.
Week 10	Electronic spectroscopy-I: Theory of UV-Vis electronic spectroscopy, Lambert-Beer's Law, Derivation of Law and limitation of Beer's law, Frank-Condon principle, Chemical analysis by electronic spectroscopy.
Week 11	Electronic spectroscopy-II: Factors Governing Absorption of Radiation in the Ultraviolet/Visible Region, solvent relaxation, solvatochromism, applications of UV-Vis spectroscopy
Week 12	Mass spectroscopy-I: Principles of Mass Spectrometry, Sample Introduction, Ionization Techniques and Mass Analyzers used in Mass Spectrometry.

Week 13	Mass spectroscopy-II: The Mass Spectrum and Interpretation of a Mass Spectrum, Applications of Mass Spectrometry.
Week 14	Raman spectroscopy: Historical background, Rayleigh and Raman scattering, Stokes and anti-Stokes lines, applications of Raman spectroscopy.
Week 15	Problems Based on Spectral Data Interpretation: Structure elucidation through various spectroscopic data such as FTIR, NMR, UV and MS. On the basis of structure, spectroscopic data analysis.
Week 16	1st course Final Term Examination

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1. Peter Atkins, Julio de Paula, James Keeler, Physical Chemistry, 11th Edition; Oxford University Press, Oxford, 2018.	Yes
Recommended Texts	2. Atkins, P and Friedman R. Molecular Quantum Mechanics, 4th Edition; Oxford University Press, Oxford, 2005. 3. Engel T. Quantum Chemistry and Spectroscopy, 3rd Edition; Pearson; 2013. 4. Quantitative Chemical Analysis, D.C. Harris. 8th edition (2011), or 9th edition Published by Freeman. Chapter 17, 19.	Yes 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
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Fail Group (0 – 49)	**FX** – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
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