MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Plasma physics**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY48040**				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	4		Semester of Delivery	8	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Haitham Abdel Hameed Ahmad		e-mail	dr.haitham@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor			e-mail		
Peer Reviewer Name	Name		e-mail	E-mail	
Scientific Committee Approval Date	06/06/2023		Version Number	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1- To give the students a concise account of present knowledge of electrical discharge in gases. 2- To provide an introduction to undergraduate students which will enable them to read with confidence some specialized works 3- Enabling the student to understand the behavior of ionized gases and plasma measurements with some plasma applications
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	A student completing a major in physics shall demonstrate the abilityto: 1- Demonstrate conceptual understanding of fundamental physics principles 2- Communicate physics reasoning in oral and written form 3- Sole physics problems using qualitative and quantitative reasoning including sophisticated mathematical techniques. 4- Conduct independent research or work successfully in a technical position. 5- To prepare students for a variety of career paths including physics graduate study, teaching and direct entry into industry
Indicative Contents المحتويات الإرشادية	Indicative contents includes the following. Introduction, types of discharge, kinetic theory of a simple gas, Collisions, attachment and recombination, mobility, diffusion, Electrode effects, Townsend discharge, effects of space discharge, Effects of secondary emission , effect of attachment, similarity, Townsend criterion, paschens law, Time of breakdown, breakdown in high pressure, corona discharge, The D.C. Low pressure glow discharge, the high pressure glow discharge, The D. C. Arc discharge, Plasma oscillation, Plasma measurements Revision problem classes (10 hours)

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Plasma science, the investigation of ionized gases and their interactions with materials, is a remarkably far-reaching discipline that is solving problems in space physics and astrophysics, materials science and engineering, atomic, molecular and optical physics, chemistry, biology, medicine, and even agriculture. Plasma physics studies are making exciting advances in fusion energy research, which may be the key for humanity to produce abundant, safe, carbon-free electricity. Plasma research is leading to profound new insights on the inner workings of the Sun and other stars, and fascinating astrophysical objects such as black holes and neutron stars. The study of plasma is enabling prediction of space weather, medical treatments, and even water purification.

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	25	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	1.7
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	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, types of discharge
Week 2	kinetic theory of a simple gas
Week 3	Collisions, attachment and recombination
Week 4	mobility, diffusion
Week 5	Electrode effects
Week 6	Townsend discharge, effects of space discharge
Week 7	Effects of secondary emission , effect of attachment
Week 8	similarity, Townsend criterion, paschens law
Week 9	Time of breakdown, breakdown in high pressure
Week 10	corona discharge
Week 11	The D.C. Low pressure glow discharge

Week 12	the high pressure glow discharge
Week 13	The D. C. Arc discharge
Week 14	, Plasma oscillation
Week 15	Plasma measurements

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	1- gas discharges. A. M. Howatson. Pergamon press. 1976 2- plasma physics A. A. Azooz. Mosul university, 1991	No Yes
Recommended Texts		
Websites	https://iopscience.iop.org/journal/1009-0630	

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	**Quantum Mechanics I**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY35021**				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	3		Semester of Delivery	5	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Alaa abdul Hakeim Hamed		e-mail	alaahakeim@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	MSc.	
Module Tutor			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. Modeling and analysis: The module aim to provide a comprehensive understanding of quantum mechanics and their behavior within a particular system. It allows scientists to create mathematical models and simulations to study the behavior of microscopic world and microscopic particles. 2. This course deals with the basic concept of the most important and discriminatory the main ideas that led to the development of quantum theory. 3. In quantum mechanics, information about the state of a particle is described by a wave function . 4. Material characterization: quantum mechanics modules can also be used to characterize Hilbert space is the mathematical foundation used for quantum mechanics. 5. Overall, the aim of an quantum mechanics is based on the basic ideas of vector analysis, with function taking the role of vectors.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Understanding of quantum mechanics theory: By studying a modern Q.M. theory, learners can develop a Q.M. by study Schrodinger eq. 2. Study time dependence and time independent Schrodinger eq. 3. Study the basic postulate of quantum statics. The postulates of Q.M. are a mathematical prescription for using the theory to predict the results of experiments. 4. Learn about the concept of operator and why we need operators in quantum mechanics. 5. Familiarize students with the applications of the Schrodinger equation on free particles and particles under the influence of potential. 6. Learn about the concept of potential barrier and potential well. 7. Study one dimensional linear harmonic oscillator. The wave equation for an oscillator. 8. Learn about angular momentum operators in cartesian and spherical polar form down to the engineering of the hydrogen atom 9. Overall, studying a quantum mechanics module can provide learners with a strong foundation in wave-particle theory, practical skills in modeling and simulation, and the ability to apply the theories of Q.M. in the field of nanometers, electron microscopy, and every related to the microscopic world.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. 1- Quantum mechanics, which by its very nature is highly mathematical, is one of the most difficult areas of physics to master. Q.M. theory help pierce the veil of obscurity by demonstrating, with explicit examples, how to do quantum mechanics. 2- we cover the basics of quantum theory from the perspective of wave mechanics. This includes a discussion of the wavefunction, the probability interpretation, operators, and the Schrödinger equation. We then consider simple one-dimensional scattering and bound state problems. 3- we cover the mathematical foundations needed to do quantum mechanics

	from a more modern perspective. We review the necessary elements of matrix mechanics and linear algebra, such as finding eigenvalues and eigenvectors, computing the trace of a matrix, and finding out if a matrix is Hermitian or unitary. We then cover Dirac notation and Hilbert spaces. The postulates of quantum mechanics are then formalized and illustrated with examples. In the chapters that cover these topics, we attempt to "demystify" quantum mechanics by providing a large number of solved examples. 4- an illustration of the mathematical foundations of quantum theory with three important cases that are typically taught in a first semester course: angular momentum and spin, the harmonic oscillator, and an introduction to the physics of the hydrogen atom. Other topics covered at some level with examples include the density operator, the Bloch vector, and two-state systems.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1- Unlike Newton's mechanics, or Maxwell's electrodynamics, or Einstein's relativity, quantum theory was not created—or even definitively packaged—by one individual, and it retains to this day some of the scars of its exhilarating but traumatic youth. There is no consensus as to what its fundamental principles are, how it should be taught, or what it really "means." Every competent physicist can "do" quantum mechanics, but the stories we tell ourselves about what we are doing are as various as the tales of Scheherazade, and almost as implausible. Niels Bohr said, "If you are not confused by quantum physics then you haven't really understood it"; Richard Feynman remarked, "I think I can safely say that nobody understands quantum mechanics." 2- Not only is quantum theory conceptually rich, it is also technically difficult, and exact solutions to all but the most artificial textbook examples are few and far between. It is therefore essential to develop special techniques for attacking more realistic problems. 3- This Module is intended for a one-semester or one-year course at the junior or senior level. A one-semester course will have to concentrate mainly on Part I; a full-year course should have room for supplementary material beyond Part II. The reader must be familiar with the rudiments of linear algebra (as summarized in the Appendix), complex numbers, and calculus up through partial derivatives; some acquaintance with Fourier analysis and the Dirac delta function would help. Elementary classical mechanics is essential, of course, and little electrodynamics would be useful in places. As always, the more physics and math you know the easier it will be, and the more you will get out of your study. But quantum mechanics is not something that flows smoothly and naturally from earlier theories. On the contrary, it represents an abrupt and revolutionary departure from classical ideas, calling forth a wholly new and radically counterintuitive way of thinking about the world. That, indeed, is what makes it such a fascinating subject.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	100	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل		Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	
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	Historical origin of the Q.M.
Week 2	Operators & requirements of eigen functions
Week 3	The basic postulate of quantum static
Week 4	Hamiltonian and eigen function
Week 5	Discussion and Quiz
Week 6	Wave packets and the uncertainty principle

Week 7	Time dependence and the schroedinger equation
Week 8	Particle under the influence of a constant pot. and particle in a box
Week 9	Step and barrier potantial
Week 10	Potential well
Week 11	One dimensional linear harmonic oscillator
Week 12	Discussion and Quiz
Week 13	Angular momentum
Week 14	Eigen values of L_z operator
Week 15	Spin angular momentum

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	1- INT ROD UCT ION TO Q UANT UM MECHANICS Third edition DAVID J. GRIFFITHS and DARRELL F. SCHROETER Seventh Edition, Matthew N. O. Sadiku, Oxford University Press, 2018.	Yes

	2- N. Zettili, Quantum Mechanics and Applications, 2nd Edition, John Wiley & Sons, Inc. 2009. 3- QUANTUM MECHANICS DEMYSTIFIED DAVID McMAHON McGRAW-HILL.2006 4- Solved Problems on Quantum Mechanics in One Dimension Charles Asman, Adam Monahan and Malcolm McMillan Department of Physics and Astronomy University of British Columbia, Vancouver, British Columbia, Canada Fall 1999; revised 2011 by Malcolm McMillan 5- Concepts of Modern Physics Sixth Edition Arthur Beiser Boston Burr Ridge, IL Dubuque, IA Madison, WI New York San Francisco St. Loui.2003	Yes
Recommended Texts	1- Quantum mechanics. Schaum out lines 2- The Feynman. Lectures on physics, third addition 3- Advanced quantum mechanics. by Paul Roman 4- Quantum mechanics for Honours and postgraduates by Dirac	No
Websites	1- http://www.mmmut.ac.in/News_content/02110tpnews_11232020.pdf 2- https://www.amazon.com/Quantum-Mechanics-Applications-Nouredine-Zettili/dp/0470026790 3- https://www.wiley.com/en-er/Quantum+Mechanics:+Concepts+and+Applications,+3rd+Edition-p-9781118307892 4- https://bibliotecatrevijano.files.wordpress.com/2017/10/zettili.pdf 5- https://books.google.com/books/about/Quantum_Mechanics.html?id=6jXIpJCSz98C	

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

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Quantum Mechanics II**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY36127**				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	3		Semester of Delivery	6	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Alaa abdul Hakeim Hamed		e-mail	alaahakeim@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	MSc.	
Module Tutor			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	Quantum Mechanics I	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. Modeling and analysis: The module aim to provide a comprehensive understanding of quantum mechanics and their behavior within a particular system. It allows scientists to create mathematical models and simulations to study the behavior of microscopic world and microscopic particles. 2. This course deals with the basic concept of the most important and discriminatory the main ideas that led to the development of quantum theory. 3. In quantum mechanics, information about the state of a particle is described by a wave function . 4. Material characterization: quantum mechanics modules can also be used to characterize Hilbert space is the mathematical foundation used for quantum mechanics. 5. Overall, the aim of an quantum mechanics is based on the basic ideas of vector analysis, with function taking the role of vectors.
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	from a more modern perspective. We review the necessary elements of matrix mechanics and linear algebra, such as finding eigenvalues and eigenvectors, computing the trace of a matrix, and finding out if a matrix is Hermitian or unitary. We then cover Dirac notation and Hilbert spaces. The postulates of quantum mechanics are then formalized and illustrated with examples. In the chapters that cover these topics, we attempt to "demystify" quantum mechanics by providing a large number of solved examples. 4- an illustration of the mathematical foundations of quantum theory with three important cases that are typically taught in a first semester course: angular momentum and spin, the harmonic oscillator, and an introduction to the physics of the hydrogen atom. Other topics covered at some level with examples include the density operator, the Bloch vector, and two-state systems.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1- Unlike Newton's mechanics, or Maxwell's electrodynamics, or Einstein's relativity, quantum theory was not created—or even definitively packaged—by one individual, and it retains to this day some of the scars of its exhilarating but traumatic youth. There is no consensus as to what its fundamental principles are, how it should be taught, or what it really "means." Every competent physicist can "do" quantum mechanics, but the stories we tell ourselves about what we are doing are as various as the tales of Scheherazade, and almost as implausible. Niels Bohr said, "If you are not confused by quantum physics then you haven't really understood it"; Richard Feynman remarked, "I think I can safely say that nobody understands quantum mechanics." 2- Not only is quantum theory conceptually rich, it is also technically difficult, and exact solutions to all but the most artificial textbook examples are few and far between. It is therefore essential to develop special techniques for attacking more realistic problems. 3- This Module is intended for a one-semester or one-year course at the junior or senior level. A one-semester course will have to concentrate mainly on Part I; a full-year course should have room for supplementary material beyond Part II. The reader must be familiar with the rudiments of linear algebra (as summarized in the Appendix), complex numbers, and calculus up through partial derivatives; some acquaintance with Fourier analysis and the Dirac delta function would help. Elementary classical mechanics is essential, of course, and little electrodynamics would be useful in places. As always, the more physics and math you know the easier it will be, and the more you will get out of your study. But quantum mechanics is not something that flows smoothly and naturally from earlier theories. On the contrary, it represents an abrupt and revolutionary departure from classical ideas, calling forth a wholly new and radically counterintuitive way of thinking about the world. That, indeed, is what makes it such a fascinating subject.

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		Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	
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	Historical origin of the Q.M.
Week 2	Operators & requirements of eigen functions
Week 3	The basic postulate of quantum static
Week 4	Hamiltonian and eigen function
Week 5	Discussion and Quiz
Week 6	Wave packets and the uncertainty principle

Week 7	Time dependence and the schroedinger equation
Week 8	Particle under the influence of a constant pot. and particle in a box
Week 9	Step and barrier potantial
Week 10	Potential well
Week 11	One dimensional linear harmonic oscillator
Week 12	Discussion and Quiz
Week 13	Angular momentum
Week 14	Eigen values of L_z operator
Week 15	Spin angular momentum

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	1- INT ROD UCT ION TO Q UANT UM MECHANICS Third edition DAVID J. GRIFFITHS and DARRELL F. SCHROETER Seventh Edition, Matthew N. O. Sadiku, Oxford University Press, 2018.	Yes

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Recommended Texts	1- Quantum mechanics. Schaum out lines 2- The Feynman. Lectures on physics, third addition 3- Advanced quantum mechanics. by Paul Roman 4- Quantum mechanics for Honours and postgraduates by Dirac	No
Websites	1- http://www.mmmut.ac.in/News_content/02110tpnews_11232020.pdf 2- https://www.amazon.com/Quantum-Mechanics-Applications-Nouredine-Zettili/dp/0470026790 3- https://www.wiley.com/en-er/Quantum+Mechanics:+Concepts+and+Applications,+3rd+Edition-p-9781118307892 4- https://bibliotecatrevijano.files.wordpress.com/2017/10/zettili.pdf 5- https://books.google.com/books/about/Quantum_Mechanics.html?id=6jXIpJCSz98C	

Grading Scheme مخطط الدرجات				
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Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Research Methodology**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☒ Seminar	
Module Code	PHY47034				
ECTS Credits	**4**				
SWL (hr/sem)	**100**				
Module Level	4		Semester of Delivery	7	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader			e-mail		
Module Leader's Acad. Title			Module Leader's Qualification	Ph.D.	
Module Tutor			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	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) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	52	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	3
Total SWL (h/sem)	100		

الحمل الدراسي الكلي للطالب خلال الفصل	

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	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

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 physics I**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY47032**				
ECTS Credits	7				
SWL (hr/sem)	175				
Module Level	4		Semester of Delivery	7	
Administering Department	Physics		College	Science	
Module Leader	Mahmood Ahmad Hamood		e-mail	mahmood@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor			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. Lattice Dynamics : The study of lattice dynamics enables us to describe the overall behavior of the material through the properties of the material. 2.Thermal properties of solid : Teaching the student the physical concept of heat, how energy transfers from one place to another, and what is the particle that transfers energy, as well as studying the heat capacity and specific heat of materials through the classical theory and the quantitative theories of Einstein and Debye. 3. Electrical properties of solid : Enable the student to understand the properties of electronic electrical and thermal conductivity of metallic solids by understanding the effect of electrons on the electric and magnetic field or the effect of ions in general. :
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks At the end of each semester, the student should be able to. Define all terms and titles within the chapter Able to write all mathematical equations and relations and know how to derive them Relate these equations to the main headings of the topics in the chapter To be able to formulate questions through these relationships Solve simple problems related to these equations The student should know that through the narration in each chapter, he is exposed to the following question: Why? Can you explain this? The student should be able to reach correct answers to specific questions that include applying the principles and fundamentals of solid state physics Each chapter concludes with a number of perceptual questions called questions and guesses .
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A – Theoretical lectures</u> 1. Lattice dynamic :Introduction , sound wave, Atomical vibration in the lattice, vibrational modes of linear monoatomic lattice , vibrational modes of diatomic linear lattice, Phase and group velocities in lattice, Acoustic branchand Optical branch, Example, summary, Questions .(5 hr) 2. Thermal properties of solid : Introduction, Heat capacity of solid, Classical theory for specific heat, Einstein theory for specific heat, Phonon, Density of state in continuous elastic medium, Debye theory for specific heat, Thermal conductivity, Example, Sammary, Question.(8hr)

	3. Electrical properties of solid: Introduction, Electrical conductivity of solid, Classical distribution of velocities, Classical theory for free electron gas, Drude theory for free electron conductivity, Thermal conductivity for free electron gas, Lorantiz theory for free electron conductivity, Quantum theory of free electron gsa, Fermi –Dirac quantum statistuics, Density state for free electron gas in 3D, Sommerfield theory for electrical conductivity, Example, Summary, Question. (8 hr) Part B – Practical labs Shape, Overlap, measurements of carapace and valves, orientation, external features, external structures, internal features, internal structures, . [18 hrs] 1- Calculate the lattice energy and Madloung 2- Determine the appropriate operating voltage of the LED . 3- Finding the conductivity of a random aluminum film gallium arsenide . 4- microwave interferometer . 5- Thermal potential and Seepac effect of a semiconductor material . 6- Using the powder method to determine the crystal structure of a substance. 7- Calculation of the relaxation time of electrons in metals. . [36 hrs

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	To begin with, this book is not an encyclopedia, but rather it contains basic topics and principles, and it does not contain lengthy derivations and historical biography, but deals with each basic principle and explains its meaning, then writes it in the form of a mathematical formula, and then moves on to applied issues and examples in order to bring the idea closer to mind. The following strategies are among the features related to the curriculum, including : 1- Enabling the student to express basic concepts with multiple lightnings, the ability to solve quantitative issues, and to be able to reach correct answers to qualitative questions that include the application of the principles of solid-state physics. 2- The ability to solve questions generates in the student the ability to formulate questions analytical. 3- One of the ways to gain experience in applying the principles of solid-state physics is to solve the largest possible number of different questions in ideas and method of solution. 4- Developing the language of understanding in physics instead of focusing on the mathematical text so that the father can formulate the required questions and translate them into mathematical formulas

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	81	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					
		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	An introduction to solid state and Explain in details lattice dynamic ,
Week 2	monoatomic lattice vibration.
Week 3	Diatomic lattice vibration, group and phase velocity,
Week 4	Acoustic and optical branch, Example, Quiz, ,
Week 5	Thermal properties of solid : Introduction, Heat capacity of solid,

Week 6	Classical theory for specific heat Einstein theory for specific heat,
Week 7	Phonon, Density of state in continuous elastic medium, ,
Week 8	Debye theory for specific heat, Thermal conductivity, Example
Week 9	Electrical properties of solid: Introduction, Electrical conductivity of solid, Classical distribution of velocities
Week 10	Classical theory for free electron gas, Summary, Question..
Week 11	Drude theory for free electron conductivity, Thermal conductivity for free electron gas,
Week 12	Lorantiz theory for free electron conductivity, Quantum theory of free electron gsa,
Week 13	Fermi –Dirac quantum statistics, Density state for free electron gas in 3D,
Week 14	Sommerfield theory for electrical conductivity, Example, Quiz
Week 15	Semi final examination .

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Calculate the lattice energy and Madloung.
Week 2	Discuss reports and grades
Week 3	Lab 2:Determine the appropriate operating voltage of the LED
Week 4	Discuss reports and grades
Week 5	Lab 3: Finding the conductivity of a random aluminum film gallium arsenide
Week 6	Discuss reports and grades
Week 7	Lab 4: microwave interferometer
Week 8	Discuss reports and grades
Week 9	Lab 5: Thermal potential and Seepac effect of a semiconductor material
Week10	Discuss reports and grades
Week 11	Lab 6:Using the powder method to determine the crystal structure of a substance
Week 12	Discuss reports and grades
Week 13	Lab 7:Calculation of the relaxation time of electrons in metals
Week 14	Discus reports and grades
Week 15	Final Examination

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	**Introduction to Solid State Physics.** by. Charles **Kittel-** 8th . ISBN: 978-0-471-41526-8 November 2004 704 Pages **Elementary solid state physics principles and applications by M. Ali Omar.** Publish Date:1975. Publisher Addison-Wesley Pub. Co. Language English. Pages (669)	Yes Yes
Recommended Texts		Yes No
Websites	https://shop.elsevier.com/books/introduction-to solid state physics https://www.ucl.ac.uk/ solid state physics	

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 physics II**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY48138**				
ECTS Credits	7				
SWL (hr/sem)	175				
Module Level	4		Semester of Delivery	8	
Administering Department	Physics		College	Science	
Module Leader	Mahmood Ahmad Hamood		e-mail	mahmood@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor			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	PHY47132	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	1- Band theory in solid: Teaching the student the mistakes of the classical theory or the quantitative theory of the free electron and its inability to explain the large differences in the electrical conductivity of conductive, insulating and semiconducting materials. 2- Semiconductor : Study the properties of semiconductor at low and high temperature and the type of semiconductor . 3- .Superconductivity :
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. At the end of each semester, the student should be able to: Define all terms and titles within the chapter Able to write all mathematical equations and relations and know how to derive them Relate these equations to the main headings of the topics in the chapter To be able to formulate questions through these relationships Solve simple problems related to these equations The student should know that through the narration in each chapter, he is exposed to the following question: Why? Can you explain this? The student should be able to reach correct answers to specific questions that include applying the principles and fundamentals of solid state physics Each chapter concludes with a number of perceptual questions called questions and guesses .
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Theoretical lectures 1. Band theory in solid: Introduction, Kroing-Penny models, Brilliouin – Zones in band theory, Fermi surface, Effective mass of electron,Example, Summary, Questions. (10hr) 2. Semiconductor: Introduction,m Intrinsic semiconductors, Concentration of electrons and holes in semiconductor, Doping of semiconductor, n-type and p- type semiconductor, Hall effect,Example, Summary, Questions.(14hr) 3. Superconductivity: Introduction, Critical temperature, Critical magnetic field, Messiner effect, Superconductivity theory (BCS), Penetration depth, Example, Summary, Questions . (12 hr) Part B – Practical labs

	Shape, Overlap, measurements of carapace and valves, orientation, external features, external structures, internal features, internal structures, . [18 hrs] 1- Measuring the current, voltage and power output of the solar cell. 2- Study of the crystal structure of KCL using X-ray spectrometry. 3- Crystal structure. 4- Calculation of the gap energy for a semiconductor using a p-n . type binary. 5- Hall effect. 6- Calculation of the bandgap of the ZnTe membrane prepared by chemical bath CBD. 7- Study of the optical properties of thin films . [36 hrs

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	To begin with, this book is not an encyclopedia, but rather it contains basic topics and principles, and it does not contain lengthy derivations and historical biography, but deals with each basic principle and explains its meaning, then writes it in the form of a mathematical formula, and then moves on to applied issues and examples in order to bring the idea closer to mind. The following strategies are among the features related to the curriculum, including : 1- Enabling the student to express basic concepts with multiple lightnings, the ability to solve quantitative issues, and to be able to reach correct answers to qualitative questions that include the application of the principles of solid-state physics. 2- The ability to solve questions generates in the student the ability to formulate questions analytical. 3- One of the ways to gain experience in applying the principles of solid-state physics is to solve the largest possible number of different questions in ideas and method of solution. 4- Developing the language of understanding in physics instead of focusing on the mathematical text so that the father can formulate the required questions and translate them into mathematical formulas

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	81	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

		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	Band theory in solid: Introduction, Bloch function
Week 2	, Kroing-Penny models, Brilliouin – Zones in band theory
Week 3	Summary, example , Quiz
Week 4	Fermi surface, Effective mass of electron, Example
Week 5	Semiconductor: Introduction Intrinsic semiconductors Direct and indirect band gap
Week 6	Concentration of electrons and holes in semiconductor
Week 7	Doping of semiconductor, n- type and p- type semiconductor
Week 8	Hall effect, Example, Quiz
Week 9	, Superconductivity: Introduction, Critical temperature, Critical magnetic field
Week 10	Examples, Discussion, Quiz

Week 11	Messiner effect, Levitation
Week 12	Superconductivity theory (BCS),
Week 13	cooper Paris formation
Week 14	Penetration depth, Example for calculating penetration depth
Week 15	Semi final examination .

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1:Measuring the current, voltage and power output of the solar cell
Week 2	Discuss reports and grades
Week 3	Lab9:Study of the crystal structure of KCL using X-ray spectrometry
Week 4	Discuss reports and grades
Week 5	Lab 10: Crystal structure
Week 6	Discuss reports and grades
Week 7	Lab 11: Calculation of the gap energy for a semiconductor using a p-n . type binary
Week 8	Discuss reports and grades
Week 9	Lab 12: Hall effect
Week10	Discuss reports and grades
Week 11	Lab 13 : Calculation of the bandgap of the ZnTe membrane prepared by chemical bath CBD
Week 12	Discuss rep[orts and grades
Week 13	Lab 14 : Study of the optical properties of thin films
Week 14	Discuss reports and grades
Week 15	Final Examination

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	**Introduction to Solid State Physics.** by. Charles **Kittel**-8th . ISBN: 978-0-471-41526-8 November 2004 704 Pages	Yes
	Elementary solid state physics principles and applications by M. Ali Omar. Publish Date:1975. Publisher Addison-Wesley Pub. Co.	Yes

	Language English. Pages (669)	
Recommended Texts		Yes No
Websites	https://shop.elsevier.com/books/introduction-to solid state physics https://www.ucl.ac.uk/ solid state physics	

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks %	Definition
Success Group (50 - 100)	A – Excellent	امتياز	90 - 100	Outstanding Performance
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	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	**Sound and wand motion**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	PHY24018				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	2		Semester of Delivery	4	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Muhammed Subhi Hameed		e-mail	mohammedsubhi@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor	Assist. Prof. Ammar Yaseen Burjes		e-mail	ammaryaseen@uomosul.edu.iq	
Peer Reviewer Name	Assist. Prof. Dr. Samir Mahmmod Ahmad		e-mail	dr.samir@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	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. Clarification of how sound and wave motion can make significant and contribute to a wide range of technical applications. 2. Identify basic of sound and wave motion. 3. This course deals with the basic concept of the most important elements in wave motion such as Free Vibration, structure of simple harmonic motions and Embedded vibration 4. Learn about the most important scientific terms (Terminology) and their definitions related to this topic. 5. To understand and comprehend the impact of these elements from Physics point of view.
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. To know about wave motion in details 2. To understand structures of wave motion 3. To understand energy diagrams related to sound 4. To comprehend conditions of movement of wave motion 5. To go through applications of wave motion and Forced Vibration. 6. To experience transversal waves in one dimension 7. To experience Longitudinal Waves analysis and application.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Theoretical lectures Chapter One (Basic Concepts of wave motion): Introduction, procedures of energy transfer, what is the wave motion? Types of wave motion, essential properties of mechanical wave motion, examples of mechanical wave motion, sound waves, types of mechanical wave motion, Characteristics of mechanical wave motion, velocities of Wave and particles, mathematical present of wave motion, general equation of wave motion. [*10* hrs] Chapter Two (Free Vibration): Introduction, oscillatory motion, Simple harmonic motion equation, solution of Simple harmonic motion equation, instantaneous velocity and instantaneous acceleration of the simple harmonic oscillator, The energy of the simple harmonic oscillation, applications of simple harmonic motion (a simple pendulum, a floating body, a liquid in a U tube, bonded mass and oscillating wire, piston in cylinder, deflectors, simple angular motion). [*8* hrs] Chapter Three (structure of simple harmonic motions) Composition rule, a combination of two simple harmonic motions in the same direction, Lissajous figures, the composition of two perpendicular simple harmonic motions of the same frequency, The graphic method for the composition of two simple harmonic movements perpendicular, the composition of two simple harmonic

	movements perpendicular to their frequency ratio 1:2, the beats. [10 hrs] Chapter Four (Embedded vibration) Introduction, the force causing vibration decay, decaying harmonic motion equation, solution of decaying harmonic motion equation (non-decay state, under-decay state, critical state, over-decay state, decay measurement (logarithmic decay, relaxation time, specificity equation). [8 hrs] Chapter Five (Forced Vibration) Introduction, Equation of Motion for a Decaying Vibrator Under the Action of a Periodic External Force, solution of forced vibration equation, resonance, the amplitude of vibration at resonance, the relationship between the resonant frequency, the natural frequencies of the oscillator, the relationship of phase angle, forced frequency and resonance. [4 hrs] Chapter 6, 7 and 8 (transversal waves in one dimension and Longitudinal Waves) Introduction, Vibrational motion and wave motion, Transverse wave motion in one dimension, Equation of transverse wave motion in an oscillating string, Transverse wave energy, Wave reflection (at the stationary end of a bonded wire, at the free end, at the movable shelf of tight wire), standing waves, Free Vibration of a Stringed String of Limited Length, Sonometry, Laws of Vibrating Strings. [4 hrs] Ultrasound and its Applications Introduction, a brief history of ultrasonic waves, the mechanism of the formation of ultrasonic waves, Audio, components of the ultrasound device, the effect of ultrasonic waves on vital cells, the behaviour of ultrasound waves in the human body, some applications of ultrasound (Detection of defects and cracks, estimation of works s by resonance, metallurgy, biomedical applications) [3 hrs] Revision problem classes [3 hrs] <u>Part B – Practical labs</u> Learning about instruments related to the sound and wave motion [8 hrs] Experiments: Applying theory of lectures to practical work [21 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Expanding students' perceptions about this science and its contents. In addition, assisting students in knowledge gathering of basic sound and wave motion principles and concepts through understanding behaviors of certain wave components. Practical work should enhance perceptions of students about particular design and analysis of wave motion.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	52	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	3
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 #9, #10
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #5, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #12
Summative assessment	Midterm Exam	2hr	10% (10)	7	LO #1 - #9
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week 1	Basic Concepts of wave motion.
Week 2	Free Vibration
Week 3	structure of simple harmonic motions
Week 4	Embedded vibration
Week 5	Forced Vibration
Week 6	transversal waves in one dimension

Week 7	Longitudinal Waves
Week 8	Sound Waves
Week 9	General Considerations in Sound and
Week 10	Wave Phenomenon
Week 11	Ultrasound
Week 12	Ultrasound and its Applications
Week 13	Mechanism of the formation of ultrasonic waves
Week 14	estimation of works s by resonance
Week 15	Doppler phenomenon

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Learning about instruments of sound and wave motion
Week 2	Lab 2: Learning about general features of Free Vibration
Week 3	Lab 3: Conducting experiments: structure of simple harmonic motions
Week 4	Lab 4: Conducting experiments: Embedded vibration
Week 5	Lab 5: Forced Vibration
Week 6	Lab 6: Transversal waves in one dimension
Week 7	Lab 7: Longitudinal Waves
Week 8	Lab 8:. Sound Waves
Week 9	Lab9: General Considerations in Sound
Week10	Lab 10: Wave Phenomenon
Week 11	Lab 11: Ultrasound
Week 12	Lab 12: Mechanism of the formation of ultrasonic waves
Week 13	Lab 14: Estimation of works s by resonance
Week 14	Lab 14: Doppler phenomenon
Week 15	Revision of All Experiments

Learning and Teaching Resources

مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	فيزياء الصوت والحركة الموجية ، د.امجد عبد الرزاق	Yes
Recommended Texts	Mechanics and Properties of Matter , By: Kohle.	Yes
Websites	https://www.britannica.com/science/wave-physics https://www.physicsclassroom.com/class/waves https://www.britannica.com/science/wave-physics	

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	**Spectra**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY35024**				
ECTS Credits	**4**				
SWL (hr/sem)	**100**				
Module Level	3		Semester of Delivery	5	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Yussra Malalah Abdullah		e-mail	yussramalalah@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	M.sc.	
Module Tutor			e-mail		
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		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	1. Course Main Objective The aim of the course is that the student at the end of the course shall: • Describe the atomic emission / absorption spectrophotometry and molecular spectroscopy • describe the atomic spectra of one and two valance electron atoms. • Explain the change in behavior of atoms in external applied electric and magnetic field. • Explain rotational, vibrational, electronic and Raman spectra of molecules. • Describe electron spin and nuclear magnetic resonance spectroscopy and their applications
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	It is easy to study the properties of elements Electron distribution and atomic levels And the loss and reduction properties of its electrons Distinguishing the types of emitted spectrum and using it in several areas such as fingerprint identification, electronic doors, and others Definition of the spectra, types (emission and absorption) and forms of the spectra (continuous, band and line) Electromagnetic waves, interaction of electromagnetic waves with matter, the main parts of the spectrophotometer (sources, dispersion units, samples compartment and detection unit) The main atomic models (Thomson, Rutherford and Bohr) Hydrogen atom review Calculation of the energies, wavelengths, frequencies and wave numbers of the Hydrogen atom series, the reasons for failure of Bohr model Quantum numbers and atomic structure review, Pauli's Exclusion principles and Hund's rules, degeneracy, couples angular momentum Spin – orbit (LS) coupling and fine structure, hyperfine interactions Spectral consequences of the fine structure, selection rules, Helium energy levels Atoms and field interactions, dipole interactions Normal and anomalous Zeeman's effect, Lande – g – factor Spectral consequences of the applied fields, Stark effect Atom - atom Interactions, Bonding: Van der Waals, rotations and vibrations , Molecular electronic spectra Experimental probes ultra violet (UV), visible (Vis) Infrared (IR) and Raman spectroscopy, Selection rules
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Devise an instrumental procedure to account for molecular absorption and scatter from particulate matter in atomic absorption spectroscopy. Groups discussion Written exam Develop problem solving skills in laser physics. Lecture and Group discussion Homework reports Competence Show responsibility for working independently and for continuous improvement of personal capacities. Group discussion Project Act in a manner consistent with the ethical standards in public and personal attitudes. Groups discussion Homework reports and projects Work effectively in group

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Knowledge: Define the nature of the interaction between the electromagnetic waves with matter and its associated spectra. Recognize theories explaining the structure of atoms and the origin of the observed spectra. Can Define the quantum numbers that describe the atomic structure and energy levels (electronic, vibrational and rotational). Skills : Devise an instrumental procedure to account for molecular absorption and scatter from particulate matter in atomic absorption spectroscopy. Develop problem solving skills in spectroscopy physics Competence: Show responsibility for working independently and for continuous improvement of personal capacities. Act in a manner consistent with the ethical standards in public and personal attitudes. Work effectively in groups and exercise leadership when needed.

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	Introduction to spectroscopy electromagnetic spectrum
Week 2	Atomic structure (Thomson, Rutherford models), Atomic spectra and spectral series
Week 3	Bohr's model and theory of the atom, Schrödinger equation of H-atom
Week 4	Many- electrons atoms and atomic quantum numbers, Harmonic model
Week 5	Rotational spectra of the molecules, Definition of molecules, types of molecules
Week 6	Boltzmann's distribution+ examples
Week 7	Isotopic effect+ examples Max. rotational quantum number+ problem
Week 8	Vibrational spectra for the molecules Harmonic vibrator +selection rule
Week 9	An-Harmonic vibrator +selection rule Compression between two models+ potential functions
Week 10	More function+ examples ,Types of vibrational bands Hot bands+ Boltzmann distribution for vibrational molecules
Week 11	Rotational –vibrational spectra
Week 12	The rotational spectrum for vibrational molecules, P, Q and R bands+ selection rules
Week 13	Some examples for diatomic molecules
Week 14	Electronic spectra Bands, Molecular orbital, Molecular states and selection rules
Week 15	The electronic transitions and their spectra of fluorescence and phosphorescence

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	1- Atomic and molecular spectroscopy; basic aspects and practical applications Svanberg S., springer, 2003. 2- Modern spectroscopy, Hollas, J. M., John Willy and Sons, Ltd. 2004.	Yes Yes
Recommended Texts	1- Atomic spectra and atomic structure, Herzberg, G., Dover Publications, New York, 1944. 2- Introduction to atomic spectra, White, H. E. McGraw-Hill Book Company, Inc. New York and London, 1934.	Yes
Websites	Web Sites on the internet that are relevant to the topics of the course & general physics websites such as : 1- http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html 2- http://www.hazemsakeek.info/magazine/ 2- 3- wikipedia.org/wiki/ physics subjects	

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

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Thermodynamic and statistical**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY24015**				
ECTS Credits	6				
SWL (hr/sem)	**150**				
Module Level	2		Semester of Delivery	4	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Haitham Abdel Hameed Ahmad		e-mail	dr.haitham@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor			e-mail		
Peer Reviewer Name	Name		e-mail	E-mail	
Scientific Committee Approval Date	06/06/2023		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. This subject represents an attempt to give an introduction to statistical physics in a form which is suitable for undergraduate students. 2.The material has been chosen in order to emphasize the basic methods of statistical physics and those results which are of particular importance for physicists.
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- The science of physics is built on theories and models as well as on experiment s 2- Theories and models structure relations and simplify reality to such a degree that predictions on physical phenomena can be derived by means of mathematics 3- Experiments allow to verify those predictions. 4-Evaluating experiments and a real phenomenon with such theories and mathematical tools to solve equations derived from those theories statistically. 5- Thermodynamics is the physics of temperature and heat. As phenomenological science, it formulates the relations observed between physical observable. 6- Even through these relations are obvious to verify in a classical tools 7- Thermodynamics laws are harder to verify classically, so the best way to done by statistical mechanics.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Theoretical lectures Introduction, The scope of statistical physics, description of the assemblies-phase space, average properties of an assembly classical and quantum assemblies, distribution over energies weights of configurations, the most probable configuration, sharpness of the configuration maximum, the multiplier β, the multiplier α, the Maxwell-Boltzmann distribution, the classical perfect gas, mean and most probable velocities, equipartition of energy, specific heats of gases, the Einstein diffusion equation, the canonical ensemble, ensembles, constant temperature ensemble, thermodynamic properties of the canonical ensemble, evaluation of the total partition function, energy distribution over the canonical ensemble, application of the canonical ensemble to an imperfect gas. (20 hours) Revision problem classes (10 hours) Part B – Practical labs

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Theoretical physics is an important subject in physics. The major goal of theoretical physics courses is to help students learn to think like a physicist. The theoretical physics curriculum mainly includes theoretical mechanics, electrodynamics, thermodynamics and statistical physics, and quantum mechanics. These courses play an important role in cultivating students' physics literacy. There are many difficulties in the learning process of theoretical physics, such as the lack of motivation and goals, negative influence of pre-scientific concepts, cognitive impairment of learning and mathematical learning disability. Teachers should use effective teaching strategies to help students to overcome learning difficulties.

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	Introduction, The scope of statistical physics
Week 2	description of the assemblies-phase space, the average properties of an assembly
Week 3	classical and quantum assemblies
Week 4	distribution over energies
Week 5	weights of configurations
Week 6	the most probable configuration,
Week 7	the sharpness of the configuration maximum
Week 8	multiplier β, the multiplier α
Week 9	the Maxwell-Boltzmann distribution
Week 10	the classical perfect gas, mean and most probable velocities
Week 11	equipartition of energy, the specific heats of gases
Week 12	Einstein diffusion equation
Week 13	the canonical ensemble, ensembles
Week 14	the constant temperature ensemble, thermodynamic properties of the canonical ensemble
Week 15	the evaluation of the total partition function, the energy distribution over the canonical ensemble, application of the canonical ensemble to an imperfect gas

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	**1-** An Introduction to Statistical Physics for Students**.** A. J. Pointon 1967	NO
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				
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	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
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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	**Analog Electronics**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	PHY23011				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	2		Semester of Delivery	3	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Muhammed Subhi Hameed		e-mail	mohammedsubhi@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor	Assist. Prof. Ammar Yaseen Burjes		e-mail	ammaryaseen@uomosul.edu.iq	
Peer Reviewer Name	Assist. Prof. Dr. Samir Mahmmod Ahmad		e-mail	dr.samir@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	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. Clarification of how analog elecronics can make significant contributions to a wide range of technical applications. 2. Identify circuit elements n details. 3. This course deals with the basic concept of the most important elements in electronics such as diodes, zener diodes and transistors amplifiers 4. Learn about the most important scientific terms (Terminology) and their definitions related to this topic. 5. To understand and comprehend the impact of these elements from Physics point of view. .
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. To know about semiconductor materials in details 2. To understand n type and p type structures 3. To understand energy diagrams related to pn junctions 4. To comprehend IV characteristic curve and diode bias conditions 5. To go through diode circuit analysis and applications. 6. To experience zener diode basic structure 7. To experience zener diode circuit analysis and application. 8. To understand npn and pnp Bipolar Junction Transistor (BJT) structures 9. To identify basic transistor biasing 10. To identify basic transistor operation 11. To identify common emitter transistor configuration 12. To identify about common emitter transistor amplifier 13. To identify about common base transistor configuration 14. To learn about common base transistor amplifier 15. To learn about common collector transistor configuration and amplifier concept
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Theoretical lectures Silicon and Germanium atoms, conduction in semiconductor crystals, n-type and p-type semiconductors, the depletion layer, energy diagram of the pn junction, biasing the pn junction, energy diagram for the forward bias, reverse bias,reverse leakage current ideal diodes, diodes and applications, diode circuits problems and solutions, half wave rectifiers, full wave rectifiers and rectifier filters [*10* hrs] Zener diode symbol, IV curve for zener diode, zener breakdown, equivalent circuit for zener diode, zener diode examples, zener voltage regulation with solved problems, zener diode regulation with varying load with solved problems and percent load regulation [*8* hrs] Bipolar junction transistor basic structure, transistor operation, transistor currents, common emitter configuration with current gain, IV characteristic input and output

	equations, solved problems, collector curves, cutoff and saturation, common emitter solved configuration problems, dc operating point and common emitter amplifier with dc analysis, signal ac voltage at the base, input impedance analysis, output impedance analysis and emitter bypass capacitor case [*10* hrs] Common emitter transistor configuration with current gain, dc analysis, IV input and output characteristic curve, collector curves, cutoff and saturation with solved problems and dc operating point [8 hrs] Common emitter transistor amplifier with dc analysis, ac equivalent circuit, signal ac voltage at the base, input impedance, output impedance and emitter bypass capacitor case [4 hrs] Common base transistor configuration with current gain, common base transistor amplifier, with voltage gain, input impedance, output impedance, current gain, power gain with solved problems [4 hrs] Common collector transistor configuration with current gain, dc analysis. Common collector amplifier with voltage gain, input impedance, output impedance, current gain and power gain with solved problems [3 hrs] Revision problem classes [3 hrs] <u>Part B – Practical labs</u> Learning about instruments: voltmeter, ammeter, oscilloscope, dc and ac power supplies, function generators and learning about general features of electronic components such as resistors, capacitors, coils, diodes, zener diodes and npn transistors [8 hrs] Conducting experiments: IV characteristic curve of diodes in forward bias, IV characteristic curve of diodes in reverse bias, half and full wave rectifiers, zener diode voltage regulation, common emitter transistor configuration, common emitter transistor amplifier, common base transistor configuration, common base transistor amplifier, common collector transistor configuration and common collector transistor amplifier [21 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Expanding students' perceptions about this science and its contents. In addition, assisting students in knowledge gathering of basic electronics principles and concepts through understanding behaviors of certain electronic components. Practical work should enhance perceptions of students about particular circuit design and analysis.

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 #9, #10
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #5, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #12
Summative assessment	Midterm Exam	2hr	10% (10)	7	LO #1 - #9
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week 1	Silicon and Germanium atoms
Week 2	n-type and p-type semiconductors, pn junctions
Week 3	n-type and p-type semiconductors, pn junctions
Week 4	Diode circuit analysis and Solving diode circuits questions
Week 5	Diode circuit analysis and Solving diode circuits questions
Week 6	Diode circuit application and Solving diode circuits questions
Week 7	Zener diode circuit analysis and solving questions

Week 8	Zener diode circuit analysis and solving questions
Week 9	Bipolar Junction Transistor (BJT), basic operation
Week 10	Bipolar Junction Transistor (BJT), basic operation
Week 11	Configuration of Common Emitter (CE),
Week 12	Common Emitter (CE) transistor amplifier,
Week 13	Configuration of Common Base (CB),
Week 14	Common Base (CB) transistor amplifier,
Week 15	Common Collector (CB) configuration with transistor amplifier, revision of solved problems

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Learning about instruments: voltmeter, ammeter, oscilloscope, dc and ac power supplies, function generators
Week 2	Lab 2: Learning about general features of electronic components such as resistors, capacitors, coils, diodes, zener diodes and npn transistors
Week 3	Lab 3: Conducting experiments: IV input characteristic curve of diodes in forward and reverse bias
Week 4	Lab 4: Half and Full Wave Rectifiers
Week 5	Lab 5: Zener voltage regulation
Week 6	Lab 6: Common emitter transistor configuration, IV input characteristic curve
Week 7	Lab 7: Common emitter transistor configuration, IV output characteristic curve
Week 8	Lab 8:.Common emitter transistor amplifier, input resistance
Week 9	Lab9: Common emitter transistor amplifier, input resistance, voltage gain, current gain
Week10	Lab 10: Common base transistor configuration, IV input characteristic curve
Week 11	Lab 11: Common base transistor configuration, IV output characteristic curve
Week 12	Lab 12: Common base transistor amplifier, input resistance, voltage gain
Week 13	Lab 14: Common collector transistor configuration, IV input characteristic curve
Week 14	Lab 14: Common collector transistor amplifier
Week 15	Revision of All Experiments

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Thomas L. Floyd (2012), Electronic Devices, Ninth Edition, Pearson Education Inc., publishing as Prentice Hall, New Jersey.	Yes
Recommended Texts	Older Versions Thomas L. Floyd (2008, 2005, 2002, 1999), Electronic Devices, Pearson Education Inc.	Yes
Websites	https://www.analog.com/en/design-center/design-tools-and-calculators/ltspice-simulator.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

Module Information معلومات المادة الدراسية					
Module Title	Analytical Mechanic II			Module Delivery	
Module Type	C			☐ Theory ☒ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	PHY24116				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	2		Semester of Delivery	4	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Dr.Ayad Jyad Jarjees		e-mail	dr.ayad@uomosul.edu.iq	
Module Leader's Acad. Title	Lecturer		Module Leader's Qualification	phd.	
Module Tutor	Heba Mohammed Tahir		e-mail	hebamohammed@uomosul.edu.iq	
Peer Reviewer Name	Name		e-mail	E-mail	
Scientific Committee Approval Date	07/06/2023		Version Number	1.0	

نموذج وصف المادة الدراسية

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	PHY23010	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	Students do study the following fields: 1. Study the Dynamic of particle (Rectilinear Motion). and study the vertical motion in a resisting medium 2. Study the force as a function of position and the concept of kinetic and potential energy. 3. Understand Force as function of velocity and time. 4. Clarification Dynamic of particle (General motion).and motion of projectile in uniform gravitational field. 5. Understand Linear Air Resistance and none linear air resistance . 6. Clarification The harmonic Oscillator in two and three dimensions. 7. Study The Energy equation for smooth constraint .and simple pendulum 8. 8.General coordinates and explaining using in LaGrange equation and its applications with examples
Module Learning Outcomes مخرجات التعلم للمادة الدراس	1. Learn basic facts, key terms, concepts and principles of Analytical Mechanic 2. Explain the main applications of Analytical Mechanic and solving the important problems 3. Summarize the most important implications and applications derived from the laws of Analytical Mechanic .
ndicative Contents المحتويات الإرشادية	Study the Dynamic of particle (Rectilinear Motion). and study the vertical motion in a resisting medium Study the force as a function of position and the concept of kinetic and potential energy. Understand Force as function of velocity and time. Clarification Dynamic of particle (General motion).and motion of projectile in uniform gravitational field. Understand Linear Air Resistance . Clarification The harmonic Oscillator in two and three dimensions. Study The Energy equation for smooth constraint .and simple pendulum

	.General coordinates and explaining using in LaGrange equation and its applications with examples. .Hamilton equation and its examples
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	• . Begin by providing an overview of analytical mechanics, focusing on the basic concepts of vectors in terms of physical quantities, units, and symbols, as well as the geometric meaning of vector algebra as well as the geometric interpretation of vector multiplication and changing the coordinate system of velocity and acceleration. Help students understand these principles for analyzing and interpreting data in these areas, and using real-world examples to illustrate the importance of scientific material. • Providing students with the basics and additional topics related to the outputs of thinking and analysis. • Asking a group of intellectual questions during the lectures, such as (how, why, when, and what is the reason) for topics. • Giving students homework that requires self-explanations using scientific methods. • his will be achieved through lectures, laboratories, interactive tutorials, reports and seminars on analytical mechanics topics.

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	5.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	50	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.7
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	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	Dynamic of particle (Rectilinear Motion). and study the vertical motion in a resisting medium
Week 2	Force as function of velocity and time
Week 3	Dynamic of particle (General motion).
Week 4	motion of projectile in uniform gravitational field
Week 5	
Week 6	Linear Air Resistance and none linear air resistance .
Week 7	The harmonic Oscillator in two and three dimensions.
Week 8	The Energy equation for smooth constraint
Week 9	Discussion and Quiz
Week 10	General coordinates and explaining using in LaGrange equation
Week 11	.solving a problems about the subject
Week 12	Discussion and Quiz
Week 13	Hamilton equation
Week 14	solving a problems about the abuove subject
Week 15	Discussion and Quiz

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	1. الثيرموداينمك / د. سامي مظلوم صالح ، د. امجد عبد الرزاق كرجيه ، د. عبد اللطيف ابراهيم 2. الحرارة والثيرموداينمك / د.رمزي حنا ميشو ، د. هاشم عبود قاسم	Yes Yes

Recommended Texts	1. الديناميكيا الحرارية والنظرية الحركية للغازات والميكانيك الاحصائي / تاليف فرنسيس وستون سيرس ، ترجمة د. رضا جاد جرجيس، د. ظاهر مجيد الشربتي. 2. Thermodynamics : sears: copy.1 ,536.7,4539 3. Thermodynamics : J.P.Holman: ,1069,536,H747. 4. الحرارة والثيرموداينمك :تعريب د. محي الدين عباس، د. حسين السايس	yes No No Yes
Websites	https://books-library. Net www.scribd.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	**Analytical Mechanics I**			Module Delivery	
Module Type	**C**			☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY23010**				
ECTS Credits	**4**				
SWL (hr/sem)	**100**				
Module Level	2		Semester of Delivery	3	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Dr.Ayad Jyad Jarjees al sofy		e-mail	Dr.ayad@uomosul.edu.iq	
Module Leader's Acad. Title	Lecturer		Module Leader's Qualification	Ph.MSc.	
Module Tutor	Heba Mohammed Tahir		e-mail	hebamohammed@uomosul.edu.iq	
Peer Reviewer Name	Name		e-mail	E-mail	
Scientific Committee Approval Date	07/06/2023		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. في الفيزياء النظرية والفيزياء الرياضية، الميكانيكا التحليلية أو الميكانيكا النظرية هي فرع من فروع الميكانيكا، وهي مجموعة من الصيغ البديلة التي لها صلة وثيقة بالميكانيكا الكلاسيكية. أثبتت الميكانيكا التحليلية أنها أداة مهمة جدا في الفيزياء النظرية. 2. من اهداف المادة ان يكون الطالب على معرفة برياضيات المتجهات وداينميك الجسيم وحركته على خط مستقيم بالاضافة الى حركته بصورة عامة وكذلك دراسة تاثير حركة المحاور الانتقالية والدورانية وعلاقتها بوصف حركة الجسيم. 3. تتيح للطالب دراسة الأنظمة والتي يكون فيها تسارع " تعجيل " في الحركة ، والتي تنطوي على (الكينماتيك) أي دراسة حركة الاجسام من حيث الزمن ، والازاحة ، والسرعة ، وسرعة الحركة ان كان في خط مستقيم أو في اتجاه دائري (والكينتيك) دراسة القوى المرتبطة مع الحركة ، بما في ذلك القوى التي تسبب الحركة والقوى الناتجة عن الحركة . 4. من اهداف المقرر هو تعريف الطالب على اهمية المادة العلمية للمقرر 5. وصف جميع الحركات اتجاهيا والية تطبيقات 6. تمكين الطالب بالاعتماد على نفسه في الية تطبيق المادة العلمية في حل جميع المسائل 1. In theoretical physics and mathematical physics, analytical mechanics or theoretical mechanics is a branch of mechanics, a group of alternative formulations closely related to classical mechanics. Analytical mechanics has proven to be a very important tool in theoretical physics. 2. One of the objectives of the course is for the student to be familiar with the mathematics of vectors, the dynamics of the particle and its movement on a straight line, in addition to its movement in general, as well as studying the effect of the movement of the transitional and rotational axes and their relationship to describing the movement of the particle. 3. It allows the student to study systems in which there is acceleration in motion, which involves (kinematics), that is, the study of the movement of bodies in terms of time, displacement, velocity, and the speed of movement whether in a straight line or in a circular direction (and kinetics) studying forces associated with motion, including forces causing motion and forces resulting from motion. 4. One of the objectives of the course is to introduce the student to the importance of the scientific material of the course 5. Describe all the directional movements and the mechanism of their applications

	6. Enabling the student to rely on himself in the mechanism of applying the scientific material in solving all issues
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	- الية تطبيق قوانين الفيزياء نظريا للمادة العلمية وطرق فهمها. . 1 توسيع مفاهيم الطلبة لموضوع المتجهات. . 2 الية تطبيق المتجهات في تحليل جميع قوانين الفيزياء . 3 كيفية حل المسائل باختلاف نوعية المحاور المستخدمة. . 4 المام الطالب بين الفكرة والتطبيق للمادة العلمية. . 5 الية الربط بين جميع مفردات المقرر المطلوب. --The mechanism of theoretically applying the laws of physics to scientific material and ways to understand them. 1 . Expand students' understanding of the topic of vectors. 2 . Vector application mechanism in the analysis of all laws of physics 3 . How to solve problems according to the type of axes used 4 . The student's knowledge between the idea and application of the scientific material. 5 . The mechanism of linking all the required course items.
Indicative Contents المحتويات الإرشادية	يتضمن المحتوى الارشادي ما يلي 1. مقدمة عن رياضيات المتجهات وحركة الانظمة الديناميكية توصف عادة بدلالة كميات عددية واتجاهية. الكمية العددية هي كميات مادية لها مقدار فقط ومن الامثلة على الكميات العددية الكتلة والكثافة والحجم ودرجة الحرارة والطاقة. الكمية الاتجاهية كمية تتحدد بكل من المقدار والاتجاه، عكس الكمية العددية ومن امثلة الكميات المتجهة الازاحة والسرعة والتعجيل والقوة . 2 . دراسة جبر المتجهات ببعض التعاريف الاصطلاحية الخاصة بالمتجهات. 3 . تغيير نظام الاحداثيات ،تفاضل ضرب المتجهات ، السرعة والتعجيل في الاحداثيات القطبية المستوية 4 . المركبات المماسية والعمودية للتعجيل 5 .السرعة والتعجيل في الاحداثيات الاسطوانية والكروية instructional content includes the following 1. Introduction to vector mathematics The motion of dynamical systems is often described in terms of scalar and vector quantities. A scalar quantity is a physical quantity that has only a magnitude. Examples of scalar

	quantities are mass, density, volume, temperature and energy. Vector quantity is a quantity that is determined by both magnitude and direction, unlike the scalar quantity. Examples of vector quantities are displacement, velocity, acceleration, and force. 2 . Studying vector algebra with some idiomatic definitions of vectors. 3 . Changing the coordinate system, differentiating vector multiplication, velocity and acceleration in plane polar coordinates 4 . Tangential and perpendicular compounds of acceleration 5. Speed and acceleration in cylindrical and spherical coordinates
Learning and Teaching Strategies **استراتيجيات التعلم والتعليم**	
Strategies	• ابدأ بتقديم نظرة عامة عن الميكانيك التحليلي ، مع التركيز على المفاهيم الأساسية للمتجهات من حيث الكميات الفيزيائية والوحدات والرموز ، بالإضافة إلى المعنى الهندسي لجبر المتجهات وكذلك التفسير الهندسي للضرب الاتجاهي وتغيير نظام الاحداثيات للسرعة والتعجيل. ومساعدة الطلاب على فهم هذه المبادئ لتحليل وتفسير البيانات في هذه المجالات ، واستخدام أمثلة من العالم الحقيقي لتوضيح أهمية المواد العلمية. • تزويد الطلاب بالأساسيات والموضوعات الإضافية المتعلقة بمخرجات التفكير والتحليل. طرح مجموعة من الأسئلة الفكرية أثناء المحاضرات مثل (كيف ولماذا ومتى وما السبب) لموضوعات. إعطاء الطلاب واجبات تتطلب شرحًا ذاتيًا باستخدام الأساليب العلمية. • سيتم تحقيق ذلك من خلال المحاضرات والمختبرات والبرامج التعليمية التفاعلية والتقارير والندوات حول مواضيع الميكانيك التحليلي. • Begin by providing an overview of analytical mechanics, focusing on the basic concepts of vectors in terms of physical quantities, units, and symbols, as well as the geometric meaning of vector algebra as well as the geometric interpretation of vector multiplication and changing the coordinate system of velocity and acceleration. Help students understand these principles for analyzing and interpreting data in these areas, and using real-world examples to illustrate the importance of scientific material. • Providing students with the basics and additional topics related to the outputs of thinking and analysis. • Asking a group of intellectual questions during the lectures, such as (how, why, when, and what is the reason) for topics.

	• Giving students homework that requires self-explanations using scientific methods. • his will be achieved through lectures, laboratories, interactive tutorials, reports and seminars on analytical mechanics topics.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	3.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	52	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.46
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

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

Delivery Plan (Weekly Syllabus)

المنهاج الأسبوعي النظري	
	Material Covered
Week 1	Introduction to thermodynamic & Fundamental concepts
Week 2	Definition : physical Quantities & units
Week 3	Scalar and Vectors Quantities, Notation
Week 4	Formal Definitions and Rules: Equality of Vectors, Vector Addition , multiplication by a scalar , Vector subtraction and the Null Vector.
Week 5	Discussion and Quiz
Week 6	Magnitude of a Vector and Unit Coordinate Vectors.
Week 7	Geometric Meaning of Vector Operations.
Week 8	Discussion and Quiz
Week 9	The Scalar Product , work and Some Applications of Vector :Equilibrium of a Particle and law of cosines
Week 10	The Vector Product : Geometric Interpretation of the cross Product
Week 11	Moment of a Force , Triple Products
Week 12	Discussion and Quiz
Week 13	Vector calculus and kinematics: vector derivative, vector integral, vector differential and Tangential and Normal compounds of acceleration
Week 14	Velocity and acceleration in plane polar coordinates and Velocity and acceleration in cylindrical and spherical coordinates
Week 15	Discussion and Quiz

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	1. الميكانيك التحليلي / تأليف : كرانت ز. فاولس , ترجمة : د. طالب ناجي الخفاجي	Yes
Recommended Texts	Analytical mechanics (Fowlus)	yes
	Analytical mechanics (Fowlus and Cassidad)	No
	Analytical mechanics	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	Biophysics			Module Delivery	
Module Type	C			☒ Theory ☒ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	PHY47036				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	4		Semester of Delivery	7	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader			e-mail		
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor			e-mail		
Peer Reviewer Name	Name		e-mail	E-mail	
Scientific Committee Approval Date			Version Number		

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	Biophysics is the scientific field concerned with studying the methods and theories of physics to understand how vital systems work, study how different parts of the cell move and their functions, and study complex systems in our bodies and their complexity such as the brain, blood circulation, digestive system, and more.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	One of the most important outputs of biophysics explains to the student a wide range of topics such as how neurons communicate with each other and how plant cells convert into energy, as well as an explanation of how and the possibility of healthy cells in DNA turning into cancerous cells in the event of some changes occurring to them and other problems and topics other biological.
Indicative Contents المحتويات الإرشادية	This course introduces the use of Chemical, physical methods in the study of biological systems: Scope of Biophysics, Fundamentals of Biophysics, interaction of light With matter, Chemical Forces, Diffusion and Brownian motion, Viscosity, Light Scattering Small - Molecule Solutes: hydrophiles, hydrophobes, large Hydrophobic Solutes and Surfacec, Aqueous Environment of the Cell, State of Water in bio-structures & its significance, phsico Chemical Techniques to Study Biophsics (Introduction, Physical Aspects, of Hearing) (The Ear, Elementary acoustics, Theories of hearing), Optical defects of the eye, Neural aspects of Vision, Chemical equilibriums in biological systems, Bioenergy

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The student of bio physics should have knowledge of the following: 1. The normal structure and functions of the human body and the main vital system. 2. Radiation, radioactivity, dosimetry and medical devices. 3. Radiation safety practice and requirements for radiation shields. 4. Medical imaging and related devices.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	47	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	53	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	3

Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	10% (10)	4, 10 and 15	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	Scope of Biophysics, Fundamentals of Biophysics.
Week 2	Interaction of light With matter.
Week 3	Chemical Forces.
Week 4	Discussion and Quiz
Week 5	Diffusion and Brownian motion, Viscosity.
Week 6	Light Scattering Small - Molecule Solutes: hydrophiles, hydrophobes, large Hydrophobic Solutes and Surfacec.
Week 7	Aqueous Environment of the Cell, State of Water in bio-structures & its significance.
Week 8	phsico Chemical Techniques to Study Biophsics (Introduction, Physical Aspects, of Hearing).
Week 9	The Ear, Elementary acoustics, Theories of hearing.
Week 10	Discussion and Quiz

Week 11	Optical defects of the eye.
Week 12	Neural aspects of Vision.
Week 13	Chemical equilibriums in biological systems.
Week 14	Bioenergy.
Week 15	Discussion and Quiz

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		
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	**Computer 1**			Module Delivery	
Module Type	B			Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	UOM103				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level		1	Semester of Delivery		2
Administering Department		Type Dept. Code	College	Type College Code	
Module Leader	Yasir aljawadi		e-mail	yasseraljwaady@uomosul.edu.iq	
Module Leader's Acad. Title		Assistant Professor	Module Leader's Qualification		Ph.D.
Module Tutor			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	Mathematic ,mechanic, electromagnetic	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1. Teaching students to use a computer. 2. Using the MATLAB program to solve mathematical problems and physical applications. 3. Use software in laboratories to draw curves and solve equations. 4. Educate the student to work in the private and public sectors.
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. Learn the basics of MATLAB® through this introductory tutorial on commonly used features and workflows. Get started with the MATLAB language and environment so that you can analyze science and engineering data 2. Write efficient, robust, and well-organized code using features in MATLAB. Take your coding to the next level by learning skills that will take you from someone who writes working MATLAB code to someone who develops high-quality MATLAB applications. 3. Learn the basics of practical machine learning for classification problems in MATLAB®. Use a machine learning model that extracts information from real-world data to group your data into predefined categories. 4. Get started creating apps in MATLAB by using App Designer to build an app from start to finish. By the end of the course, you will have an app that creates random mazes based on different settings selected by the user
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Matlab, command window, inept, output, workspaces, command history, File, edit, debug, desktop, window, help. Arithmetic, error input. Vectors, creating large vectors from existing variables, creating vectors with uniformly spaced elements. Characterizing a vector, magnitude of vectors. Vector dot and cross products Referencing vector component. Add, subtraction, division of vector. Examples for application physics. Course Outcomes: By following through the teaching process of matlab language in order to enable students to understand the program. To help students to solving physics problems. To encourage students, develop their own skills in computer.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Expand students' perceptions of this computer science and its contents, which help the student to analyze and study the results of laboratory and theoretical experiments, expand understanding of physics and other sciences, and give the student an opportunity to obtain work in the public or private sector by learning a global programming language, the MATLAB language that serves All engineering, medical and specialized sciences ...

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	40	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	60	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 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	5% (5)	Continuous	All
	Report	1	5% (5)	13	LO #5, #8 and #10
Summative assessment	Midterm Exam	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Matlab, command window, workspace
Week 2	Lab 2: command history, file, edit, debuge,.
Week 3	Lab 3: desktop, window, help, input, output
Week 4	Lab 4: Arithmetic, error input, vectors, ng large vectors from existing variables
Week 5	Discussion and Quiz
Week 6	Lab 5: creating vectors with uniformly spaced elements
Week 7	Lab 6: Characterizing a vector, magnitude of vectors
Week 8	Mid Exam.
Week 9	Lab 7: Vector cross products
Week10	Lab 8: Vector dot products
Week 11	Lab9: Find the coefficient of thermal conductivity of a good conductor using the Searle method
Week 12	Lab 10: Use of simple constant volume air thermometer and to measure:
Week 13	Lab 11: Use matlab to calculate Room temperature, Boiling point of liquid.
Week 14	Discussion and Quiz
Week 15	Lab 12: curriculum review

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	MATLAB DeMYSTiFieD A self-teaching guide David McMAHON	Yes
Recommended Texts	A Guide to MATLAB Bian R. Hunt Ronald L. Lipsman Jonathan M. Rosenberg	Yes
Websites	https://www.mathworks.com/matlabcentral/	

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 2**			Module Delivery	
Module Type	**C**			Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	PHY23112				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	2		Semester of Delivery	3	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Yasir aljawadi		e-mail	yasseraljwaady@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor			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	UOM103	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1. Teaching students to use a computer. 2. Using the MATLAB program to solve mathematical problems and physical applications. 3. Use software in laboratories to draw curves and solve equations. 4. Educate the student to work in the private and public sectors.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1.The matrices, matrix from vector, transpose of matrix , complex element, compiex conjugates,. 2.Matrix multiplication, diminutions of matrix, array multiplication, columns rows. 3. Augmentation of matrices,. 5. Addition and subtraction of matrices, matrices division, formatrat. 6. Special matrix, identity matrix, square matrix, diagonal matrix, zeroe matrix, once matrix. 7. Same matrix operations, sum, sgrt, sartm, isequal,. 8. Referencing matrix elements,. 9. Rotting and graphics ,sin, cos, tan, tanh, exp,atan, asin,acos,atan
Indicative Contents المحتويات الإرشادية	By following through the teaching process of matiab language in order to enable students to understand the program To help students to solving physics problems. To encourage students develop their own skills in compute

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Expand students' perceptions of this computer science and its contents, which help the student to analyze and study the results of laboratory and theoretical experiments, expand understanding of physics and other sciences, and give the student an opportunity to obtain work in the public or private sector by learning a global programming language, the MATLAB language that serves All engineering, medical and specialized sciences ...

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	40	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	60	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 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	5% (5)	Continuous	All
	Report	1	5% (5)	13	LO #5, #8 and #10
Summative assessment	Midterm Exam	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Lab. Syllabus)
المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	Lab 1: The matrices, matrix from vector, transpose of matrix,
Week 2	Lab 2: Complex element, complex conjugates
Week 3	Lab 3: Matrix multiplication, diminutions of matrix
Week 4	Lab 4: Referencing matrix elements, array multiplication, columns rows
Week 5	Lab 5: Array multiplication, columns rows
Week 6	Lab 6: Applications and examples
Week 7	Lab 7: Special matrix, identity matrix, square matrix
Week 8	Lab 8: Diagonal matrix, zeroes matrix, once matrix
Week 9	Lab9: Add, subtraction, division of vector
Week10	Lab 10: Potting and graphics ,sin, cos, tan, tanh, exp,atan, asin, acos, atan,
Week 11	Lab 11: Axis commands, grid on, axis equal, collars, hold on, figure
Week 12	Lab 12: curriculum review

Learning and Teaching Resources

مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	MATLAB DeMYSTiFieD A self-teaching guide David McMAHON	Yes
Recommended Texts	A Guide to MATLAB Bian R. Hunt Ronald L. Lipsman Jonathan M. Rosenberg	Yes
Websites	App Building Onramp | Self-Paced Online Courses - MATLAB & Simulink Get started creating apps in MATLAB by using App Designer to build an app from start to finish. By the end of the course, you will have an app that creates random mazes based on different settings selected by the user.	

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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	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	Democracy &Human Right			Module Delivery	
Module Type	B			√ Theory √ Lecture Lab Tutorial Practical Seminar	
Module Code	UOM104				
ECTS Credits	2				
SWL (hr/sem)	50				
Module Level		1	Semester of Delivery		1
Administering Department		Type Dept. Code	College	Type College Code	
Module Leader	Basma Mohamed Natheer Ahmed		e-mail	bsmam2022@uomosul.edu.iq	
Module Leader's Acad. Title		assistant teacher	Module Leader's Qualification		Master's
Module Tutor			e-mail		
Peer Reviewer Name		Name	e-mail	E-mail	
Scientific Committee Approval Date			Version Number		

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- يهدف المُقرر بأنَّ يكون الطالب مُلِماً بمفاهيم العلوم السياسية والتعرف على مبادئ علم السياسة. 2- تقديم فهم علمي متوازن لأسُس حقوق الانسان بطريقة مُبسطة ومفهومة لأَغلب المُفردات والمواضيع التي تهم الطالب والتي تدخل ضمن تخصُصات مرحلة الأَولية الجامعية في العلوم السياسية، ساعين لفهم وإدراك أَفضل للمقومات والمبادئ الأَولية للدِراسات السياسية في إطار النظرية السياسية. 3- السعي لبلورة التفكير الإبداعي لدى الطالب والتي تركز على القدرة على استِدعاء معلومات أو خبرات تكون مُخزنة بعقله وطرح بدائل سريعة، وكذلك السعي لبلورة التفكير المعرفي لديه. 4- أَنَّ يكون مُتمكِناً مِن تشخيص كُل مُفردة أَو مادة علمية وتوظيفها في دِراسته أَو مجال عمله مُستقبلاً. 5- تنمية مهارات الطالب في التحليل الاجتماعي والسياسي . 6- التقريب ما بين الدِراسة النظرية والواقع الراهن. 7- توسيع مدارك طالب العلوم السياسية في التفريق بين المفاهيم السياسية.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	ا- المعرفة والفهم 1- أَنَّ يكون الطالب مُلِماً بمفاهيم ومُصطلحات العلوم السياسية. 2- أَنَّ يكون قادِراً على تحليل مُفردات العلوم السياسية باستخدام المناهج المُتخصِصة. 3- أَنَّ يكون قادراً على تمييز ماهية العوامل التي تؤَثر في سياسات الدولة داخلياً وخارجياً. 4- أَنَّ يكون قادراً على تحديد ماهية المفاهيم والمُصطلحات السياسية ومعرفة العلاقة الترابطية بين حقوق الانسان ببقية العلوم الاخرى. 5- أَنَّ يكون مُتمكِناً مِن تشخيص كُل مُفردة أَو مادة علمية وتوظيفها في دِراسته أَو مجال عمله مُستقبلاً. 6- أَنَّ يتمكن من فهم أَسُس حقوق الانسان. ب - المهارات الخاصة بالموضوع 7– اكتساب الطالب لمهارات وقدرات التحليل المنطقي للتفاعُلات والمُتغيرات السياسية والاجتماعية الداخلية واثرها على سياسة الدولة. 8– اكتساب الطالب لمهارات االتحليل العلمي. 9– القدرة على الجمع بين الذكاء والدِراسة والمُمارسة بغية الوصول إلى الأَكاديمي المُتخصص الذي يملك معرفة في العلوم السياسية، جنباً إلى جنب مع المعرفة بالمؤثرات الاجتماعية والاقتصادية والثقافية التي تؤثر في اتجاهات ومواقف الدولة والمجتمع
Indicative Contents المحتويات الإرشادية	- التذكر : السعي لبلورة التفكير الابداعي لدى الطالب والتي تُركز على القدرة على استدعاء معلومات أو خبرات تكون مُخزنة بعقله وطرح بدائل سريعة، والقدرة على طرح افكار متنوعة تتغير مع تغير الموضوع. 2- الاستنتاج والتقييم : السعي لبلورة التفكير الناقد لدى الطالب والذي يُركز على

التحليل والتقييم للحلول المعروضة أمامه وفق معايير مُتفق عليها. 3- الملاحظة.	

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1. المُحاضرات المصحوبة بالشرح والتوضيح. 2. المُناقشة والعصف الذهني. 3. المحاضرات الفيديوية. 4. استِخدام الأمثلة التوضيحية والتطبيقية لإثراء المادة العلمية. 5. الحلقات النقاشية والمجاميع البحثية. 6. المُسابقات العلمية. 7. البحوث والتقارير النظرية والتحليلية ومُناقشتها وتقييمها. 8. عرض المادة بوربوينت. 9. استخدام التعليم حضوري+مدمج عبر برنامج Google Classroom

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	15	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	10	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	75		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	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	حقوق الانسان وتطورها في التاريخ البشري
Week 2	حقوق الانسان في العصور القديمة والوسيطة
Week 3	حقوق الانسان في التاريخ الحديث
Week 4	حقوق الانسان (التحديد والتعريف والضمانات)
Week 5	العلاقة بين حقوق الانسان والحريات العامة
Week 6	اشكال واصناف حقوق الانسان والترابط بينها
Week 7	ضمانات الحريات العامة
Week 8	التقاضي والتظلم غير القضائي
Week 9	الطعن القضائي
Week 10	تحديد مسؤولية الدولة عن اعمالها الشرعية
Week 11	اثر ازدواجية القضاء على الحريات العامة
Week 12	مفهوم المساواة
Week 13	التطور التاريخي لمفهوم المساواة
Week 14	التطور الحديث لمفهوم المساواة
Week 15	تعريف الحريات العامة وتطورها التاريخي

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	كتاب حقوق الانسان تأليف (د. حافظ علوان الدليمي)	Yes
Recommended Texts	1. الديمقراطية وحقوق الانسان, محمد عابد الجابري 2. حقوق الانسان والديمقراطية والحريات العامة ، ماهر صبري كاظم 3. حقوق الانسان تطورها مضامينها حمايتها ، رياض عزيز هادي	No
Websites	https\\:nur.uobasrah.edu.iq https\\:uomustansiriyah.edu.iq	

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	Digital Electronics			Module Delivery	
Module Type	**Core**			☒Theory ☒Lecture ☒Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY24017**				
ECTS Credits	**6**				
SWL (hr/sem)	150				
Module Level	2		Semester of Delivery	4	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Yussra Malalah Abdullah		e-mail	yussramalalah@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Msc	
Module Tutor			e-mail		
Peer Reviewer Name	Name		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		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. Explain the basic differences between digital and analog quantities Show how voltage levels are used to represent digital quantities Describe various parameters of a pulse waveform such as rise time, fall time, pulse width, frequency, period, and duty cycle ■ Explain the basic logic functions of NOT, AND, and OR ■ Describe several types of logic operations and explain their application in an example system ■ Describe programmable logic, discuss the various types, and describe how PLDs are programmed ■ Identify fixed-function digital integrated circuits according to their complexity and the type of circuit packaging ■ Identify pin numbers on integrated circuit packages 2. Review the decimal number system ■ Count in the binary number system ■ Convert from decimal to binary and from binary to decimal ■ Apply arithmetic operations to binary numbers ■ Determine the 1's and 2's complements of a binary number ■ Express signed binary numbers in sign-magnitude, 1's complement, 2's complement, and floating-point format ■ Carry out arithmetic operations with signed binary numbers ■ Convert between the binary and hexadecimal number systems ■ Add numbers in hexadecimal form ■ Convert between the binary and octal number systems ■ Express decimal numbers in binary coded decimal (BCD) form 3. ■ Describe the operation of the inverter, the AND gate, and the OR gate ■ Describe the operation of the NAND gate and the NOR gate ■ Express the operation of NOT, AND, OR, NAND, and NOR gates with Boolean algebra ■ Describe the operation of the exclusive-OR and exclusive-NOR gates 4. ■ Analyze basic combinational logic circuits, such as AND-OR, AND-OR-Invert, exclusive-OR, and exclusive-NOR ■ Use AND-OR and AND-OR-Invert circuits to implement sum-of-products (SOP) and product-of sums (POS) expressions ■ Write the Boolean output expression for any combinational logic circuit ■ Develop a truth table from the output expression for a combinational logic circuit ■ Use the Karnaugh map to expand an output expression containing terms with missing variables into a full SOP form 5. ■ Distinguish between half-adders and full-adders ■ Use full-adders to implement multibit parallel binary adders ■ Explain the differences between ripple carry and look-ahead carry parallel adders ■ Use the magnitude comparator to determine the relationship between two binary numbers and use cascaded comparators to handle the comparison of larger numbers ■ Implement a basic binary decoder ■ Use BCD-to-7-segment decoders in display systems ■ Apply a decimal-to-BCD priority encoder in a simple keyboard application
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	**The student should be able to:** 1. . Define analog ◆ Define digital ◆ Explain the difference between digital and analog quantities ◆ State the advantages of digital over analog ◆ Give examples of how digital and analog quantities are used in electronics 2. Also should be able to ◆ List three basic logic functions ◆ Define the NOT function ◆ Define the AND function ◆ Define the OR function 3. Explain why the decimal number system is a weighted system ◆ Explain how powers of ten are used in the decimal system ◆ Determine the weight of

	each digit in a decimal number 4. List the hexadecimal characters ◆ Count in hexadecimal ◆ Convert from binary to hexadecimal ◆ Convert from hexadecimal to binary ◆ Convert from hexadecimal to decimal ◆ Convert from decimal to hexadecimal ◆ Add hexadecimal numbers ◆ Determine the 2's complement of a hexadecimal number ◆ Subtract hexadecimal numbers 5. ◆ Identify negation and polarity indicators ◆ Identify an inverter by either its distinctive shape symbol or its rectangular outline symbol ◆ Produce the truth table for an inverter ◆ Describe the logical operation of an inverter 6. ◆ Define variable ◆ Define literal ◆ Identify a sum term ◆ Evaluate a sum term ◆ Identify a product term ◆ Evaluate a product term ◆ Explain Boolean addition ◆ Explain Boolean multiplication 7. ◆ Analyze and apply AND-OR circuits ◆ Analyze and apply AND-OR-Invert circuits ◆ Analyze and apply exclusive-OR gates ◆ Analyze and apply exclusive-NOR gates 8. ◆ Describe the function of a half-adder ◆ Draw a half-adder logic diagram ◆ Describe the function of the full-adder ◆ Draw a full-adder logic diagram using half-adders ◆ Implement a full-adder using AND-OR logic 9. Define decoder ◆ Design a logic circuit to decode any combination of bits ◆ Describe the 74HC154 binary-to-decimal decoder ◆ Expand decoders to accommodate larger numbers of bits in a code ◆ Describe the 74HC42 BCD-to-decimal decoder ◆ Describe the 74HC47 BCD-to-7-segment decoder ◆ Discuss zero suppression in 7-segment displays ◆ Use VHDL to describe various types of decoders ◆ Apply decoders to specific applications
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Theoretical lectures: The term digital is derived from the way operations are performed, by counting digits. For many years, applications of digital electronics were confined to computer systems. Today, digital technology is applied in a wide range of areas in addition to computers. Such applications as television, communications systems, radar, navigation and guidance systems, military systems, medical instrumentation, industrial process control, and consumer electronics use digital techniques. Over the years digital technology has progressed from vacuum-tube circuits The binary number system and digital codes are fundamental to computers and to digital electronics in general. In this chapter, the binary number system and its relationship to other number systems such as decimal, hexadecimal, and octal are presented. Arithmetic operations with binary numbers are covered to provide a basis for understanding how computers and many other types of digital systems work. Also, digital codes such as binary coded decimal (BCD), the Gray code, and the ASCII are covered. The parity method for detecting errors in codes is introduced. The TI-36X calculator is used to illustrate certain operations [*8* hrs] Several types of combinational logic functions are introduced including adders, comparators, decoders, encoders, code converters, multiplexers (data selectors), DE multiplexers, and parity generators/checkers. VHDL implementation of each logic function is provided, and examples of fixed-function IC devices are included. Each

	device introduced may also be available in other logic families. [*10* hrs] the laws, rules, and theorems of Boolean algebra and their application to digital circuits. You will learn how to define a given circuit with a Boolean expression and then evaluate its operation. You will also learn how to simplify logic circuits using the methods of Boolean algebra, Karnaugh maps, and the Quine-McCluskey method. Boolean expressions using the hardware description language VHDL are also cover [8 hrs] Revision problem classes [3 hrs] Part B – Practical labs Eight experiments are included in this manual to provide through coverage of basic digital principles. They begin with a series of experiments on the principles of basic logic gates and their application in digital electronics and follow with the last experiment of flip-flops. Many types of IC logic families have been explained in the relevant sections and pin connections of many TTL have been given at the end of the laboratory manual book. [18 hrs] Each experiment is divided into four sections: 1-) Purpose, 2-) Theory, 3-) Experimental Procedure, and 4-) Discussion and Conclusions about the experiment. The theory section gives required brief information about the experiment's subject. Although the theoretical background for the experiment is provided at the theory section through each experiment, the necessary further information should be obtained during the theoretical consideration of this course and from many auxiliary books that are available in our library. The discussion and conclusion part should include the necessary interested questions about the experiment and related subjects to understand very well the experiment and its related subjects and also for the evaluation and the significance of the results of the experiment [18 hrs

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Students will learn factual material through lectures and guided reading. Tutorials will be used to apply the basic principles. Laboratory work that will be done in a co-requisite separate course will be used to demonstrate concepts and show differences between theory and reality. Lecture notes will be given to students prior to all lectures. That would help the learners to clarify their doubts during lecture time and make it more interactive. Problem sheets are given out to students and after time, the problems are discussed in class. Some of the problems will be handed in and then marked by peers to give Interactive lecturing style, with opportunities for questions, and requirement to work on simple problems, Peer marking of tutorial questions for formative feedback. Tutorial classes where students can ask questions and be lead through solutions as required formative feedback to fellow students

	Expanding students' Using visual aids and the latest technology to understand electronic circuits, using a computer and simulating all experiments and logical circuits to help students understand the subject. Using the method of discussion among everyone in solving related questions, and all students are required to participate and explain the subject to their peers, and this highlights the student's self-confidence, in addition to knowing his mistakes and avoiding them in the future

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	Digital and Analog Quantities Binary Digits, logic Levels, digital waveforms
Week 2	Basic Logic Functions, Combinational and Sequential Logic Functions

Week 3	Decimal Numbers ,Binary Numbers
Week 4	Decimal-to-Binary Conversion ,Binary Arithmetic
Week 5	Complements of Binary Numbers, Hexadecimal Numbers ,Octal Numbers
Week 6	Binary Coded Decimal (BCD) ,Digital Codes
Week 7	The Inverter, The AND gate, The OR Gate
Week 8	The NAND Gate, The NOR Gate ,The Exclusive-OR and Exclusive-NOR Gates
Week 9	Boolean Operations and Expressions, Laws and Rules of Boolean Algebra
Week 10	DE Morgan's Theorems, Boolean Analysis of Logic Circuits, Logic Simp. Using B. Algebra
Week 11	Standard Forms of Boolean Expressions, Boolean Expressions and Truth Tables
Week 12	The Karnaugh Map ,Karnaugh Map SOP Minimization
Week 13	Basic Combinational Logic Circuits, Implementing Combinational Logic
Week 14	The Universal Property of NAND and NOR gates , pulse Waveform Operation
Week 15	Half and Full Adders, parallel Binary Adders ,decoders - encoders –Comparators,muiliplexer

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: The basic logic gates (AND ,OR, NOT)
Week 2	Lab 2: The university gates (NAND ,NOR)
Week 3	Lab 3: And-OR-INVERTER Logic circuit
Week 4	Lab 4: Ex-OR ,Ex-NOR gates
Week 5	Lab 5: Conversion binary system to Gray code
Week 6	Lab 6: Conversion Gray code to binary system
Week 7	Lab 7: Half-Adder ,Full-Adder, design logic circuit
Week 8	Lab 8:. 4-bit parallel Adder
Week 9	Lab 9: Decoder ,Binary decoded decimal(BCD)

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Digital Fundamentals ELEVENTH EDITION Thomas L. Floyd	Yes
Recommended Texts	Digital Electronics Principles, Devices and Applications Anil K. Maini Defence Research and Development Organization (DRDO), India	Yes
Websites	https://www.javatpoint.com/digital-electronics	

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	Elective 2 (Special Relativity + Medical physics)			Module Delivery	
Module Type	E			☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY48042**				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level		4	Semester of Delivery		8
Administering Department		Type Dept. Code	College	Type College Code	
Module Leader	Imad Ahmed Hussain		e-mail	dr.imad1972@uomosul.edu.iq	
Module Leader's Acad. Title		Assistant Professor	Module Leader's Qualification		Ph.D.
Module Tutor			e-mail		
Peer Reviewer Name		Name	e-mail	E-mail	
Scientific Committee Approval Date		06/06/2023	Version Number		1.0

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1- This course deals with the basic concepts of Special relativity. 2- Knowing the most important cosmological scientific terms and their definition related to the subject of Special relativity. 3- To learn about Frames of Reference and The Galilean Transformation. 4- To understand the relationship between Newton's relativity and Einstein's relativity. 5- To know the Maxwell's Equations and the Ether. 6- To know the Lorentz Transformation and Geometry of Spacetime.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. identify basic concepts of the special theory of relativity, including Frames of Reference, Galilean Transformation, Lorentz Transformation and Geometry of Spacetime. 2. recognize and apply the scientific method to solve special theory of relativity problems and to critically evaluate hypotheses and theories proposed; 3. analyses and interpret information in order to communicate solutions to unpredictable and sometimes complex problems in the field of relativity. 4. demonstrate competence in, and/or understanding of, the use of basic cosmological instruments. 5. Helping the student to understand and analyze the evolution of the universe.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. 1 – Frames of Reference What is Relativity?, Constructing an Arbitrary Reference Frame, Inertial Frames of Reference. **2- Newtonian Relativity** The Galilean Transformation, Newtonian Force and Momentum**,** Newton's Second Law of Motion, Newton's Third Law of Motion, Newtonian Relativity, Maxwell's Equations and the Ether. **3- Einsteinian Relativity** Einstein's Postulates, Clock Synchronization in an Inertial Frame, Lorentz Transformation, Relativistic Kinematics, (Length Contraction, Time Dilation, Simultaneity, Transformation of Velocities (Addition of Velocities)), Relativistic Dynamics (Relativistic Momentum, Relativistic Force, Work, Kinetic Energy, Total Relativistic Energy, Equivalence of Mass and Energy, Zero Rest Mass Particles). **4- Geometry of Flat Spacetime** Geo metrical Properties of 3 Dimensional Space, Space Time Four Vectors, Spacetime

	Diagrams, Properties of Spacetime Intervals , Four-Vector Notation, Tensors.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Understanding the basic principles: providing an overview of the principles of special relativity, and this helps the student to comprehend and understand the universe that surrounds the globe. Using visualization tools: Relativity requires a deep visualization to understand models of universe. Therefore, educational videos are used in order for the student to understand. Other tools: Assigning students to make reports on special relativity and then discussing these reports, as well as assigning them to make posters or summarizing and presenting it for discussion. Collaboration and Discussion: Promote collaboration among students by organizing group discussions, case studies or problem-solving sessions. Encourage them to share their views, ideas and experiences related to special relativity. This collaborative environment promotes active learning, critical thinking, and knowledge sharing. Assessment and Feedback: Regularly assess students' understanding through quizzes, tests, or projects that evaluate their application of special relativity concepts. Provide constructive feedback to guide their learning and address any misconceptions. Consider incorporating formative assessments to gauge understanding before major evaluations, allowing for timely intervention and support.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ أسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	52	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	1
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	5% (5)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	5% (5)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	5% (5)	Continuous	All
	Report	1	5% (5)	13	LO #5, #8 and #10
Summative assessment	Midterm Exam	2hr	20% (20)	7	LO #1 - #7
	Final Exam	3hr	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week 1	What is Relativity?
Week 2	Frames of Reference
Week 3	The Galilean Transformation
Week 4	Newtonian Force and Momentum
Week 5	Discussion and Quiz
Week 6	Newtonian Relativity
Week 7	Maxwell's Equations and the Ether
Week 8	Einstein's Postulates
Week 9	Clock Synchronization in an Inertial Frame
Week 10	Discussion and Quiz
Week 11	Lorentz Transformation
Week 12	Relativistic Dynamics
Week 13	Relativistic Dynamics
Week 14	Geometry of Spacetime
Week 15	Discussion and Quiz

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	1- Relativity The Special and the General Theory - Albert Einstein -2005 2- THE SPECIAL THEORY OF RELATIVITY- J D Cresser-2003	No No
Recommended Texts	1- Introduction to special relativity-John W. & Sons,I. -1968 2- Special Relativity and Classical Field Theory – leonard S., Art F. -2019 3- Special Relativity-Alessio M. -2020	No No No
Websites	1- https://www.space.com/36273-theory-special-relativity.html 2- https://www.khanacademy.org/science/physics/special-relativity	

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	**Elective1 (solar energy+Nuclear reactors)**			Module Delivery	
Module Type	**E**			☒ Theory ☐Lecture ☐Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY47035**				
ECTS Credits	**4**				
SWL (hr/sem)	**100**				
Module Level	4		Semester of Delivery	7	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Yussra Malalah Abdullah		e-mail	yussramalalah@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Msc	
Module Tutor			e-mail		
Peer Reviewer Name	Name		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		Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	This subject provides the application of principles of solar energy .A number of solar technologies and applications methods are investigated. This subject uses a project based learning where students work in teams to design a solar system for a particular application considering environmental, social and financial constraints. Students learn to apply the principles of solar energy and design. Knowledge gained in this subject will allow graduates to practice in the area of renewable energy industry. The subject complements other subjects offered in the energy theme of the Department such as Energy for Sustainable Development and Sustainable Infrastructure Engineering ALSO : 1.Explain the Solar constant ,black body emission 2.Dealing with the sun ,its apparent motion acrossthe sky 3. Explain the insolation from the sun provides at the earth́s surface 4. Show how Solar astronmy affect on the solar radiation 5. Describe solar heating panels 6. Describe the optics of collectors 7.Explain the basic solar heating system 8. Direct conversion of solar energy to – work—photovoltaics
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	This is geared to students who desire ,desire a deeper understanding of the fundamental principles behind solar energy technology, also this give the student an insight into the nature of terrestrial insolation Also take the student survey the principles of heat transfer and optics ,to have scientific background to understand solar heaters with applications to space heating and hot water supply systems and include topics such as flat plate collectors arrays ,thermal storage and solar-assisted systems. The student also learns thermodynamic and photovoltaic conversion of solar energy to useful work. On completion of this subject the student is expected to: Identify the potential and limitations of solar energy as an alternative source of energy Analyze the distribution and variability of solar energy availability, and the limitations of solar energy devices Create solar energy system designs for sustainable energy solutions. **Generic skills** Ability to utilize a systems approach to complex problems, design and operational performance Proficiency in engineering design Ability to manage information and documentation Capacity for creativity and innovation Ability to function effectively as an individual and in multidisciplinary and multicultural teams, as a team leader or manager as well as an effective team member

Indicative Contents المحتويات الإرشادية	Indicative content includes the following: 1. Introduction to Solar Energy in the energy economy; Fundamental heat & mass transfer; Radiation properties of materials; and selective surfaces 2. Solar Geometry and solar angles; atmospheric effects and radiation prediction; and Solar radiation measurement 3. Flat plate collectors design and performance characteristic 4. Concentrating collectors design and performance characteristic; Evacuated tube collectors 5. Solar System design methods 6. Fundamentals of photovoltaic systems 7. Solar process heating 8. Solar drying, Solar cookers, Green houses and Solar stills 9. Solar water pumping; Solar refrigeration 10. Built environment applications passive and active systems 11. Solar hot water and solar heat pump systems

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Expanding students' Using visual aids and the latest technology to understand electronic circuits, using a computer and simulating all experiments and logical circuits to help students understand the subject. Using the method of discussion among everyone in solving related questions, and all students are required to participate and explain the subject to their peers, and this highlights the student's self-confidence, in addition to knowing his mistakes and avoiding them in the future

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	100		

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

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week 1	Explain the Solar constant ,the model sun ,black body radiation, Explain the insolation from the sun provides at the earth's surface
Week 2	Radiactive emission from the sun ,the spectral composition the solar constant
Week 3	Solar astronomy ,the earth orbit, the solar day ,solar coordinate ,
Week 4	insolation at zero air mass, Dealing with the sun ,its apparent motion acrossthe,
Week 5	Atmosphere model ,temperature profile, absorption and scattering radiation by atmosphere components, Show how Solar astronmy affect on the solar radiation
Week 6	Direct solar radiation ,Diffuse flux ,
Week 7	Explain the basic solar heating system ,Describe solar heating panels,Stagnant performance of a solar heating panel,
Week 8	Operational characteristics of a Flat –Plate collector
Week 9	Measurement of heat collection rate,Temperture controllers, overall performance of heating panels
Week 10	Solar heating system, Array orientation ,Array size ,Series and Parallel Array ,Pipe losses
Week 11	Heat exchangers ,Storage,
Week 12	Direct conversion of solar energy to – work—photovoltaics(intrinsic(pure)semiconductors,Extrinsic (doped)semiconductors
Week 13	The p-n junction ,the junction photovoltaic, spectral responsively of the photocurrent

Week 14	Maximum theoretical Efficiency as a function of Band gab
Week 15	Photovoltaic Array and Systems, Fabrication of silicon Photovoltaic

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	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	An Introduction to Solar Energy for Scientists and Engineers Sol WIEDER Fairleigh Dickinson University	Yes
Recommended Texts	Solar Energy by Arno Laus Olindo Miro and Rene	Yes
Websites	https://energypedia.info/wiki/Portal:Solar?gclid=CjwKCAjwhJukBhBPEiwAniIcNY93SIvfLaAJYrvLswcQo8r9Yg--6b8DhSTWk0vOZqVJX9VNv8-BIBoCFYMQAvD_BwE	

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	Electricity			Module Delivery	
Module Type	Core			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	PHY1102				
ECTS Credits	8				
SWL (hr/sem)	200				
Module Level	1		Semester of Delivery	1	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Abdulkhaliq auoyb sulaiman		e-mail	dr.abdulkhaliq@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor			e-mail		
Peer Reviewer Name	Name		e-mail	E-mail	
Scientific Committee Approval Date			Version Number		

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. The student must know the important Electric Field 2. The student must know the important Electron Flux 3. The student must know the important The Electric potential 4. Teaching the student cognitive concepts
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Matter & Charge 2. Electric Field 3. Electron charge 4. Electron Flux 5. The Electric potential. 6. Connect the electrical circuit 7. Motion of charge particle inside the electrical field
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Theoretical lectures Electric charges , Conductors and Insulators , Rutherford Experiment , Electric Field Strength , Lines of Force , electric field , , strength calculator , Applications on how to calculate electric field , strength , The field arising from a charged ring , The effect of an electric field on , charged particles , Electron charge , Electron Flux , The Electric potential , The potential of a charged disk Part B – Practical labs 1- قانون اوم 2- ايجاد مقاومة فولتميتر باستخدام طريقة المنحني البياني 3- ايجاد تردد التيار المتناوب باستخدام الصنوميتر 4- تحقيق قانون التربيع العكسي بواسطة الماكنتوميتر 5- ايجاد القوة الدافعة الكهربائية والمقاومة الداخلية لبطارية باستخدام طريقة المنحني البياني 6- ايجاد المركبة الافقية للمجال المغناطيسي باستخدام بطارية معلومة القوة الدافعة

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Expanding students ' perceptions about this science and its contents it includes that help in teaching the student cognitive concepts , Matter and Charge, Electric Field, Electron charge , Electron Flux , The Electric potential

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	Electric charges.
Week 2	Conductors and Insulators
Week 3	Rutherford Experiment
Week 4	Electric Field Strength
Week 5	Lines of Force
Week 6	electric field strength calculator
Week 7	Applications on how to calculate electric field strength.
Week 8	The field arising from a charged ring

Week 9	Electron charge
Week 10	Electron Flux
Week 11	The Electric potential
Week 12	The potential of a charged disk
Week 13	The effect of an electric field on charged particles
Week 14	charged particles
Week 15	, The potential of a charged ring

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: قانون اوم
Week 2	Lab 2: ايجاد مقاومة فولتميتر باستخدام طريقة المنحني البياني
Week 3	Lab 3: ايجاد تردد التيار المتناوب باستخدام الصنوميتر
Week 4	Lab 4: تحقيق قانون التربيع العكسي بواسطة الماكنتوميتر
Week 5	Lab 5: ايجاد القوة الدافعة الكهربائية والمقاومة الداخلية لبطارية باستخدام طريقة المنحني البياني
Week 6	Lab 6: ايجاد المركبة الافقية للمجال المغناطيسي باستخدام بطارية معلومة القوة الدافعة
Week 7	Lab 7:
Week 8	Lab 8:.
Week 9	Lab9:
Week10	Lab 10:
Week 11	Lab 11:
Week 12	Lab 12:

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	1- PHYSICS for SCIENTISTS & ENGINEERS with Modern Physics	Yes

	2- PHYSICS for SCIENTISTS & ENGINEERS , SERWAY.	Yes
Recommended Texts	.	
Websites	https://faculty.wcas.northwestern.edu/infocom/Ideas/electric.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	**Electromagnetic theory I**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	PHY47033				
ECTS Credits	4.00				
SWL (hr/sem)	100				
Module Level	4		Semester of Delivery	7	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Abdullah Idrees Mustafa		e-mail	abdullahidrees@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor	Abdullah Idrees Mustafa		e-mail	abdullahidrees@uomosul.edu.iq	
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	None	Semester	4
Co-requisites module	Electricity And Magnetism	Semester	

1

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1. Modeling and analysis: The module aims to provide a comprehensive understanding of electromagnetic fields and their behavior within a particular system or device. It allows engineers and scientists to create mathematical models and simulations to study the behavior of electromagnetic waves, currents, and fields. 2. Design optimization: The electromagnetic module can assist in optimizing the design of electromagnetic devices, such as antennas, sensors, motors, transformers, and circuits. By simulating the electromagnetic behavior, engineers can refine the design parameters and improve the efficiency, performance, and reliability of these devices. 3. Electromagnetic compatibility (EMC): The module helps in assessing electromagnetic compatibility issues, ensuring that different electronic systems can operate without interfering with each other. It analyzes electromagnetic interference (EMI) and electromagnetic susceptibility (EMS) to identify potential problems and propose solutions for reducing interference and improving system reliability. 4. Signal integrity analysis: In the field of high-speed electronics, the electromagnetic module aids in analyzing signal integrity issues that can arise due to electromagnetic effects, such as crosstalk, reflections, and transmission line effects. By simulating the behavior of signals in complex electronic circuits, engineers can optimize the design to minimize signal degradation and improve performance. 5. Antenna design and analysis: Electromagnetic modules are often used for designing and analyzing antennas, including their radiation patterns, impedance matching, and gain. The aim is to optimize the antenna's performance for specific applications, such as wireless communication, radar systems, and satellite communication. 6. Material characterization: Electromagnetic modules can also be used to characterize the electromagnetic properties of materials, such as conductivity, permittivity, and permeability. This information is crucial for designing electromagnetic devices and understanding their interactions with different materials. 7. Overall, the aim of an electromagnetic module is to provide engineers and scientists with powerful tools for understanding, analyzing, and optimizing electromagnetic phenomena in various systems and devices.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Understanding of electromagnetic theory: By studying an electromagnetic module, learners can develop a solid understanding of the fundamental principles and theories governing electromagnetic fields, including Maxwell's equations, electromagnetic wave propagation, and the behavior of electric and magnetic fields. 2. Proficiency in electromagnetic modeling and simulation: Learners can gain practical skills in using electromagnetic simulation software or tools within the module. They can learn how to create accurate mathematical models, set up simulations, and analyze the results to predict and understand the behavior of electromagnetic fields and devices. 3. Ability to design and optimize electromagnetic devices: With knowledge gained from the module, learners can acquire the skills necessary to design

	and optimize electromagnetic devices, such as antennas, circuits, motors, transformers, and sensors. They can learn techniques for improving device performance, efficiency, and reliability through simulation and analysis. 4. Familiarity with electromagnetic compatibility (EMC) principles: The module can provide learners with knowledge about EMC principles and techniques. They can understand how electromagnetic interference (EMI) can affect electronic systems and learn methods to mitigate EMI issues to ensure electromagnetic compatibility. 5. Insight into signal integrity analysis: Learners can develop an understanding of signal integrity issues in high-speed electronics and the impact of electromagnetic effects on signal quality. They can learn techniques to analyze and minimize signal degradation, crosstalk, reflections, and other phenomena that affect signal integrity. 6. Knowledge of antenna design and analysis: The module can equip learners with the skills needed to design and analyze antennas for various applications. They can understand antenna characteristics, such as radiation patterns, impedance matching, and gain, and learn techniques to optimize antenna performance. 7. Understanding of material properties and characterization: Learners can gain knowledge about the electromagnetic properties of different materials, such as conductivity, permittivity, and permeability. They can learn techniques to characterize materials and use this information to design electromagnetic devices and understand their interactions with different materials. 8. Problem-solving and critical thinking skills: Through the module, learners can develop problem-solving and critical thinking skills by applying electromagnetic theories and concepts to analyze and solve real-world engineering problems. They can learn to think analytically, make informed decisions, and troubleshoot issues related to electromagnetic phenomena. 9. Overall, studying an electromagnetic module can provide learners with a strong foundation in electromagnetic theory, practical skills in modeling and simulation, and the ability to design and optimize electromagnetic devices. It equips them with valuable knowledge and skills that are applicable in various fields, including electrical engineering, telecommunications, electronics, and related industries.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. 1- Vector Analysis for Electromagnetic Theory <u>A- Scalars and Vectors:</u> Introduction to scalars and vectors: Differentiating between scalar quantities (e.g., temperature, mass) and vector quantities (e.g., displacement, velocity) and their representation. Scalar and vector quantities in electromagnetic theory: Identifying scalar and vector quantities used in electromagnetic theory, such as electric field, magnetic field, and electric potential. Addition, subtraction, and multiplication of vectors: Understanding the operations involved in adding, subtracting, and multiplying vectors, including scalar

	multiplication and vector dot product. B- Vector Operations: Dot product and its applications: Defining the dot product of vectors, calculating dot products, and understanding its applications in finding the angle between vectors, determining work done, and calculating projections. Cross product and its applications: Defining the cross product of vectors, calculating cross products, and understanding its applications in finding the magnitude and direction of the resulting vector, calculating torque, and determining areas and volumes. Triple product and its applications: Exploring triple products, including the scalar triple product and vector triple product, and their applications in geometry and physics. Vector identities and properties: Introducing vector identities and properties, such as the distributive, associative, and commutative properties, as well as the triple scalar product and triple vector product identities. C- Coordinate Systems and Transformations: Cartesian coordinate system: Reviewing the Cartesian coordinate system and its representation of vectors using components. Cylindrical coordinate system: Introducing the cylindrical coordinate system and understanding how to express vectors in terms of cylindrical coordinates. Spherical coordinate system: Exploring the spherical coordinate system and learning how to express vectors in terms of spherical coordinates. Transformations between coordinate systems: Understanding the transformations between different coordinate systems, including conversions between Cartesian, cylindrical, and spherical coordinates. D- Gradient, Divergence, and Curl: Gradient operator and its properties: Defining the gradient operator and its properties, such as linearity and directional derivatives. Divergence operator and its applications in electromagnetic theory: Defining the divergence operator and its applications in analyzing the behavior of vector fields, such as electric and magnetic fields, and understanding the concept of flux. Curl operator and its applications in electromagnetic theory: Defining the curl operator and its applications in analyzing the rotation and circulation of vector fields, such as electromagnetic fields, and understanding the concept of circulation. Vector identities involving gradient, divergence, and curl: Introducing vector identities that involve gradient, divergence, and curl operators, such as the gradient theorem, divergence theorem, and curl theorem. E- Vector Fields: Electric field and magnetic field as vector fields: Exploring the concept of vector fields, specifically electric field and magnetic field, and understanding their behavior and properties. Line integrals of vector fields: Introducing line integrals and understanding their

	applications in evaluating the work done by a vector field along a curve. Surface integrals of vector fields: Defining surface integrals and understanding their applications in calculating flux through a surface defined by a vector field. Volume integrals of vector fields: Introducing volume integrals and understanding their applications in calculating the total effect of a vector field within a region of space. <u>F- Stokes' Theorem and Gauss's Divergence Theorem:</u> Statement and derivation of Stokes' theorem: Understanding the statement and derivation of Stokes' theorem, which relates the line integral of a vector field to the surface integral of its curl. Application of Stokes' theorem in electromagnetic theory: Applying Stokes' theorem to evaluate line integrals and surface integrals in electromagnetic theory 2- Introduction to Electromagnetic Theory: Electric and magnetic fields: Understanding the concept of electric and magnetic fields, their properties, and how they are represented mathematically. Coulomb's law and Gauss's law: Exploring the fundamental laws that describe the behavior of electric fields, including the inverse square law and electric flux. Ampere's law and Faraday's law: Examining the laws that relate magnetic fields to electric currents and changing magnetic fields to induced electric fields. Maxwell's equations: Introducing the set of equations that unify and summarize the behavior of electric and magnetic fields. Electrostatics: Electric field and potential: Studying the concepts of electric field intensity, electric potential, and their relationship. Conductors and dielectrics: Understanding the behavior of electric fields in conductive and dielectric materials. Capacitance and capacitance matrices: Analyzing the concept of capacitance, calculating capacitance values, and exploring the use of capacitance matrices in circuit analysis. Boundary value problems: Solving boundary value problems related to electric fields in different configurations. Magnetostatics: Magnetic field and magnetic flux: Understanding the magnetic field and magnetic flux density, as well as their properties and calculations. Biot-Savart law: Examining the law that relates a current element to the magnetic field it produces. Magnetic materials and magnetization: Exploring the behavior of magnetic materials, including ferromagnetic, paramagnetic, and diamagnetic materials. Inductance and inductance matrices: Studying the concept of inductance, calculating inductance values, and analyzing inductance matrices in circuit analysis.

	Magnetic boundary conditions: Understanding the conditions that govern the behavior of magnetic fields at interfaces and boundaries.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Conceptual Understanding: Start by providing an overview of electromagnetic theory, emphasizing its applications in stratigraphic,. Help students understand how electromagnetic principles and methods are used to analyze and interpret data in these areas. Use real-world examples and case studies to illustrate the relevance and significance of electromagnetic techniques. Visualization Tools: Utilize visual aids, diagrams, and interactive software to help students visualize electromagnetic phenomena and processes. Demonstrate the behavior of electromagnetic waves, electromagnetic induction, and other related concepts using animations or simulations. This will aid in reinforcing the understanding of abstract concepts and facilitate knowledge retention. Problem-Solving Practice: Include problem-solving activities and assignments that require students to apply electromagnetic theory to practical scenarios. Present them with real or simulated data and challenge them to analyze and interpret the information using appropriate electromagnetic techniques. This will develop their problem-solving skills and reinforce their understanding of the subject matter. Supplemental Resources: Recommend supplementary resources such as textbooks, research articles, and online resources that provide additional information on electromagnetic theory and its applications. Encourage students to explore these resources to gain a deeper understanding of the subject matter. Provide a curated list of recommended readings and online tools to support their learning. Assessment and Feedback: Regularly assess students' understanding through quizzes, tests, or projects that evaluate their application of electromagnetic concepts. Provide constructive feedback to guide their learning and address any misconceptions. Consider incorporating formative assessments to gauge understanding before major evaluations, allowing for timely intervention and support. Collaboration and Discussion: Foster collaboration among students by organizing group discussions, case studies, or problem-solving sessions. Encourage them to share their perspectives, ideas, and experiences related to electromagnetic analysis. This collaborative environment promotes active learning, critical thinking, and knowledge sharing.

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	Vector Analysis
Week 2	Applications on Vector analysis
Week 3	Coordinate Systems and Transformations:
Week 4	Gradient, Divergence, and Curl:
Week 5	Vector and scalar Fields:
Week 6	Stokes' Theorem and Gauss's Divergence Theorem.
Week 7	Discussion
Week 8	Quiz
Week 9	Introduction to Electromagnetic Theory:
Week 10	Discussion
Week 11	Quiz
Week 12	Electrostatics
Week 13	Magnetostatics

Week 14	Quiz
Week 15	Discussion

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	1-Engineering Electromagnetics, EIGHTH EDITION, William H. Hayt, Jr. and John A. Buck, The McGraw-Hill Companies, Inc., 2010. 2-Elements Of Electromagnetics, Seventh Edition, Matthew N. O. Sadiku, Oxford University Press, 2018.	Yes Yes
Recommended Texts	1-"Introduction to Electrodynamics" by David J. Griffiths This book provides a comprehensive introduction to electromagnetic theory, covering topics such as electrostatics, magnetostatics, electromagnetic waves, and electromagnetic radiation. It also includes numerous examples, illustrations, and exercises to reinforce understanding. 2-"Electromagnetic Fields and Waves" by Paul Lorrain, Dale R. Corson, and François Lorrain	Yes No No

	This book offers a detailed treatment of electromagnetic theory, covering topics such as vector analysis, electrostatics, magnetostatics, electromagnetic waves, and transmission lines. It includes numerous examples, exercises, and applications in various areas of physics and engineering. 3-"Classical Electromagnetism" by Jerrold Franklin This textbook provides a comprehensive and rigorous introduction to classical electromagnetism. It covers topics such as electrostatics, magnetostatics, electromagnetic waves, and electromagnetic radiation. The book also includes numerous worked examples and exercises. 3- "A Student's Guide to Maxwell's Equations" by Daniel Fleisch This book focuses specifically on Maxwell's equations, which form the foundation of electromagnetic theory. It provides a clear and intuitive explanation of the equations, their physical meaning, and their applications. The book includes numerous illustrations and examples to aid understanding. 4- "Electromagnetic Theory and Computation: A Topological Approach" by Paul W. Gross and P. Robert Kotiuga This book provides a unique perspective on electromagnetic theory, emphasizing the topological aspects of the subject. It covers topics such as vector calculus, electrostatics, magnetostatics, electromagnetic waves, and the principles of electromagnetic computation. 5-"Electromagnetic Waves and Radiating Systems" by Edward C. Jordan and Keith G. Balmain This book offers a comprehensive treatment of electromagnetic theory and its applications. It covers topics such as wave propagation, transmission lines, antennas, and electromagnetic radiation. The book includes numerous examples, illustrations, and exercises.	No No No No
Websites	1- Khan Academy (https://www.khanacademy.org/science/physics/electric-charge-electric-force-and-voltage) 2- Khan Academy offers a comprehensive collection of video lessons, practice exercises, and quizzes on various topics related to electromagnetic theory. It covers concepts such as electric charge, electric force, voltage, electric fields, and more. HyperPhysics (http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html) HyperPhysics is an online resource that provides a wide range of information on physics	

	topics, including electromagnetic theory. It offers clear explanations, diagrams, and interactive simulations to help visualize and understand electromagnetic concepts. MIT OpenCourseWare (https://ocw.mit.edu/courses/physics/) 3- MIT OpenCourseWare provides free access to lecture notes, problem sets, and other educational materials from MIT's physics courses. You can find courses specifically focused on electromagnetism, such as "Physics II: Electricity and Magnetism." Physics Classroom (https://www.physicsclassroom.com/) 4- The Physics Classroom offers interactive tutorials, conceptual explanations, and practice problems on various physics topics, including electromagnetism. It covers concepts such as electric fields, electric potential, circuits, magnetism, and electromagnetic waves. University of Colorado Boulder Physics Simulations (https://phet.colorado.edu/) 5- The University of Colorado Boulder offers a collection of interactive simulations on its PhET website. These simulations allow you to explore electromagnetic concepts, including electric fields, circuits, and electromagnetic waves, providing a hands-on learning experience. All About Circuits (https://www.allaboutcircuits.com/) 6- All About Circuits is a comprehensive online resource dedicated to electronics and electrical engineering. It covers various topics related to circuits, including electromagnetism, with detailed explanations, tutorials, and circuit analysis tools. Electromagnetic Field Theory Fundamentals (http://emft.ee.psu.edu/) 7- Electromagnetic Field Theory Fundamentals is a website developed by Pennsylvania State University. It provides lecture notes, examples, and interactive demonstrations on electromagnetic theory topics such as Maxwell's equations, wave propagation, and transmission lines.

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	**Electromagnetic theory II**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	PHY48139				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	4		Semester of Delivery	8	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Abdullah Idrees Mustafa		e-mail	abdullahidrees@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor	Abdullah Idrees Mustafa		e-mail	abdullahidrees@uomosul.edu.iq	
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	Electromagnetic THEORY I	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	1. Modeling and analysis: The module aims to provide a comprehensive understanding of electromagnetic fields and their behavior within a particular system or device. It allows engineers and scientists to create mathematical models and simulations to study the behavior of electromagnetic waves, currents, and fields. 2. Design optimization: The electromagnetic module can assist in optimizing the design of electromagnetic devices, such as antennas, sensors, motors, transformers, and circuits. By simulating the electromagnetic behavior, engineers can refine the design parameters and improve the efficiency, performance, and reliability of these devices. 3. Electromagnetic compatibility (EMC): The module helps in assessing electromagnetic compatibility issues, ensuring that different electronic systems can operate without interfering with each other. It analyzes electromagnetic interference (EMI) and electromagnetic susceptibility (EMS) to identify potential problems and propose solutions for reducing interference and improving system reliability. 4. Signal integrity analysis: In the field of high-speed electronics, the electromagnetic module aids in analyzing signal integrity issues that can arise due to electromagnetic effects, such as crosstalk, reflections, and transmission line effects. By simulating the behavior of signals in complex electronic circuits, engineers can optimize the design to minimize signal degradation and improve performance. 5. Antenna design and analysis: Electromagnetic modules are often used for designing and analyzing antennas, including their radiation patterns, impedance matching, and gain. The aim is to optimize the antenna's performance for specific applications, such as wireless communication, radar systems, and satellite communication. 6. Material characterization: Electromagnetic modules can also be used to characterize the electromagnetic properties of materials, such as conductivity, permittivity, and permeability. This information is crucial for designing electromagnetic devices and understanding their interactions with different materials. 7. Overall, the aim of an electromagnetic module is to provide engineers and scientists with powerful tools for understanding, analyzing, and optimizing electromagnetic phenomena in various systems and devices.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Understanding of electromagnetic theory: By studying an electromagnetic module, learners can develop a solid understanding of the fundamental principles and theories governing electromagnetic fields, including Maxwell's equations, electromagnetic wave propagation, and the behavior of electric and magnetic fields. 2. Proficiency in electromagnetic modeling and simulation: Learners can gain practical skills in using electromagnetic simulation software or tools within the module. They can learn how to create accurate mathematical models, set up simulations, and analyze the results to predict and understand the behavior of electromagnetic fields and devices. 3. Ability to design and optimize electromagnetic devices: With knowledge gained from the module, learners can acquire the skills necessary to design

	and optimize electromagnetic devices, such as antennas, circuits, motors, transformers, and sensors. They can learn techniques for improving device performance, efficiency, and reliability through simulation and analysis. 4. Familiarity with electromagnetic compatibility (EMC) principles: The module can provide learners with knowledge about EMC principles and techniques. They can understand how electromagnetic interference (EMI) can affect electronic systems and learn methods to mitigate EMI issues to ensure electromagnetic compatibility. 5. Insight into signal integrity analysis: Learners can develop an understanding of signal integrity issues in high-speed electronics and the impact of electromagnetic effects on signal quality. They can learn techniques to analyze and minimize signal degradation, crosstalk, reflections, and other phenomena that affect signal integrity. 6. Knowledge of antenna design and analysis: The module can equip learners with the skills needed to design and analyze antennas for various applications. They can understand antenna characteristics, such as radiation patterns, impedance matching, and gain, and learn techniques to optimize antenna performance. 7. Understanding of material properties and characterization: Learners can gain knowledge about the electromagnetic properties of different materials, such as conductivity, permittivity, and permeability. They can learn techniques to characterize materials and use this information to design electromagnetic devices and understand their interactions with different materials. 8. Problem-solving and critical thinking skills: Through the module, learners can develop problem-solving and critical thinking skills by applying electromagnetic theories and concepts to analyze and solve real-world engineering problems. They can learn to think analytically, make informed decisions, and troubleshoot issues related to electromagnetic phenomena. 9. Overall, studying an electromagnetic module can provide learners with a strong foundation in electromagnetic theory, practical skills in modeling and simulation, and the ability to design and optimize electromagnetic devices. It equips them with valuable knowledge and skills that are applicable in various fields, including electrical engineering, telecommunications, electronics, and related industries.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. 1 – Introduction to Electromagnetic Theory: Electric and magnetic fields: Understanding the concept of electric and magnetic fields, their properties, and how they are represented mathematically. Coulomb's law and Gauss's law: Exploring the fundamental laws that describe the behavior of electric fields, including the inverse square law and electric flux. Ampere's law and Faraday's law: Examining the laws that relate magnetic fields to electric currents and changing magnetic fields to induced electric fields. Maxwell's equations: Introducing the set of equations that unify and summarize the behavior of electric and magnetic fields.

	2- Electric and Magnetic Fields: Electric Fields: Electric fields are a fundamental concept in electromagnetism. They are generated by electric charges and exert forces on other charges within their vicinity. Electric fields can be visualized as the influence or "field" that surrounds charged particles, determining the direction and strength of the electric force they experience. Electric fields are characterized by their magnitude and direction. They follow the principle of superposition, meaning that the total electric field at a point is the vector sum of the fields generated by individual charges. Electric fields are responsible for various phenomena, including the attraction or repulsion of charged objects and the flow of electric current. Magnetic Fields: Magnetic fields are produced by moving electric charges or by the presence of magnetic materials. They exert forces on other moving charges and interact with other magnetic fields. Magnetic fields can be visualized as lines of force that form closed loops around a current-carrying wire or a magnetic dipole. Magnetic fields have both magnitude and direction. They exhibit properties such as polarity (north and south poles) and magnetic field strength. Magnetic fields are essential in various applications, including electric motors, generators, transformers, and magnetic resonance imaging (MRI) technology. Interplay between Electric and Magnetic Fields: One of the most significant aspects of electromagnetism is the interplay between electric and magnetic fields. This relationship is described by Maxwell's equations, which show how changing electric fields induce magnetic fields, and changing magnetic fields induce electric fields. This interplay leads to phenomena such as electromagnetic waves, where oscillating electric and magnetic fields propagate through space. It also gives rise to various electromagnetic devices and technologies, such as antennas, radio communication, and electric power transmission. 3- Maxwell’s Equations and Their Empirical Basis Gauss's Law for Electric Fields: This sub-module focuses on Gauss's law, which states that the electric flux through a closed surface is proportional to the net charge enclosed within that surface. It explores how Gauss's law is derived from Maxwell's equations and its implications in understanding the behavior of electric fields. Gauss's Law for Magnetic Fields: In this sub-module, you will study Gauss's law for magnetism, also known as the magnetic Gauss's law. It states that there are no magnetic monopoles, and the total magnetic flux through any closed surface is zero. This sub-module delves into the magnetic field behavior and the interplay between magnetic fields and currents. Faraday's Law of Electromagnetic Induction: This sub-module focuses on Faraday's law, which describes how a changing magnetic field induces an electromotive force (EMF) and generates an electric field. It covers

	topics such as electromagnetic induction, Lenz's law, and the concept of induced electromotive force. Ampere's Law with Maxwell's Addition: Ampere's law with Maxwell's addition relates the circulation of the magnetic field around a closed loop to the electric current passing through the loop, including the displacement current term. This sub-module explores the significance of the displacement current and its role in the generation of electromagnetic waves. Displacement Current and the Wave Equation: This sub-module delves deeper into the concept of displacement current, which is a term added to Ampere's law to ensure consistency with conservation of charge and to explain the propagation of electromagnetic waves. It explains how the displacement current leads to the wave equation and the derivation of the wave equation for electromagnetic waves. Electromagnetic Waves and Wave Propagation: This sub-module focuses on the characteristics and properties of electromagnetic waves, including their speed, wavelength, frequency, and polarization. It explores wave propagation in different media, the relationship between electric and magnetic fields in electromagnetic waves, and the energy carried by these waves. Time-Varying Fields and Maxwell's Equations: Time-varying electric and magnetic fields: Investigating the behavior of electric and magnetic fields in the presence of time-varying sources. Displacement current: Introducing the concept of displacement current and its role in the continuity equation. Wave equation and plane waves: Deriving the wave equation from Maxwell's equations and exploring the properties of electromagnetic waves, including their speed, wavelength, and frequency. Electromagnetic wave propagation: Studying the propagation of electromagnetic waves in various media, including free space, dielectric materials, and conductors. 3- Electromagnetic Waves: Wave polarization and polarization states: Understanding different polarization states of electromagnetic waves, such as linear, circular, and elliptical polarization. Reflection, transmission, and refraction of electromagnetic waves: Analyzing the behavior of electromagnetic waves at interfaces, including reflection, transmission, and refraction phenomena. Waveguides and transmission lines: Exploring the principles and characteristics of waveguides and transmission lines, including their modes of propagation and impedance matching techniques.

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	Conceptual Understanding: Start by providing an overview of electromagnetic theory, emphasizing its applications in stratigraphic,. Help students understand how electromagnetic principles and methods are used to analyze and interpret data in these areas. Use real-world examples and case studies to illustrate the relevance and significance of electromagnetic techniques. Visualization Tools: Utilize visual aids, diagrams, and interactive software to help students visualize electromagnetic phenomena and processes. Demonstrate the behavior of electromagnetic waves, electromagnetic induction, and other related concepts using animations or simulations. This will aid in reinforcing the understanding of abstract concepts and facilitate knowledge retention. Problem-Solving Practice: Include problem-solving activities and assignments that require students to apply electromagnetic theory to practical scenarios. Present them with real or simulated data and challenge them to analyze and interpret the information using appropriate electromagnetic techniques. This will develop their problem-solving skills and reinforce their understanding of the subject matter. Supplemental Resources: Recommend supplementary resources such as textbooks, research articles, and online resources that provide additional information on electromagnetic theory and its applications. Encourage students to explore these resources to gain a deeper understanding of the subject matter. Provide a curated list of recommended readings and online tools to support their learning. Assessment and Feedback: Regularly assess students' understanding through quizzes, tests, or projects that evaluate their application of electromagnetic concepts. Provide constructive feedback to guide their learning and address any misconceptions. Consider incorporating formative assessments to gauge understanding before major evaluations, allowing for timely intervention and support. Collaboration and Discussion: Foster collaboration among students by organizing group discussions, case studies, or problem-solving sessions. Encourage them to share their perspectives, ideas, and experiences related to electromagnetic analysis. This collaborative environment promotes active learning, critical thinking, and knowledge sharing.

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	Introduction to Electromagnetic Theory:
Week 2	Electric and Magnetic Fields:
Week 3	Electric Fields: Magnetic Fields:
Week 4	Interplay between Electric and Magnetic Fields:
Week 5	Discussion and Quiz
Week 6	Maxwell's Equations and Their Empirical Basis Gauss's Law for Electric Fields:
Week 7	Gauss's Law for Magnetic Fields:
Week 8	Faraday's Law of Electromagnetic Induction:
Week 9	Ampere's Law with Maxwell's Addition:
Week 10	Displacement Current and the Wave Equation:
Week 11	Electromagnetic Waves and Wave Propagation:
Week 12	Time-Varying Fields and Maxwell's Equations:
Week 13	Discussion and Quiz
Week 14	Electromagnetic Waves:
Week 15	Discussion and Quiz

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	1-Engineering Electromagnetics, EIGHTH EDITION, William H. Hayt, Jr. and John A. Buck, The McGraw-Hill Companies, Inc., 2010. 2-Elements Of Electromagnetics, Seventh Edition, Matthew N. O. Sadiku, Oxford University Press, 2018.	Yes Yes
Recommended Texts	1-"Introduction to Electrodynamics" by David J. Griffiths This book provides a comprehensive introduction to electromagnetic theory, covering topics such as electrostatics, magnetostatics, electromagnetic waves, and electromagnetic radiation. It also includes numerous examples, illustrations, and exercises to reinforce understanding. 2-"Electromagnetic Fields and Waves" by Paul Lorrain, Dale R. Corson, and François Lorrain This book offers a detailed treatment of electromagnetic theory, covering topics such as vector analysis, electrostatics, magnetostatics, electromagnetic waves, and transmission	Yes No No

	lines. It includes numerous examples, exercises, and applications in various areas of physics and engineering. 3-"Classical Electromagnetism" by Jerrold Franklin This textbook provides a comprehensive and rigorous introduction to classical electromagnetism. It covers topics such as electrostatics, magnetostatics, electromagnetic waves, and electromagnetic radiation. The book also includes numerous worked examples and exercises. 3- "A Student's Guide to Maxwell's Equations" by Daniel Fleisch This book focuses specifically on Maxwell's equations, which form the foundation of electromagnetic theory. It provides a clear and intuitive explanation of the equations, their physical meaning, and their applications. The book includes numerous illustrations and examples to aid understanding. 4- "Electromagnetic Theory and Computation: A Topological Approach" by Paul W. Gross and P. Robert Kotiuga This book provides a unique perspective on electromagnetic theory, emphasizing the topological aspects of the subject. It covers topics such as vector calculus, electrostatics, magnetostatics, electromagnetic waves, and the principles of electromagnetic computation. 5-"Electromagnetic Waves and Radiating Systems" by Edward C. Jordan and Keith G. Balmain This book offers a comprehensive treatment of electromagnetic theory and its applications. It covers topics such as wave propagation, transmission lines, antennas, and electromagnetic radiation. The book includes numerous examples, illustrations, and exercises.	No No No No
Websites	1- Khan Academy (https://www.khanacademy.org/science/physics/electric-charge-electric-force-and-voltage) 2- Khan Academy offers a comprehensive collection of video lessons, practice exercises, and quizzes on various topics related to electromagnetic theory. It covers concepts such as electric charge, electric force, voltage, electric fields, and more. HyperPhysics (http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html) HyperPhysics is an online resource that provides a wide range of information on physics topics, including electromagnetic theory. It offers clear explanations, diagrams, and interactive simulations to help visualize and understand electromagnetic concepts.	

	MIT OpenCourseWare (https://ocw.mit.edu/courses/physics/) 3- MIT OpenCourseWare provides free access to lecture notes, problem sets, and other educational materials from MIT's physics courses. You can find courses specifically focused on electromagnetism, such as "Physics II: Electricity and Magnetism." Physics Classroom (https://www.physicsclassroom.com/) 4- The Physics Classroom offers interactive tutorials, conceptual explanations, and practice problems on various physics topics, including electromagnetism. It covers concepts such as electric fields, electric potential, circuits, magnetism, and electromagnetic waves. University of Colorado Boulder Physics Simulations (https://phet.colorado.edu/) 5- The University of Colorado Boulder offers a collection of interactive simulations on its PhET website. These simulations allow you to explore electromagnetic concepts, including electric fields, circuits, and electromagnetic waves, providing a hands-on learning experience. All About Circuits (https://www.allaboutcircuits.com/) 6- All About Circuits is a comprehensive online resource dedicated to electronics and electrical engineering. It covers various topics related to circuits, including electromagnetism, with detailed explanations, tutorials, and circuit analysis tools. Electromagnetic Field Theory Fundamentals (http://emft.ee.psu.edu/) Electromagnetic Field Theory Fundamentals is a website developed by Pennsylvania State University. It provides lecture notes, examples, and interactive demonstrations on electromagnetic theory topics such as Maxwell's equations, wave propagation, and transmission lines.

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	**English Language**			Module Delivery	
Module Type	**S**			☒ Theory ☒ Lecture ☐Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**UOM102**				
ECTS Credits	2				
SWL (hr/sem)	50				
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	MA	
Module Tutor			e-mail		
Peer Reviewer Name			e-mail		
Scientific Committee Approval Date	/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 يتم كتابة اهم الأهداف التي تغطيها هذه المادة الدراسية بشكل جمل او فقرات توضح المواضيع التي سيتم التطرق اليها و دراستها و معالجتها)	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 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- 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 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.	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 استراتيجيات التعلم والتعليم	
Strategies يتم كتابة ملخص الاستراتيجية الرئيسية التي سيتم تبنيها في تقديم هذه المادة	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) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	32	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	18	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	1.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	50		

Module Evaluation تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	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) المنهاج الأسبوعي النظري	
	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 مصادر التعلم والتدريس		
	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 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	**General Astronomy**			Module Delivery	
Module Type	C			☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY1103**				
ECTS Credits	**8**				
SWL (hr/sem)	**200**				
Module Level	UGL		Semester of Delivery	One	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Imad Ahmed Hussain		e-mail	dr.imad1972@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor			e-mail		
Peer Reviewer Name	Name		e-mail	E-mail	
Scientific Committee Approval Date	06/06/2023		Version Number	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1- This course deals with the basic concepts of astronomy and its importance in human life. 2- Knowing the most important astronomical scientific terms and their definition related to the subject of astronomy. 3- To learn about celestial coordinates and methods of observing celestial bodies. 4- To understand our solar system and its composition, and the formation of the sun and its impact on the earth. 5- To know the solar and lunar eclipses and the difference between them. 6- To know the classification, evolution and formation of stars.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. identify basic concepts from the many areas of astronomy, including motions in the sky, gravity, electromagnetic radiation, solar system, stars; 2. recognize and apply the scientific method to solve astronomical problems and to critically evaluate hypotheses and theories proposed; 3. analyses and interpret information in order to communicate solutions to unpredictable and sometimes complex problems in the field of astronomy; and 4. demonstrate competence in, and/or understanding of, the use of basic astronomical instruments. 5. By following through the teaching process of astronomy in order to enable students to understand the mechanism of Motion of Celestial Bodies and determine their location. 6. Enabling the student to understand and analyze the mechanism of energy production inside the stars (the sun). 7. To encourage students, develop their own skills in Observing planets and stars, especially during an eclipse. 8. Helping the student to understand and analyze the evolution of the solar system and stars.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. 1 – **The Celestial Sphere: Coordinate Systems** Spherical Astronomy, Celestial Coordinate System (The horizontal coordinate system, The equatorial coordinate system, The ecliptic coordinate system), Ecliptic and Zodiac, Equinoxes, Solstices, Precession, The Seasons, Astronomical System of Units, Kepler's Laws of Planetary Motion. **2- The Solar System** Structure of Solar System, The Sun, Structure of the Sun, Atmosphere of the

	sun, The solar wind, Solar phenomena, Solar magnetic field. **3- The Moon** Basic Lunar Information, Relationship to Earth, Eclipses (Solar Eclipse, Lunar Eclipse). **4- The Stars** Astronomical Magnitudes, Color index, Luminosity, The Classification of Stellar Spectra, Standard Stellar Types, The Hertzsprung-Russell diagram, Stellar structure, Star formation, Stellar nurseries, Protostar, Main sequence, Mature stars, Stellar remnants.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Understanding the basic principles: providing an overview of the principles of astronomy and the universe, especially the solar system and what it contains of the sun and planets, and this helps the student to comprehend and understand the universe that surrounds the globe. Using visualization tools: Astronomy requires a deep visualization to understand astronomical phenomena. Therefore, educational videos and astronomical models are used in order for the student to understand how these phenomena occur. Other tools: Assigning students to make reports on an astronomical phenomenon and then discussing these reports, as well as assigning them to make posters or summarizing astronomical scientific research and presenting it for discussion. External activities: Doing day or night observations to witness an astronomical phenomenon that increases the student's comprehension and increases his understanding and interest in astronomy. Collaboration and Discussion: Promote collaboration among students by organizing group discussions, case studies or problem-solving sessions. Encourage them to share their views, ideas and experiences related to astronomy. This collaborative environment promotes active learning, critical thinking, and knowledge sharing. Assessment and Feedback: Regularly assess students' understanding through quizzes, tests, or projects that evaluate their application of astronomy concepts. Provide constructive feedback to guide their learning and address any misconceptions. Consider incorporating formative assessments to gauge understanding before major evaluations, allowing for timely intervention and support.

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	2

Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	51	Unstructured SWL (h/w) 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	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	History of astronomy ,The Celestial Sphere: Coordinate Systems
Week 2	Ecliptic and Zodiac, Equinoxes, Solstices, Precession
Week 3	The Seasons
Week 4	Astronomical System of Units:
Week 5	Discussion and Quiz
Week 6	The Solar System
Week 7	Structure of the Sun
Week 8	Atmosphere of the Sun
Week 9	Solar phenomena
Week 10	Discussion and Quiz

Week 11	The Moon The eclipses
Week 12	The Stars
Week 13	Stellar structure
Week 14	Star formation
Week 15	Discussion and Quiz

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	1-An Introduction to Astronomy and Astrophysics P. Jain 2015 2- Fundamental Astronomy 5th Edition H. Karttunen and et.al 2007 3-The Sun, the Solar Wind and the Heliosphere M. Paz Miralles and J. S. Almeida 2011	No No
Recommended Texts	1-Introduction to Solar system astronomy B. Ryden 2004 2-Understanding the Sun and Solar System Plasmas: Future Directions in Solar and Space Physics (2004) 3-Lecture Notes for Introduction to Astronomy, Ka Chun Yu	No No

	2004 4- Introduction to Astronomy and Astrophysics, Arnold Hanslmeier 2023	No No
Websites	1- https://www.une.edu.au/study/units/introduction-to-astronomy-and-astrophysics-asty221 2- https://podcasts.ox.ac.uk/keywords/astrophysics 3- https://kipac.stanford.edu/education/media/lectures	

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	**General Chemistry**			Module Delivery	
Module Type	**S**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY1206**				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	1		Semester of Delivery	2	
Administering Department	Physics		College	Science	
Module Leader	**Lecture Doha N. Saad**		e-mail	doha.neithal@uomosul.edu.iq	
Module Leader's Acad. Title	Lecturer		Module Leader's Qualification	Master	
Module Lab	Dr. Hiba abed salam Mohammed Khalid Nadheer Hameed		e-mail	hibaabed34@uomosul.edu.iq kalsarraf05@uomosul.edu.iq	
Peer Reviewer Name			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	This course give information about the Foundations of Chemistry, Introduction and properties of matter and Thermodynamic science , thermodynamic properties, terms, Properties of systems, classification of systems, reversible and irreversible process with examples ,general properties of gases ,types of gases ,ideal and real gas , energy and its types, kinetic molecular theory postulates ,state of gases and gases laws .
Module Learning Outcomes	1. Understand the foundations of chemistry , classification of matter, Structure of Atoms and Molecules, 2. Chemical reaction in solution & Concentration, Molarity& Molality. 3. Conceptually understand thermodynamic science ,thermodynamic terms , Extensive & Intensive properties, reversible and irreversible process ,ideal and real gas . 4. Identify which thermodynamic process is present. 5. Utilize the first law of thermodynamic to determine work , internal energy and quantity of heat . 6. Thermochemistry, Exothermic& Endothermic process 7. Discuss the difference between ideal and real gases ,Ideal gas law

Indicative Contents	**Part A – Theoretical lectures** Introduction of Chemistry ,Introduction of thermodynamic science, Properties and classification of systems ,Quiz, solution for the problem ,Reversible and Irreversible Process, Examples, First law of thermodynamic . [12 hrs] Mathematical examples about first law of thermodynamic,Thermodynamic process ,Mathematical examples about thermodynamic process , Heat capacity and specific heat capacity. energy and its types,Quiz, solution for the problem. [12 hrs] Gases , general properties of gases ,Types of gases ,The Kinetic Molecular Theory Postulate and the state of gases,Gases laws. [6 hrs] **Part B – Practical labs** Introduction of analytical chemistry, define of the analytical chemistry function of analytical chemistry theory, protoplasm theory ,Types of analytical chemistry ,Qualitative analysis ,Quantitative analysis ,Gravimetric analysis,Volumetric analysis methods . [12 hrs] Abbreviations,Apparatus and glassware used in qualitative analysis,Analysis of group I cations ,Analysis of group II cations, Group II A,Group II B. [12 hrs] Volumetric analysis ,Neutralization Reactions ,Determination of sodium hydroxide by with standardized HCl. [6 hrs]

Learning and Teaching Strategies	
Strategies	Expanding students' perceptions about this science and its contents it includes that help to understand the chemistry . In addition to the use of different mathematical equations to understand some idea about thermodynamic properties and gases law This will be achieved through lectures, labs, and tutorials.

Student Workload (SWL)			
Structured SWL (h/sem)	64	Structured SWL (h/w)	5
Unstructured SWL (h/sem)	36	Unstructured SWL (h/w)	2
Total SWL (h/sem)	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)	
	Material Covered
Week 1	Introduction of Chemistry.
Week 2	Introduction of thermodynamic science.
Week 3	Properties and classification of systems.
Week 4	Quiz, solution for the problem.
Week 5	Reversible and Irreversible Process, Examples.
Week 6	First law of thermodynamic .
Week 7	Mathematical examples about first law of thermodynamic .
Week 8	Thermodynamic process .
Week 9	Mathematical examples about thermodynamic process .
Week 10	Heat capacity and specific heat capacity.
Week 11	energy and its types.
Week 12	Quiz, solution for the problem.
Week 13	Gases , general properties of gases ,Types of gases.
Week 14	The Kinetic Molecular Theory Postulate and the state of gases.
Week 15	Gases laws.

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Introduction of analytical chemistry, define of the analytical chemistry function of analytical chemistry theory, protoplasm theory .
Week 2	Types of analytical chemistry .
Week 3	Qualitative analysis
Week 4	Quantitative analysis
Week 5	Gravimetric analysis.
Week 6	Volumetric analysis methods .
Week 7	Abbreviations.
Week 8	Apparatus and glassware used in qualitative analysis.
Week 9	Analysis of group I cations
Week10	Analysis of group II cations
Week 11	Group II A
Week 12	Group II B
Week 13	Volumetric analysis

Week 14	Neutralization Reactions .
Week 15	Determination of sodium hydroxide by with standardized HCl.

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. 3. Atkin's Physical Chemistry, Peter Atkins, Eleventh Edition, 2018. 4. Physical Chemistry, (4th ed.), Robert J. Sillbey et al, 2005.	Yes No No No
Recommended Texts	1.Skoog, Douglas A.; West, Donald M.; Holler, F. James; Crouch, Stanley R. (2014). Fundamentals of Analytical Chemistry. Belmont: Brooks/Cole, Cengage Learning. 2.Bard, A.J.; Faulkner, L.R. (2000). Electrochemical Methods: Fundamentals and Applications. New York: John Wiley & Sons, 2nd Ed. 3.D.C.Harris "Quantitative Chemical Analysis "8th Ed.,W.H.Freeman and Company,USA(2010). 4. R.M.Verma "Analytical Chemistry Theory and Practice",CBS Publishers and Distributions , Delhi,(2007). 5.D.A.Skoog,D.M.West,F.J.Holler,S.R.Crouch,"Fundamentals of Analytical Chemistry "8th .Ed.,Thomson Learning Inc.(2004). 6.D.Harvey," Modern Analytical Chemistry" ,1 st Ed., Mc Graw-Hill Companies ,Inc.,USA(2000).	No
Websites	https://www.britannica.com/science/thermodynamics	

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	**Geometrical Optics**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	PHY35019				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	4		Semester of Delivery	5	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Rana Waleed Najim		e-mail	ranawaleed@uomosul.edu.iq	
Module Leader's Acad. Title	Teacher		Module Leader's Qualification	T.	
Module Tutor			e-mail		
Peer Reviewer Name	Name		e-mail	E-mail	
Scientific Committee Approval Date	07/06/2023		Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Physical Optics	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	This course introduces the basic concepts to provide the student with the cognitive and skill capabilities of the course Cognitive goals: 1- The student should be able to give explanations and meanings to light phenomena related to the universality of light, reflection and refraction. 2- The student should be able to solve basic problems related to the different optical phenomena. 3- The student should be able to think about the use of natural phenomena in practical life.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	The student is familiar with the theoretical and practical aspects of the basic fields of engineering optics, which include: Marathi goals: 1- Providing students with the skill of using mathematical equations in calculating focal lengths and refractive index. 2- Acquiring the student the skill of using laboratory equipment. 3- Providing the student with the skill of preparing and writing scientific reports on the experiments he performs in the laboratory.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. 1 – Introduction to properties of light: Study Properties of Light, Electromagnetic Spectrum, Speed of Light, Laws of Reflection and Refraction, Fermi Principle, Critical Angle, Total Reflection. 2- Some Applications of Internal Reflection, Refractometers (Abe) Refraction by Prism - Dispersion Thin Prism, Convexity, Spherical Surfaces, Conjugate Points and Planes, Lenses Thin (sign term, composition drawing, magnification, body dimension and image dimension, lens maker formula), thin lens composition, thin lens force, thin lens in contact. 3- Thick lenses (focal points and main points), plane and spherical mirrors (concave and convex), thick mirrors. 4- aberration in mirrors, astigmatic spherical aberration, aberration in spherical lenses, chromatic coma, astigmatism, field curvature and distortion, optical devices (magnifier, compound microscope, Astronomical telescope, eye), field stop (field correction). .

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Conceptual Understanding: Start by providing an overview of laws of reflection and refraction, emphasizing its applications in our life. Help students understand how optical phenomena and methods are used to analyze and interpret data in these areas. Use real-world examples and case studies to illustrate the relevance and significance of optical techniques. Problem-Solving Practice: Include problem-solving activities and assignments that require students to apply geometric optics theories to practical scenarios. Present them with real or simulated data and challenge them to analyze and interpret the information using appropriate optical techniques. This will develop their problem-solving skills and reinforce their understanding of the subject matter. Supplemental Resources: Recommend supplementary resources such as textbooks, research articles, and online resources that provide additional information on geometric optics theories and its applications. Assessment and Feedback: Regularly assess students' understanding through quizzes, tests, or projects that evaluate their application of geometric optical concepts. Provide constructive feedback to guide their learning and address any misconceptions. Consider incorporating formative assessments to gauge understanding before major evaluations, allowing for timely intervention and support. Collaboration and Discussion: Foster collaboration among students by organizing group discussions, case studies, or problem-solving sessions. This collaborative environment promotes active learning, critical thinking, and knowledge sharing.

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	5.26
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	71	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.73
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	Properties of Light, Electromagnetic Spectrum, Speed of Light.
Week 2	Laws of Reflection and Refraction, Fermi Principle, Critical Angle, Total Reflection .
Week 3	Some Applications of Internal Reflection.
Week 4	Refractometers (Abe) Refraction by Prism - Dispersion Thin Prism, Convexity.
Week 5	Spherical Surfaces, Conjugate Points and Planes, Lenses Thin (sign term, composition drawing, magnification, body dimension and image dimension, lens maker formula).
Week 6	thin lens composition, thin lens force, thin lens in contact.
Week 7	Thick lenses (focal points and main points).
Week 8	plane and spherical mirrors and lenses
Week 9	concave and convex mirrors and lenses
Week 10	thick mirrors and lenses .
Week 11	aberration in mirrors and astigmatic spherical aberration
Week 12	aberration in spherical lenses, chromatic coma, astigmatism.
Week 13	field curvature and distortion.
Week 14	optical devices (magnifier, compound microscope, Astronomical telescope, eye).
Week 15	field stop (field correction).

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	1-F.A Jenkins and H.E. White, Fundamentals of Optics;-Mc. grow-Hill prim 1Custom publishing, 2001. 2-College Physics-9th Edition Raymond A. Serway | Emeritus, James Madison University Chris Vuille | Embry-Riddle Aeronautical University.	yes Yes
Recommended Texts	3- College Physics-9th Edition ,Hugh D. Yuong. 4- College Physics With an Integrated Approach to Forces and Kinematics Alan Giambattista Cornell University Betty McCarthy Richardson Cornell University Robert C. Richardson Cornell University THIRD EDITION	Yes yes
Websites	https://sciences-library.blogspot.com/2018/03/Book-of-Optics-pdf.html?m=1.	

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

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Heat and Thermodynamic**			Module Delivery	
Module Type	**C**			☐ Theory ☒ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY2309**				
ECTS Credits	**8**				
SWL (hr/sem)	**150**				
Module Level	2		Semester of Delivery	3	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Enas Mohammed Yonis		e-mail	enasmohammed@uomosul.edu.iq	
Module Leader's Acad. Title	lecturer		Module Leader's Qualification	Ph.MSc.	
Module Tutor			e-mail		
Peer Reviewer Name	Name		e-mail	E-mail	
Scientific Committee Approval Date	07/06/2023		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. The aim of studying thermodynamics - as the name indicates - is the branch of physics which is study of the relationship between properties of heat, temperature, energy, and work. Central to that relationship and to the laws of thermodynamics are the concepts of entropy and the Internal Energy Formula. 1. Understand how thermal energy is stored or generated. 2. Knowledge of the main laws on which the science of thermodynamics depends, namely the Zero Law (or the Fourth Law), the First Law, the Second Law, and the Third Law. 3. Studying the relationship between heat and mechanical motion, as in the invention of the steam engine and the gasoline engine, and ways to raise their efficiency. 4. Understanding and studying the generation of electric power from several means such as coal-fired plants, hydroelectric power or nuclear energy, all of these technologies depend on their development in order to raise their efficiency in the science of thermodynamics.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Learn basic facts, key terms, concepts and principles of thermodynamics. 2. Explain the main applications of thermodynamics in solving thermodynamic problems 3. Summarize the most important implications and applications derived from the laws of thermodynamics.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Introduction to Thermodynamics : Thermodynamics is concerned with the study of energy and its transformations. The study in this field focuses on the quantitative relationship between thermal energy and other forms of energy.This science is also concerned with studying and analyzing the properties of a material that is affected by temperature change.There are four basic principles upon which the science of thermodynamics is based, called the laws of thermodynamics The laws of thermodynamics The laws of thermodynamics describe the relationships between thermal energy, or heat, and other forms of energy, and how energy affects matter. The First Law of Thermodynamics states that energy cannot be created or destroyed; the total *quantity* of energy in the universe stays the same. The Second Law of Thermodynamics is about the *quality* of energy. It states that as energy is transferred or transformed, more and more of it is wasted. The Second Law also states that there is a natural tendency of any isolated system to degenerate into a more disordered state.

Thermodynamic Process

It is the process of the system's transition from one state of equilibrium to another state of equilibrium over a period of time and also means the change in the thermodynamic properties of the system. Therefore, it is said that the system undergoes a thermodynamic process when any of the system properties (variables) change.

Energy

Energy is defined as the ability to accomplish work and includes stored energy and Transit Energy. Stored energy is in several forms: chemical energy, electrical energy, internal energy, and mechanical energy (potential and kinetic). As for the transient energy, it is in two forms: heat and work

Temperature

The temperature of a body is a measures relative hotness or coldness, Heat is a form of energy that is transferred from one body to another due to the difference between the temperature of the two bodies, and when there is no heat exchange between them upon contact, they are said to be in a state of thermal equilibrium

Thermometer :

It is used to measure the temperature and quantify it digitally, and a special device called a thermometer must be built, and there are different types of thermometers.

Equation of state

state equation is a mathematical equation that relates the variables of a thermodynamic system. Experiment in thermodynamics shows that fixing some variables leads to the remaining variables having to take specified values, that is, randomness

Heat capacity C

It is energy in transit or transmission, and the word heat ceases to be used whenever the thermal energy transit or transmission stops.

The Work:

The idea of work is of fundamental importance in the topic of thermodynamics, so the existence of thermal machines is for the purpose of completing work and providing effort for humans.

	Carnot's reversible engine As it is known that thermal machines are used to convert thermal energy into mechanical work. In 1824, the French engineer Carnot was able to make improvements in the efficiency of the thermal machine. Heat Engine is a machine that converts thermal energy into mechanical energy through a system that is taken in a cycle of thermodynamic processes so that it absorbs heat from the hot warehouse and expels heat to the cold warehouse and the system makes work On the surrounding . Refrigerator As for the idea of a refrigerator, it is the opposite of the idea of a thermal engine, where the refrigerator uses the external work that is exerted on the system so that the system, through a thermodynamic cycle, absorbs heat from the cold store and losses heat to the hot reservoir . Thus, the refrigerator cools the hot reservoir by absorbing heat from it
Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Begin by providing an overview of thermodynamics, focusing on basic concepts such as systems, their types and properties, as well as the walls that surround them such as adiabatic walls, isothermal , etc, as well as the type of thermodynamic processes that occur in systems and help students understand these principles for analyzing and interpreting data in these areas, and using real-world examples to illustrate the importance of scientific material. Providing students with the basics and additional topics related to the outputs of thinking and analysis. Asking a group of intellectual questions during the lectures, such as (how, why, when, and what is the reason) for topics. Giving students homework that requires self-explanations using scientific methods. This will be achieved through lectures, laboratories, interactive educational programs, reports and seminars on topics of thermodynamics.

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	5.2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	50	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.7
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	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 to thermodynamic & Fundamental concepts
Week 2	Definition & Temperature scales
Week 3	Kinds of thermometers: Gas& liquid thermometers
Week 4	Kinds of thermometers: Other types of thermometers
Week 5	Discussion and Quiz
Week 6	Equation of state for ideal gas and real gas.
Week 7	First law of thermodynamic
Week 8	Discussion and Quiz

Week 9	Conservation of energy
Week 10	Work
Week 11	Work done in different process.
Week 12	Discussion and Quiz
Week 13	Second law of thermodynamic
Week 14	Application of 2nd law of thermodynamic(heat engine & rifregerater)
Week 15	Discussion and Quiz

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	1. الثيرموداينمك / د. سامي مظلوم صالح ، د. امجد عبد الرزاق كرجيه ، د. عبد اللطيف ابراهيم	Yes
	2. الحرارة والثيرموداينمك / د.رمزي حنا ميشو ، د. هاشم عبود قاسم	Yes

Recommended Texts	1. الديناميكيا الحرارية والنظرية الحركية للغازات والميكانيك الاحصائي / تاليف فرنسيس وستون سيرس ، ترجمة د. رضا جاد جرجيس، د. ظاهر مجيد الشربتي. 2. Thermodynamics : sears: copy.1 ,536.7,4539 3. Thermodynamics : J.P.Holman: ,1069,536,H747. 4. الحرارة والثيرموداينمك :تعريب د. محي الدين عباس، د. حسين السايس	yes No No Yes
Websites	https://www.thermodynamics.net/ https://www.coursera.org/ https://www.researchgate.net/ https://www.thermodynamics.org/ https://www.youtube.com/@user-gu7mf4jl4d	

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks %	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
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	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	**Laser Physics I**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY35020**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	3		Semester of Delivery	5	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Erada abd alkhalik al dabbagh		e-mail	dr.eradaaldabagh@uompsul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor			e-mail		
Peer Reviewer Name	Name		e-mail	E-mail	
Scientific Committee Approval Date	08/06/2023		Version Number		

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Laser	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	Laser fundamentals with the idea of simplifying the explanation of how laser operate. It is designed to be used as a senior-level of third –year graduate student. Understanding lasers involves concepts associated with light, viewed either as waves or as photons, and its interaction with matter. The module aims to provide a comprehensive understanding of Laser. Study the basic concepts of laser, how to generated it? Laser conditions and characteristics, the developed stages of laser, the differences between the original light and laser, which makes it very important for many applications. The unique aspect is the treatment of emission linewidth and broadening, and discussion of special laser cavities.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Understanding the laser theory, from Enishtain constants since 1917 until now. Anishtain gives the fundamental theory of laser, which define the laser word. In our semester, students transfer from know nothing about the laser to learn the basic concepts of laser physics. There is nothing magical about a laser. It has many unique properties that make it a special light source.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. 1 – Introduction to Laser Theory: Include laser idea, three main transitions stimulated, spontaneous and absorption. Three conditions for generation of laser briefly, population inversion, resonator and pumping. 2- population Inversion: The concept of stimulated emission and the relationship of the Enishtain A and B coefficients. Those coefficients are associated with the interaction of radiation with two specific energy levels, where the radiation has the exact frequency corresponding to the energy separation between the two levels. How gain (amplification) and absorption of radiation can occur in a medium containing population inversion in these two levels. We will derive the equation that predicts the amount of exponential growth or absorption of an incident light beam passing throw such a medium, including the beam frequency, the value of the stimulated emission cross section of the laser transition, Population inversion in, two levels, three levels and four levels. There is no possible to make the population inversion between two levels. So the laser generated in just three and four level or more. Put the rate equations for every sample, then calculate the steady state and the assume the pumping for each one. We will then obtain the sufficient conditions that how much gain is nessesary for the beam to reach the saturation intensity as it grows within the medium. Threshold conditions for laser operation will be obtained for mirrorless amplifiers as well as for the more common laser amplifiers having two mirrors,

	3- The resonator: We consider the properties associated with the optical cavity of a laser that has mirrors located at each end of the laser gain medium. These properties, which will be related to cavity modes, play a significant role in determining the output characteristics of the laser beam. We will discuss the Fabry-Perot optical cavity (resonator) and there by develop the concept of longitudinal modes. Study the various kinds of resonator and calculate the stability for each one, so, we then study the characteristic which conclude the advantage and dis advantage for every kind. We will consider increasing the gain length by putting either a mirror at one end of the medium or mirrors at both ends of the medium. 4- The Pumping: Two principal types of pumping or excitation are used to produce lasers. One type involves optical pumping, generally with flashlamps or with other lasers. The second type involves particle pumping in the form of particles within a gaseous or plasms discharge or particle beam interacting with a potential gain medium. Particle pumping is usually done with electrons, but it can also employ metastable atoms or ions. 5- Properties of Laser Beams: Laser radiation is characterized by extremely high degree of 1. Monochromaticity, 2. coherence, 3. directionality, 4. Brightness and 5. short time duration.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Conceptual Understanding: Start by providing an overview of laser theory, emphasizing its properties. Help students understand how laser principles and methods are important. Problem-Solving Practice: Include problem-solving activities and assignments that require students to apply laser theory to practical scenarios. Supplemental Resources: Recommend supplementary resources such as textbooks, research articles, and online resources that provide additional information on laser theory and its applications. Encourage students to explore these resources to gain a deeper understanding of the subject matter. Provide a curated list of recommended readings and online tools to support their learning. Assessment and Feedback: Regularly assess students' understanding through quizzes, tests, or projects that evaluate their application of laser concepts. Provide constructive feedback to guide their learning and address any misconceptions. Consider incorporating formative assessments to gauge understanding before major evaluations, allowing for timely intervention and support.

	Collaboration and Discussion: Foster collaboration among students by organizing group discussions, case studies, or problem-solving sessions. Encourage them to share their perspectives, ideas, and experiences related to laser analysis. This collaborative environment promotes active learning, critical thinking, and knowledge sharing.

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	Introduction to Laser Theory, The Laser Idea:
Week 2	The Basic Transitions in Laser Medium:

Week 3	Population Inversion
Week 4	Three Level Laser with the Intermediate Level as the Upper Laser Level: (solid state laser):
Week 5	Discussion and Quiz
Week 6	Three Level Laser with the Upper Laser Level as the Highest Level:
Week 7	Four -Level Lasers:
Week 8	Emission Broadening and line width due Radiative Decay:
Week 9	Saturation Intensity (Sufficient Condition for a Laser):
Week 10	Development and Growth of a Laser Beam for a Gain Medium with Homogeneous Broadening:
Week 11	Quiz:
Week 12	Shape or Geometry of Amplifying Medium:
Week 13	Stable Curved Mirror Cavities:
Week 14	Properties of Laser Beams:
Week 15	Laser Pumping Requirement

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	1-Laser Fundamental, SECOND EDITION, William T. Silvfast 2-The Laser Book: Laser Sailing From Start To Finish by Tim Davison	Yes Yes
Recommended Texts	1-" Introduction to Laser Technology, 4th Edition C. Breck Hitz, James J. Ewing, Jeff Hecht Introduction to Laser Technology, Fourth Edition provides readers with a good understanding of what a laser is and what it can and cannot do. The book explains what types of laser to use for different purposes and how a laser can be modified to improve its performance in a given application. With a unique combination of clarity and technical depth, the book explains the characteristics and important applications of commercial lasers worldwide and discusses light and optics, the fundamental elements of lasers, and laser modification.? 2- Lasers Basics, Advances and Applications Hans Joachim Eichler , Jürgen Eichler , Oliver Lux Presents a comprehensive overview of the state-of-the-art in gas solid state and diode lasers including high power lasers Covers basics, components, and applications Highlights potential areas for further development.	yes No
Websites	1- Laser Cutting Machine On Sale - High Power Laser Source gwklaser.com https://www.gwklaser.com GWEIKE focus on laser cutting machine for 16 years and machine with CE FDA ISO certificate. sheet metal laser cutting machine work on all kinds of metal as steel, copper and ect. Free Training. Customer Feedback. Free Shipping Fee. Fast Delivery.	

	. 2-Laser Fundamentals I | Understanding Lasers and Fiberoptics https://ocw.mit.edu › resources › laser... MIT OpenCourseWare is a web based publication of virtually all MIT course content. OCW is open and available to the world and is a permanent MIT activity.

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	**Laser Physics II**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY36126**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	3		Semester of Delivery	6	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Erada Abd Alkhalik Al Dabbagh		e-mail	dr.eradaaldabagh@uompsul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor			e-mail		
Peer Reviewer Name	Name		e-mail	E-mail	
Scientific Committee Approval Date	11/06/2023		Version Number		

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	PHY35020	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	Lasers are involved in almost all aspects of fields, from “light shows” to Compact Discs (CDs) and Digital Video Discs (DVDs), to special effects in the movies. Some other commonplace application of lasers are as Laser pointers, barcode scanners, laser printers. Lasers have a wide and growing range of applications in medicine. Lasers for Medical Applications summarises the wealth of recent research on the principles, technologies and application of lasers in diagnostics, therapy and surgery. We give an overview of the use of lasers in medicine, key principles of lasers and radiation interactions with tissue. To understand the wide diversity and therefore the large possible choice of these devices for a specific diagnosis or treatment, the respective types of the laser (solid state, gas, dye, and semiconductor) are studied. Industrial Application of Lasers, takes the reader through laser fundamentals, unusual properties of laser light, and types of practical lasers available. Current uses of lasers, including laser welding and cutting, electronic fabrication techniques, light wave communications, laser-based applications in alignment, surveying, and metrology.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	The unique quality of laser light has resulted in lasers now being used in an increasing number of applications. This includes fields as diverse as science, medicine, communications, chemistry, printing, data storage, imaging, welding, robotics, surveying, mapping, guidance and cutting.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. 1 Laser Systems Involving Low- Density Gain Medium 1- Gas Lasers Atomic Gas Lasers 1-1 Helium-Neon Laser 1-1-1 General Description 1-1-2 Laser Structure 1-1-3 Excitation Mechanism 1-1-4 Applications 1-2 Argon Ion Laser 2-1-1 General Description 1-2-1 Laserstructure 1-2-3 Excitation mechanism 1-2-4 Advantages of Argon ion laser and dis Advantages of Argon ion laser 1-2-5 Krypton Ion Laser 1-2-6 Applications 1-3 Molecular gas Laser 1-3-1 Energy Levels of Molecules

	1-3-2 General Description 1-3-3 Laser Structure 1-3-4 Excitation Mechanism 1-3-5 Advantages of Carbon Dioxide Laser and dis Advantages of Carbon Dioxide Laser 1-3-6 Applications 2- Excimer Lasers 2-1 General Description 2-2 Excimer Energy Levels 2-3 Laser Structure 2-4 Excitation Mechanism 2-5 Applications 2- Laser System Involving High-Density Gain Media 2-1 Organic Dye Lasers 2-2 Structure of dye Molecules 2-3 Energy Levels of Dye Molecules 2-4 Excitation and Emission of Dye Molecules 2-5 Applications 3 Solid State Laser 3-1 Ruby Laser 3-2 Ruby Laser Structure 3-3 Excitation Mechanism 3-4 Advantages of Ruby Laser and Dis Advantages of Ruby Laser 3-5 Applications 4-Semiconductor laser 4-1 Semiconductor Laser Structure 4-2 Excitation Mechanism 4-3 Applications

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Conceptual Understanding: Start by providing an overview of laser applications. Help students understand how laser characteristics and properties are important. Supplemental Resources: Recommend supplementary resources such as textbooks, research articles, and online resources that provide additional information on laser applications. Encourage students to explore these resources to gain a deeper understanding of the subject matter. Provide a curated list of recommended readings and online tools to support their learning. Assessment and Feedback: Regularly assess students' understanding through quizzes, tests, or projects that evaluate their application of laser concepts. Provide constructive feedback to guide their learning and address any misconceptions. Consider incorporating formative assessments to gauge understanding before major evaluations, allowing for timely intervention and support. Collaboration and Discussion: Foster collaboration among students by organizing group discussions, case studies, or problem-solving sessions. Encourage them to share their perspectives, ideas, and experiences related to laser analysis. This collaborative environment promotes active learning, critical thinking, and knowledge sharing.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ أسبوعا			
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	Laser Systems Involving Low- Density Gain Medium 3- Gas Lasers Atomic Gas Lasers Helium-Neon Laser Excitation Mechanism
Week 2	Laser Structure General Description
Week 3	Applications, Discussion and Quiz
Week 4	Argon Ion Laser General Description Laser structure
Week 5	Excitation mechanism Advantages of Argon ion laser and dis Advantages of Argon ion laser
Week 6	Krypton Ion Laser Applications
Week 7	Molecular gas Laser Energy Levels of Molecules General Description
Week 8	Laser Structure Excitation Mechanism
Week 9	Advantages of Carbon Dioxide Laser and dis Advantages of Carbon Dioxide Laser Applications, quiz
Week 10	Excimer Lasers General Description, Excimer Energy Levels, Laser Structure

Week 11	Excitation Mechanism Applications
Week 12	Laser System Involving High-Density Gain Media Organic Dye Lasers Structure of dye Molecules
Week 13	Mid exam
Week 14	Energy Levels of Dye Molecules Excitation and Emission of Dye Molecules Applications
Week 15	3 Solid State Laser 3-1 Ruby Laser 3-2 Ruby Laser Structure, quiz
Week 16	3-3 Excitation Mechanism 3-4 Advantages of Ruby Laser and Dis Advantages of Ruby Laser 3-5 Applications
Week 17	Semiconductor laser Semiconductor Laser Structure
Week 18	Excitation Mechanism Applications

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	1-Laser Fundamental, SECOND EDITION, William T. Silvfast 2-Handbook of Laser Technology and ApplicationsLasers Applications: Materials Processing and Spectroscopy (Volume Three) Edited By Chunlei Guo, Subhash Chandra Singh	Yes Yes
Recommended Texts	1-" Introduction to Laser Technology, 4th Edition C. Breck Hitz, James J. Ewing, Jeff Hecht Introduction to Laser Technology, Fourth Edition provides readers with a good understanding of what a laser is and what it can and cannot do. The book explains what types of laser to use for different purposes and how a laser can be modified to improve its performance in a given application. With a unique combination of clarity and technical depth, the book explains the characteristics and important applications of commercial lasers worldwide and discusses light and optics, the fundamental elements of lasers, and laser modification.? 2- Lasers Basics, Advances and Applications Hans Joachim Eichler , Jürgen Eichler , Oliver Lux Presents a comprehensive overview of the state-of-the-art in gas solid state and diode lasers including high power lasers Covers basics, components, and applications Highlights potential areas for further development.	Yes No
Websites		

	1- Laser Cutting Machine On Sale - High Power Laser Source gwklaser.com https://www.gwklaser.com GWEIKE focus on laser cutting machine for 16 years and machine with CE FDA ISO certificate. sheet metal laser cutting machine work on all kinds of metal as steel, copper and ect. Free Training. Customer Feedback. Free Shipping Fee. Fast Delivery. . 2-Laser Fundamentals I | Understanding Lasers and Fiberoptics https://ocw.mit.edu › resources › laser... MIT OpenCourseWare is a web based publication of virtually all MIT course content. OCW is open and available to the world and is a permanent MIT activity.

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	Magnetism			Module Delivery	
Module Type	C			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	PHY1215				
ECTS Credits	8				
SWL (hr/sem)	200				
Module Level	1		Semester of Delivery	2	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Abdulkhaliq auoyb sulaiman		e-mail	dr.abdulkhaliq@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor			e-mail		
Peer Reviewer Name	Name		e-mail	E-mail	
Scientific Committee Approval Date			Version Number		

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
1	PHY1102	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. The student must know the important Magnetic Field 2. The student must know the important Sources of the Magnetic Field 3. The student must know the important Faraday's Law 4. Teaching the student cognitive concepts
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. The Magnetic Field 2. Sources of the Magnetic Field 3. Faraday's Law .
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A – Theoretical lectures</u> Magnetic Fields and Forces, Motion of a Charged Particle in a Uniform Magnetic Field, Applications Involving Charged Particles Moving in a Magnetic Field Magnetic Force Acting on a Current-Carrying Conductorcharge , Electron Flux , The Electric potential , The potential of a charged disk, The Biot–Savart Law The Magnetic Force Between Two Parallel Conductors , Ampère's Law The Magnetic Field of a Solenoid ,Gauss's Law in Magnetism, Magnetism in Matter, Faraday's Law of Induction, Motional emf ,Lenz's Law ,Induced emf and Electric Fields Generators and Motors , Eddy Currents <u>Part B – Practical labs</u> 1- قنطرة وتستون 2- تعيين القدرة العظمى لمنبع كهربائي باستخدام تكافؤ الحمل 3- تعيين معامل الاختزال لكلفانوميتر الظل باستخدام اميتر 4- تعيين العزم المغناطيسي باستخدام كلفانوميتر الظل 5- قياس محاثة ملف وتعيين مقاومته باستخدام فولتميتر 6- رسم خطوط تساوي الجهد وخطوط المجال الكهربائي

Learning and Teaching Strategies
استراتيجيات التعلم والتعليم

Strategies	Expanding students ' perceptions about this science and its contents it includes that help in teaching the student cognitive concepts , Matter and Charge, magnetic Field, Electron charge , magnetic Flux , The magnetic potential , hall effect

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	Magnetic Fields and Forces
Week 2	Motion of a Charged Particle in a Uniform Magnetic Field

Week 3	Applications Involving Charged Particles Moving in a Magnetic Field
Week 4	Magnetic Force Acting on a Current-CarryingConductor
Week 5	The Biot–Savart Law
Week 6	The Magnetic Force Between Two Parallel Conductors
Week 7	Ampere's Law
Week 8	The Magnetic Field of a Solenoid
Week 9	Gauss's Law in Magnetism
Week 10	Magnetism in Matter
Week 11	Faraday's Law of Induction Motional emf
Week 12	Lenz's Law
Week 13	Induced emf and Electric Fields Generators and Motors
Week 14	Eddy Currents
Week 15	Hall effect

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: قنطرة وتستون
Week 2	Lab 2: تعيين القدرة العظمى لمنبع كهربائي باستخدام تكافؤ الحمل
Week 3	Lab 3: تعيين معامل الاختزال لكلفانوميتر الظل باستخدام اميتر
Week 4	Lab 4: تعيين العزم المغناطيسي باستخدام كلفانوميتر الظل
Week 5	Lab 5: قياس محاثة ملف وتعيين مقاومته باستخدام فولتميتر
Week 6	Lab 6: رسم خطوط تساوي الجهد وخطوط المجال الكهربائي
Week 7	Lab 7:
Week 8	Lab 8:.
Week 9	Lab9:
Week10	Lab 10:
Week 11	Lab 11:
Week 12	Lab 12:

Learning and Teaching Resources

مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	1- PHYSICS for SCIENTISTS & ENGINEERS with Modern Physics 2- PHYSICS for SCIENTISTS & ENGINEERS , SERWAY.	Yes Yes
Recommended Texts	. fundamentals of Physics, 8th edition, by Jearl Walker	
Websites	https://books.google.com/books?op=library&hl=ar&gl=iq&atml_id=o4o3SwAACAAJ	

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	**Materials Physics I**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY35022**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level	3		Semester of Delivery	5	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Edrees Edaan Ghadeer		e-mail	dr.adrees@uomosul.edu.iq	
Module Leader's Acad. Title	Lecturer		Module Leader's Qualification	Ph.D.	
Module Tutor			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	Material Physics I	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. Understand the properties of materials. 2. The arrangement and bonding of atoms in crystalline solids 3. The geometric structure of crystal lattices. 4. X-ray diffraction; Producing, Uses, Applications, Types of X-ray diffraction. 5. Determine positions of atoms contained in the unit cell by Fourier transform technique. 6. Binding force and energy between atoms and molecular. 7. Advantages and dis advantages of defect in crystals.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Differentiate between crystalline and amorphous solids, Arrangements of atoms, Crystal, Lattice; directions and planes, Unit cell, Translation vectors, Crystal systems, Crystal planes and directions, Miller indices, Recognize symmetry elements of molecules and simple crystal structures . 2. Diffraction of waves by crystal, Bragg law, Reciprocal lattice, Reciprocal lattice vectors, Diffraction condition, Identify and describe different experimental of X-rat diffraction (Laue method, Rotating crystal method, Powder method), Electron diffraction, Neutron diffraction, Reciprocal space and Laue equations, Brillouin Zone. 3. Crystal binding, Crystal of inert gases, Van der Waals-London interaction, Repulsive interaction, Cohesive energy, Ionic crystals, Madelung energy and constant, Covalent crystals, Metals, Hydrogen bonds. 4. Analyze the types of crystal defects and its effects on crystals.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. 1 – Definition of the crystal lattice and unit cell, lattice parameters, Lattice transilation vectors,The seven crystal systems, Conventional and primitive lattices: The 14 Bravais lattices in (2D) and (3D). 2- Miller indices of crystal faces and crystal forms, Area and volume of unit cell, Coordination number, Relation between (r) and (a), Atomic packing factor calculation, Density calculation from lattice parameter. 3- Symmetry and its operations, Interplanar distances and angles relations. 4- Methods for structure investigation: photons, electrons and neutrons, X-ray diffraction production technique, Interaction between X-ray and materials, Bragg's Law, Bragg’s law and crystal structure. 5- Experimental of diffraction methods and applications (Laue method, Rotating crystal method, Powder method), Electron diffraction, Neutron diffraction., Reciprocal lattice, Structure factors, Fourier synthesis, phase problem. 6- Crystal binding; binding force and energy, Madelung constant in (1D) and (3D), Bonding in element and compounds, Types of bonding; Ionic,Covalent and Metallic bonds, Hydrogen bonding, Van-der-Waals bonding, Van-der-Waals London

	interaction.Cryastal of inert gas. 7- Crystal imperfections: Point defects,Schotcky and Frenkel point defect concentrations relations. 8- Line defects; Dislocations types, Dislocation motion, Dislocations interactions, Planar defects, Surface defects and Volume defects.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Conceptual Understanding: Materials are of technological interest for their properties - electrical conductivity, strength, magnetization, toughness and numerous other properties for various applications. All of these properties originate with the type of the atoms in the materials, their local configuration, and their arrangement into microstructures. The characterization of materials structure is often best performed by x-ray diffraction (XRD), one can utilize imaging, diffraction, chemistry and electronic structure analysis to characterize important features such as crystal structure, presence of different phases, orientation and character at different scale down to atomic level. This course is tailored to acquaint students the basic of Materials Physics I; materials structure, crystallography, as well as the materials structure analysis methods using X-ray (photons), electrons and neutrons diffraction. Along this way, students will learn some broadly applicable diffraction physics, materials science and matter defects. Problem-Solving Practice: A continuous and comprehensive evaluation of the student competences will be carried out based on their performance in the following activities: 1- Daily class work, including problem solving tests, practical questions, exercises and related activities during the learning process. At the end of each topic, a document will be distributed to the students with a reduced number of basic questions to be worked out by the students. 2- Written test (decided by students) at the end of the course dealing with problems and questions about the course contents. Supplemental Resources: Recommend supplementary resources such as textbooks, research articles, and online resources that provide additional information on and its applications. Encourage students to explore these resources to gain a deeper understanding of the subject matter. Provide a curated list of recommended readings and online tools to support their learning. Assessment and Feedback: Regularly assess students' understanding through quizzes, tests, or projects that evaluate their application of crystal structure concepts. Provide constructive feedback to guide their learning and address any misconceptions. Consider incorporating formative assessments to gauge understanding before major evaluations, allowing for timely intervention and support.

	Collaboration and Discussion: Foster collaboration among students by organizing group discussions, case studies, or problem-solving sessions. Encourage them to share their perspectives, ideas, and experiences related to materials science. This collaborative environment promotes active learning, critical thinking, and knowledge sharing.

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 12	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 14	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	0	0	13	LO #5, #8 and #10
Summative assessment	Midterm Exam	2hr	20% (20)	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	Definition of the crystal lattice and unit cell, lattice parameters, Lattice transilation vectors,The seven crystal systems, Conventional and primitive lattices: The 14 Bravais lattices in (2D) and (3D).

Week 2	Miller indices of crystal faces and crystal forms, Area and volume of unit cell.
Week 3	Coordination number, Relation btween (r) and (a), Atomic packing factor calculation, Density calculation from lattice parameter.
Week 4	Symmetry and it's operations, Interplanar distances and angles relations.
Week 5	Discussion and Quiz
Week 6	Methods for structure investigation: photons, electrons and neutrons, X-ray diffraction production technique, Interaction between X-ray and materials, Bragg's Law, Bragg's law and crystal structure.
Week 7	Experimental of diffraction methods and applications (Laue method, Rotating crystal method, Powder method), Electron diffraction, Neutron diffraction., Reciprocal lattice, Structure factors.
Week 8	Crystal binding; binding force and energy
Week 9	Madelung constant in (1D) and (3D), Bonding in element and compounds.
Week 10	Types of bonding; Ionic,Covalent and Metallic bonds, Hydrogen bonding, Van-der-Waals bonding, Van-der-Waals London Interaction.
Week 11	Cryastal of inert gas.
Week 12	Discussion and Quiz
Week 13	Crystal imperfections: Point defects,Schotcky and Frenkel point defect concentrations relations.
Week 14	Line defects; Dislocations types, Dislocation motion, Dislocations interactions, Planar defects.
Week 15	Surface defects and Volume defects.

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	1- William D. Callister, Jr., Materials Science and Engineering: An Introduction, 9th Edition, John Wiley & Sons, (2005). 2- Charles Kittle, Introduction to solid state physics, 7th Edition, John Wiley & Sons, (2014). 3- Donald R. Askeland, The Science and Engineering of Materials, 3th Edition, Nelson Thomes Ltd., (1996).	Yes Yes No
Recommended Texts	1- S.L. Kakani and Amit Kakani, " Material science", New Age International (P) Ltd., Publishers Published by New Age International (P) Ltd., Publishers. 2- V. Raghavan, "Materials Science and Engineering: A first course", 5th Edition, John Wiley & Sons, (2011).	No No

Websites	https://www.uou.ac.in/sites/default/files/slm/BSCPH-203.pdf http://metal.elte.hu/~groma/Anyagtudomany/kittel.pdf https://rcub.ac.in/econtent/ug/bsc/6sem/BSc%20Sem%20VI%20Physics%20Solid%20state%20physics.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	**Materials Physics II**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY36128**				
ECTS Credits	**7**				
SWL (hr/sem)	**175**				
Module Level	3		Semester of Delivery	6	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Edrees Edaan Ghadeer		e-mail	dr.adrees@uomosul.edu.iq	
Module Leader's Acad. Title	Lecturer		Module Leader's Qualification	Ph.D.	
Module Tutor			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	PHY35022	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. The purpose of this course is to provide a general background of the field of materials science and engineering for graduate level students. 2. Fundamental topics such as the diffusion in Solids, mechanical properties of Metals. 3. understand the different type of materials failure and examine the causes of material failure. 4. The formation of polymers, long-chain molecules made of repeating units of monomers (the essential building). 5. Study the composite materials and their macro/micro mechanical properties also, design, manufacture and analysis of composite materials from a material scientist's viewpoint.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Understands the significance of gradients of certain 'fields' [/'potentials'] and resulting fluxes (of species, heat and momentum) and the significance of equilibrium, steady and non-steady state. 2. A fundamental understanding of mechanical behavior of materials. 3. Describe and predict elastic deformation in engineering materials and predict yielding of engineering materials under uniaxial and multiaxial states of stress. 4. Study the different techniques of polymerization of polymers. 5. The student will able to understand various structure of polymers and their effect on different mechanical and physical properties of polymers. 6. Understand the basic concepts , operation and applications of various techniques used for molecular weights of polymers 7. Students shall learn composite material history, definition, grouping and its applications. 8. knowledge about macromechanical properties (stress/strain/elastic module/Hooke's law/strain energy/stress-strain relations) of composite lamina and laminates. 9. Learn about micromechanical properties (volume and mass fractions,. Density and void content) of composite lamina. 10. Students able to design and analyze composite materials to assess failure criteria.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. 1. Diffusion in Solid; An introduction. Types of Diffusion; Self-Diffusion, Inter-Diffusion. Diffusion mechanisms; i) Vacancy Mechanism, (ii) The Interstitial Mechanism, Interchange Mechanism. Laws of Diffusion; Fick's first Law, Fick's second Law. Factors that influence diffusion. Diffusion paths in solids. Diffusion as a random walk process. Kirkendall Effect. Applications of Diffusion. 2. Mechanical Properties of Metals; An introduction. The Standards and Specifications for Design in Mechanics or Strength of Materials. Concepts of Stress and Strain. Mechanical Tests; Tension Tests, Compression Tests, Shear and Torsional Tests. Poisson's ratio. Stress – Strain Relation. Ductile and

	Brittle Materials. Ductility, Resilience, Toughness (tensile toughness). True Stress and Strain. Hardness Test; Brinell hardness test, Vickers hardness. 3. Polymer Structures, General characteristics of polymers, Classification of Polymers, Polymer molecules, The Chemistry of Polymer Molecules, Molecular Weight. Molecular Configurations, Polymer Crystallinity, Polymer Crystals, Defects in Polymers, Diffusion in Polymeric Materials, Stress - Strain Behavior of Polymers. 4. Introduction, PARTICLE-REINFORCED COMPOSITES; Large-Particle Composites, Dispersion Strengthened Composites, FIBER-REINFORCED COMPOSITES; Influence of Fiber Length, Influence of Fiber Orientation and Concentration, The Fiber Phase, The Matrix Phase, Polymer -Matrix Composites, Metal-Matrix Composites, Ceramic-Matrix Composites, Carbon–Carbon Composites, Hybrid Composites, STRUCTURAL COMPOSITES, Laminar Composites, Sandwich Panels.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	This course is tailored to acquaint students the basic of Materials Physics II; . Problem-Solving Practice: A continuous and comprehensive evaluation of the student competences will be carried out based on their performance in the following activities: 1- Daily class work, including problem solving tests, practical questions, exercises and related activities during the learning process. At the end of each topic, a document will be distributed to the students with a reduced number of basic questions to be worked out by the students. 2- Written test (decided by students) at the end of the course dealing with problems and questions about the course contents. Supplemental Resources: Recommend supplementary resources such as textbooks, research articles, and online resources that provide additional information on and its applications. Encourage students to explore these resources to gain a deeper understanding of the subject matter. Provide a curated list of recommended readings and online tools to support their learning. Assessment and Feedback: Regularly assess students' understanding through quizzes, tests, or projects that evaluate their application of materials science concepts. Provide constructive feedback to guide their learning and address any misconceptions. Consider incorporating formative assessments to gauge understanding before major evaluations, allowing for timely intervention and support. Collaboration and Discussion: Foster collaboration among students by organizing group discussions, case studies, or problem-solving sessions. Encourage them to share their perspectives, ideas, and experiences related to materials science. This collaborative environment promotes active learning, critical thinking, and knowledge sharing.

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	7
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	81	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	7
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	175		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	8 and 14	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	0	0	13	LO #5, #8 and #10
Summative assessment	Midterm Exam	2hr	20% (20)	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	Diffusion in Solid; An introduction. Types of Diffusion, Diffusion mechanisms.
Week 2	Laws of Diffusion; Fick's first Law, Fick's second Law.
Week 3	Factors that influence diffusion. Diffusion paths in solids. Diffusion as a random walk process. Kirkendall Effect. Applications of Diffusion.
Week 4	Mechanical Properties of Metals; An introduction. The Standards and Specifications for Design in Mechanics or Strength of Materials. Concepts of Stress and Strain.
Week 5	Mechanical Tests; Tension Tests, Compression Tests, Shear and Torsional Tests.

Week 6	Poisson's ratio. Stress – Strain Relation. Ductile and Brittle Materials. Ductility, Resilience, Toughness (tensile toughness).
Week 7	True Stress and Strain. Hardness Test; Brinell hardness test, Vickers hardness.
Week 8	Discussion and Quiz
Week 9	Polymer Structures, General characteristics of polymers, Classification of Polymers, Polymer molecules.
Week 10	The Chemistry of Polymer Molecules, Molecular Weight. Molecular Configurations,.
Week 11	Polymer Crystallinity, Diffusion in Polymeric Materials, Stress - Strain Behavior of Polymers.
Week 12	Introduction, PARTICLE-REINFORCED COMPOSITES, FIBER-REINFORCED COMPOSITES, The Fiber Phase,
Week 13	The Matrix Phase, Polymer -Matrix Composites, Metal-Matrix Composites, Ceramic-Matrix Composites, Carbon–Carbon Composites, Hybrid Composites.
Week 14	Discussion and Quiz
Week 15	STRUCTURAL COMPOSITES, Laminar Composites, Sandwich Panels.

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	1. Materials Science and Engineering; an introduction, WILLIAM D. CALLISTER, JR. and DAVID G. RETHWISCH, John Wiley & Sons, 2014. 2. Diffusion in solids I, Lecture 15, Kharagpur : Prof. R. N. Ghosh, Dept. of Metallurgical and Materials Engineering. 3. Materials Science, G. K. Narula ،K. S. Narula ،V. K. Gupta, Tata McGraw-Hill Education, 2007. 4. The Science and Engineering of Materials; Sixth Edition, Donald R. Askeland, Pradeep P. Fulay, Wendelin J. Wright, (2010).	Yes Yes No
Recommended Texts	1. Mass Transport–Induced Failure, Milton Ohring, Copyright 2020 Elsevier Journals & Books, book in Reliability and Failure of Electronic Materials and Devices, printed in 1998. 2. Properties of Materials Lecture 3: Instructor : Dr. Tsz Ho Kwok. 3. Mechanical Properties of Materials; Chapter Four, Dr. Ali Abadi.	Yes No No

Websites	https://ftp.idu.ac.id/wp-content/uploads/ebook/tdg/TEKNOLOGI%20REKAYASA%20MATERIAL%20PERTAHANAN/Fundamentals%20of%20Materials%20Science%20and%20Engineering%20An%20Integrated%20Approach%20by%20William%20D.%20Callister,%20David%20G.%20Rethwisch%20(z-lib.org).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	**Mathamatic 2**			Module Delivery	
Module Type	**نوع المادة Core**			☒ Theory ☒ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**رمز الوحدة PHY1217**				
ECTS Credits	**عدد وحدات المادة 4**				
SWL (hr/sem)	**عدد وحدات المادة في الفصل الواحد 100**				
Module Level	**المرحلة رقماً** 1		Semester of Delivery	2	
Administering Department	Type Dept. Code **رمز المادة**		College	**Type College Code** **رمز الكلية**	
Module Leader	Name:زينة طلال ياسين		e-mail	E-mail:zena-talal @ uomosul.edu.iq **البريد الرسمي لمدرس المادة**	
Module Leader's Acad. Title	**Professor مدرس** **لقب مدرس المادة**		Module Leader's Qualification	Ph.D. ماجستير **الشهادة**	
Module Tutor	Name (if available)		e-mail	E-mail	
Peer Reviewer Name	**Name** **اسم المدرس الثاني للمادة**		e-mail	E-mail **البريد الرسمي لمدرس المادة الثاني**	
Scientific Committee Approval Date	01/06/2023 **تاريخ موافقة اللجنة العلمية**		Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Sci-1105	Semester	
Co-requisites module	None وحدة المتطلبات المكملة	Semester	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
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	هام: اكتب 6 مخرجات تعليمية على الأقل ، ومن الأفضل أن تكون مساوية لعدد أسابيع الدراسة. 1. مقدمه عن التكامل المحدد وغير 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	109	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	7
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	91	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	200		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment التقييم التكويني	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 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	**Mathematics 3**			Module Delivery	
Module Type	**Core** نوع المادة			☒ Theory ☒ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY24113** رمز الوحدة				
ECTS Credits	**4** عدد وحدات المادة				
SWL (hr/sem)	**100** عدد وحدات المادة في الفصل الواحد				
Module Level	2		Semester of Delivery	4	
Administering Department	Type Dept. Code رمز المادة		College	**Type College Code** رمز الكلية	
Module Leader	Name: عبير عبدالخالق احمد		e-mail	E-mail: abeeraldabagh@ uomosul.edu.iq البريد الرسمي لمدرس المادة	
Module Leader's Acad. Title	**Professor** مدرس لقب مدرس المادة		Module Leader's Qualification	Ph.D. ماجستير الشهادة	
Module Tutor	Name (if available)		e-mail	E-mail	
Peer Reviewer Name	**Name** اسم المدرس الثاني للمادة		e-mail	E-mail البريد الرسمي لمدرس المادة الثاني	
Scientific Committee Approval Date	01/06/2023 تاريخ موافقة اللجنة العلمية		Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	PHY1217	Semester	
Co-requisites module	None وحدة المتطلبات المكملة	Semester	

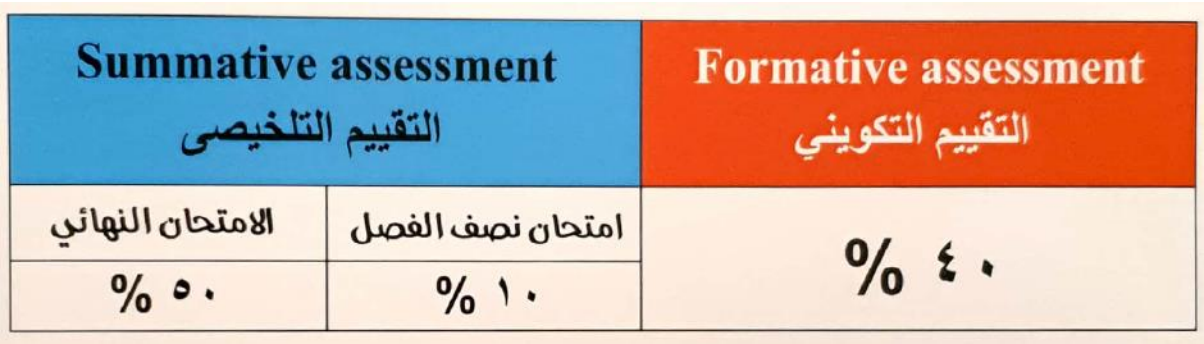
Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	تختلف أهداف المشتقات الجزئية (Partial Derivatives) وفقًا للتطبيقات المختلفة، ولكن يمكن تلخيص بعض أهدافها على النحو التالي: 1- تحليل سلوك الدوال: حيث تستخدم المشتقات الجزئية لتحليل سلوك الدوال في نقاط معينة، وتحديد معالم النقاط الحرجة كالنقاط المحليّة القصوى ونقاط التقاطع مع المحاور. 2- دراسة مسائل الفيزياء والهندسة: حيث تستخدم المشتقات الجزئية في دراسة الانحدارات والمنحنيات والمساحات والأحجام وغيرها من الخصائص الهندسية للأجسام. 3- تحليل مسائل الاقتصاد والإدارة: حيث تستخدم المشتقات الجزئية في تحليل الأسواق وتحديد أفضل الاستراتيجيات الاقتصادية وتقدير قيمة الأصول والخسائر المحتملة وغيرها من المسائل الاقتصادية. 4- تطوير نماذج رياضية: حيث تستخدم المشتقات الجزئية في تطوير نماذج رياضية معقدة لحل مسائل عديدة في مجالات مختلفة مثل الفيزياء والرياضيات والهندسة وغيرها، وذلك للحصول على حلول دقيقة لتلك المسائل.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	هام: اكتب 6 مخرجات تعليمية على الأقل ، ومن الأفضل أن تكون مساوية لعدد أسابيع الدراسة. 1. المشتقات الجزئية، المشتقة الجزئية الأولى والثانية 2. حساب المشتقة الجزئية الاولى والثانية حسب التعريف الرياضي 3. تعريف التكامل المضاعف 4. التكامل الثنائي والتكامل الثلاثي مع تطبيقات 5. حساب المساحات والحجوم 6. مقدمة عن المتسلسلات النهائية
Indicative Contents المحتويات الإرشادية	يتضمن المحتوى الإرشادي ما يلي. المشتقة الجزئية هي مصطلح يستخدم في علم الرياضيات ويعني تغير قيمة دالة ما بالنسبة لإحدى المتغيرات التي تدخل فيها. وبشكل عام، يمكن القول أن المحتوى الإرشادي للمشتقة الجزئية يتضمن الفهم الجيد لمفهوم المشتقة الجزئية وكيفية حسابها باستخدام القواعد والتقنيات المختلفة. على سبيل المثال، يجب فهم مفهوم الحدود والتفاضل والتكامل، كما يجب فهم القواعد الأساسية لحساب المشتقات الجزئية، مثل قاعدة السلسلة وقاعدة الضرب وقاعدة القوة، إضافة إلى القدرة على حل المسائل والمشاكل الرياضية التي تتطلب استخدام المشتقات الجزئية. ويمكن الحصول على هذا المحتوى الإرشادي من خلال الدروس والمقالات الرياضية المتخصصة، وكذلك من خلال التدريب العملي على حل المسائل وإجراء التمارين الرياضية المختلفة.

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	109	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	7
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	91	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	200		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment التقييم التكويني	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 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	المشتقات الجزئية، المشتقة الجزئية الأولى والثانية
Week 2	حساب المشتقة الجزئية الاولى والثانية حسب التعريف الرياضي
Week 3	حل تمارين
Week 4	تعريف التكامل المضاعف
Week 5	التكامل الثنائي والتكامل الثلاثي مع تطبيقات
Week 6	حساب المساحات والحجوم
Week 7	حل تمارين
Week 8	مقدمة عن المتسلسلات النهائية
Week 9	أنواع المتسلسلات
Week 10	تعريف الاعداد المركبة
Week 11	تطبيقات على الاعداد المركبة
Week 12	حل تمارين
Week 13	
Week 14	
Week 15	
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	**Mathematics 4**			Module Delivery	
Module Type	**C**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY-24121**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level	3		Semester of Delivery	5	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Mohammed Khayri Zeki Abed		e-mail	dr.mohammedkhayri@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor			e-mail		
Peer Reviewer Name	Sadoon Hussein Abdullah – lecturer		e-mail	Sadosbio113@uomosul.edu.iq	
Scientific Committee Approval Date	/ /2023		Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	PHY24113	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 following courses will be used to monitor students' performance : 1- Matrices, Special Matrices, Determinant. and inverse of a Matrix. 2- Elementary Transformations . 3- Solution of System of Linear Algebra Equations, Grammer's method. 4- Eigen Values and Eigen Vectors, normalization of eigenvectors. 5-Matrix Diagonalization, Powers of Matrices, the Cayley-Hamilton Theorem. 6- Two Dimensional Transformations. 7-Gamma Function, Beta function, Relation between Gamma and Beta functions. 8- applications for these topics are applied as in MATLAB programs. Students who successfully complete all of the preceding topics should reach the following goals: - Be able to apply problem-solving and logical skills -Have a deeper understanding of mathematical theory -Be able to communicate mathematical/logical ideas in writing -Be competent in computer programming -Be familiar with several subfields of mathematics . -Be exposed to undergraduate research or internship opportunities
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Students will learn various techniques for performing algebraic and analytic manipulations of the previously mentioned topics(1-8). By the end of the course, the student will be able to understand the fundamental terminology used in the above-mentioned topics, and will observe how these methods are used in MATLAB laboratory .
Indicative Contents المحتويات الإرشادية	The indicative content is the subject specific content that students may have provided in response to the question. Indicative content includes the following. <u>Part A – Theoretical lectures</u> -Matrices, Special Matrices, Determinant and inverse of a Matrix. [8 hrs] - Elementary Transformations, Inverse of a matrix using Elementary Transformations, Solution of System of Linear Algebra Equations, Grammer's method,Eigen Values and Eigen Vectors, [10 hrs] -Eigen Values and Eigen Vectors, Normalization of eigenvectors, Diagonalization of Matrices , Powers of Matrices, The Cayley-Hamilton Theorem. [10 hrs] - Two Dimensional Transformations. Gamma Function, Beta function.[6 hrs] <u>Part B –MATLAB lab.:</u> Lab. Experimental Assignments: MATLAB Environmen, for, while loops, (Samples of programs), switch-case, (Samples of programs), Application - Two dimensional plots, Applications, Translation , Scaling (samples of programs), Rotations and shearing (samples of programs), Animation (EraseMode, Movie methods) Describing Particles

	Movements.[30 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	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	Matrices.
Week 2	Special Matrices.
Week 3	Determinant.
Week 4	and inverse of a Matrix.
Week 5	Elementary Transformations .
Week 6	Inverse of a matrix using Elementary Transformations .
Week 7	Solution of System of Linear Algebra Equations.
Week 8	Grammer's method.
Week 9	Eigen Values and Eigen Vectors.
Week 10	Normalization of eigenvectors.
Week 11	Diagonalization of Matrices , Powers of Matrices.
Week 12	The Cayley-Hamilton Theorem.
Week 13	Two Dimensional Transformations.
Week 14	Gamma Function.
Week 15	Beta function.

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Lab. 1: MATLAB Environment.
Week 2	Lab. 1: MATLAB Environment.
Week 3	Lab 3: for loop (Samples of programs).
Week 4	Lab 4: while loops, (Samples of programs).
Week 5	Lab 5: switch-case, (Samples of programs).

Week 6	Lab 6: program applications.
Week 7	Lab 7: Two dimensional plots.
Week 8	Lab 8: Applications.
Week 9	Lab9: Translation (samples of programs).
Week10	Lab 10: Scaling (samples of programs).
Week 11	Lab 11: Rotations (samples of programs).
Week 12-15	Lab 12 : Shearing (samples of programs) Lab 12: Review. Lab 13: Animation Lab 14: EraseMode and Movie methods Lab 15 : Particles Movements.

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Peter O'Neil, 2003, Advanced Engineering Mathematics, 5th Edition. Arfken, G. 1973, Mathematical Methods for Physicist (2nd ed.; Cambridge, MA: Academic Press).	Yes Yes
Recommended Texts	Dass, H., K., 2009, Mathematical Physics , S. Chand ,India.	Yes
Websites	https://books.google.com.bd/books?id=IzJdPqEn6VYC&printsec=frontcover#v=onepage&q&f=false https://msashigri.files.wordpress.com/2016/11/methods-of-mathemacial-for-physicists.pdf	

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

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Mathematics I**			Module Delivery	
Module Type	**B**			☐ Theory ☒ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**Sci-1105**				
ECTS Credits	**2**				
SWL (hr/sem)	**50**				
Module Level	1		Semester of Delivery	1	
Administering Department	Type Dept. Code **رمز المادة**		College	**Type College Code** **رمز الكلية**	
Module Leader	Name: Raghad Abdulazeez Mustafa		e-mail	E-mail: Raghad.math@uomosul.edu.iq **البريد الرسمي لمدرس المادة**	
Module Leader's Acad. Title	**Lecturer** **لقب مدرس المادة**		Module Leader's Qualification	Ph.D. **الشهادة**	
Module Tutor	Name (if available)		e-mail	E-mail	
Peer Reviewer Name	**Name** **اسم المدرس الثاني للمادة**		e-mail	E-mail **البريد الرسمي لمدرس المادة الثاني**	
Scientific Committee Approval Date	01/06/2023 **تاريخ موافقة اللجنة العلمية**		Version Number	1.0	

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

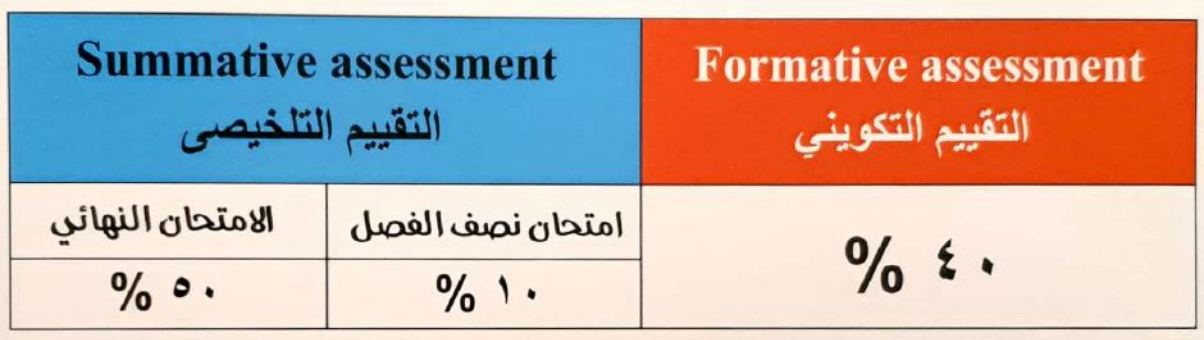
Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1. Provide the fundamental base for elementary mathematics. 2. Use mathematical functions like algebraic and transcendental functions and application of derivatives to solve mathematics, engineering and physics problems.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Basic 2D curves drawing and lines using properties. 2. Apply mathematic techniques to find the limits and continuous. 3. Apply differential calculus and higher order to solve mathematics, engineering and physics problems. 4. Expanding on many of the functions that were taken in the previous stages. 5. Learn about new functions and study their properties.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Chapter 1 Relations and functions, domain and range, operations on functions, special function and graphs. The rate of change functions, increasing and decreasing functions. Slope and Equations for lines, functions and their graph. [20 hrs.] Chapter 2 Limits and continuity, introduction to limit, some properties of limits, limit involving infinity. Formula definition of Limit. The Limits of rational functions. Some important Theorem on limits. [15 hrs.] Chapter 3 Introduction to continuous functions, algebraic operations on continuous functions, properties of continuous functions. [15 hrs.] Chapter 4 Derivative of functions, derivative by using definition. Derivative of corner, Differentiation rules. Second and higher order derivatives. Chain rule, implicit differentiation. [15 hrs.] Chapter 5 Derivative of special functions and some properties of Transcendental functions, such as: Trigonometric functions, Natural logarithm function, Exponential function, Exponential and logarithmic function bases other than e, Hyperbolic functions, L'Hopital's Rules. [20 hrs.] Chapter 6 Applications of derivatives: Related rates of change. Slopes and tangent lines with derivatives, Extreme values, Maximum and Minimum Theorems, Rolle's Theorem and Mean Value Theorem. [15 hrs.]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding

	their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students. And knowing the basis of the concepts and where they came from and taking realistic applications on that.

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	91	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	6
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	200		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment التقييم التكويني	Quizzes	5	30% (10)	3,5,7,9,11	LO # 2,3,4,5,6
	Assignments	2	10% (10)	2 and 12	LO # 4,7
	Projects / Lab.				
	Report				
Summative assessment التقييم التلخيصي	Midterm Exam	1hr. and half	10%		LO #1 - #4
	Final Exam	3hrs	50%		All
Total assessment			100% (100 Marks)		



Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Relations and functions, domain and range, operations on functions.
Week 2	Special function and graphs.
Week 3	Introduction to limit, some properties of limits, limit involving infinity.
Week 4	Formula definition of Limit, The limits of rational functions. Some important Theorem on limits.
Week 5	Introduction to continuous functions, algebraic operations on continuous functions, properties of continuous functions.
Week 6	Derivative of functions, derivative by using definition. Derivative of corner.
Week 7	Differentiation rules. Second and higher order derivatives. Chain rule, implicit differentiation.
Week 8	Mid-course Exam
Week 9	Derivative of special functions and some properties of Transcendental functions, such as: Trigonometric functions.
Week 10	Natural logarithm function, Exponential function,
Week 11	Exponential and logarithmic function bases other than e.
Week 12	Hyperbolic functions.
Week 13	L'Hopital's Rules.
Week 14	Applications of derivatives: Related rates of change.
Week 15	Preparatory week before the final Exam
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	
Week 2	

Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts النصوص المطلوبة	THOMAS' CALCULUS, 4th edition , 2018 BY: GEORGE B. THOMAS, JR., JOEL HASS, CHRISTOPHER HEIL and MAURICE D. WEIR	
Recommended Texts	CALCULUS, 9th edition , 2020 BY: JAMES STEWART, DANIEL CLEGG and SALEEM WATSON.	
Websites		

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks %	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance أداء 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	Mechanics and properties of matter I			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	PHY1101				
ECTS Credits	**8**				
SWL (hr/sem)	**200**				
Module Level	1		Semester of Delivery	1	
Administering Department	Physics		College	Science	
Module Leader	Ammar Yaseen Burjes		e-mail	ammaryaseen@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Msc	
Module Tutor			e-mail		
Peer Reviewer Name	Alaa abdul hakeim hamed		e-mail	E-mail: alaahakeim@uomosuledu.iq	
Scientific Committee Approval Date	02/06/2023		Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module		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- Introduce students to the importance of Classical Mechanics in physics by explaining (The SI Units, Quantities, Displacement, Distance, Scalar & Vector Quantities, Motion, Velocity, Speed, Acceleration, Kinematic equations, a Freely Falling Body, Projectile Motion, laws of Newton's of motion, and Friction). 2- Enabling students to distinguish between Vectors quantities and Scalar quantities and the motion of the body at constant Velocity and constant Acceleration with Kinematic equations, Freely falling body, Projectile Motion, Newton's Laws of Motion, and Friction. 3- Develop students' knowledge about the most important mechanics in (Scalar & Vector quantities, Displacement, Distance, Velocity, Acceleration, Kinematic equation, the Freely Falling body, Projectile motion, Newton's Laws of Motion, and Friction). 4- Accustom students to linking the theoretical side of the module with the daily practical life of the student, by giving him examples related to ordinary life. 5- Study the (Scalar quantities & Vector quantities) properties by studying the sum, subtract, Scalar product & Vector product. 6- Study the Displacement, and (Motion of the body) at constant Velocity & acceleration, and the Kinematic equations. 7-Enabling the student to know the basic concepts of a Freely Falling body, Projectile Motion, Newton's Laws of Motion, and Friction. 8- Overall, the aim of a module is to provide students with powerful tools for understanding and analyzing Classical Mechanics properties.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1-Properties of Mechanics: Mechanics are classified into Two important essential branches which are namely kinematics and Dynamics. 2- Kinematic: This is the branch of mechanics that studies the motion of a body without regard to the cause of that motion. which include the study of average velocity and a constant velocity of a moving body, average acceleration and constant acceleration of a moving body, Instantaneous velocity, and instantaneous acceleration of a moving body. 3- The Three Kinematic equations of motion which describe the motion of body with initial velocity and final velocity, instant of time (t), displacement, and acceleration of a moving body. 4- The Freely Falling Body: which describe the body that is moving freely under the influence of gravity, where it is assumed that the effect of air is negligible. 5- Projectile Motion: which describe of an object is simple to analyze if we make two assumption: (1) the free-fall acceleration is constant over the range of motion and is directed downward, and (2) the effect of air resistance is negligible, and study Horizontal Range, Maximum Height of Projectile and time of flight of the projectile. 6- Dynamic: is the branch of mechanics concerned with the forces that change or produce the motion of bodies. the foundation of dynamics is Newton's Laws of motion (First, Second and Third Law).

	Another type of Dynamic is the Friction which is divided in two type the first is (Force of Static Friction) and the second is the (Force of Kinetic Friction).
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Indicative content includes the following. Part A – Theoretical lectures The SI Units, Quantities, Scalar quantities, Vector quantities, sum, subtract, multiplication of quantities, displacement, distance, Study of Motion, Kinematic, average velocity, body moving at constant velocity, Speed, average acceleration, body moving at constant acceleration, instantaneous velocity and instantaneous acceleration of a moving body, The three Kinematic equations of motion, Freely Falling body, Projectile Motion with (Range, maximum Hight, Time of flight). The Dynamic with Newton's Three laws of motion. Friction, Force of static friction and Force of Kinetic Friction. Part B – Practical labs

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Expanding students' perceptions about this science and its contents it includes that help in understanding the properties of Classical Mechanics which includes, Standard Unites, Scalar Quantities and Vector Quantities, displacement, distance, Study of Motion, Kinematic, average velocity, body moving at constant velocity, Speed, average acceleration, body moving at constant acceleration, instantaneous velocity and instantaneous acceleration of a moving body, The three Kinematic equations of motion, Freely Falling body, Projectile Motion with (Range, maximum Hight, Time of flight). The Dynamic with Newton's Three laws of motion. Friction, Force of static friction and Force of Kinetic Friction. . In addition, the explain different methods to velocity and acceleration measurement. also, explain the Freely Falling body, Projectile Motion, Force, Friction property. This will be achieved through lectures, labs, and interactive tutorials and by types of practical diagnostic methods for matter and involving some 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	94	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	81	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	5

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	10% (10)	7,9 and 15	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	15% (15)	Continuous	All
	Report	1	5% (5)	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)		

Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	175

Delivery Plan (Weekly Syllabus)
المنهاج الأسبوعي النظري

	Material Covered
Week 1	Introduction to Classical Mechanics
Week 2	The Standard Unites and Scalar Quantities and Vector Quantities
Week 3	Sum and Subtract of Scalar & Vector Quantities
Week 4	Multiplication of Scalar & Vector Quantities
Week 5	Distance and displacement
Week 6	Study of Motion, Kinematic, average velocity, body moving at constant velocity, Speed,
Week 7	Discussion and Quiz
Week 8	average acceleration, body moving at constant acceleration,
Week 9	instantaneous velocity and instantaneous acceleration of a moving body,
Week 10	Discussion and Mid-term Exam
Week 11	The three Kinematic equations of motion, Freely Falling body,
Week 12	Projectile Motion with (Range, maximum Hight, Time of flight).
Week 13	The Dynamic with Newton's Three laws of motion.
Week 14	Friction, Force of static friction and Force of Kinetic Friction.
Week 15	Discussion and Quiz

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Rigidity modulus-static torsion
Week 2	Rigidity modulus of the suspension wire of a Torsion pendulum
Week 3	The simple Pendulum
Week 4	The moment of inertia of a fly wheel
Week 5	Compound pendulum
Week 6	Investigate how the frequency of vibration of a stretched string depends upon:1- the length and 2- tension
Week 7	Determined the frequency of a tuning fork by means of a sonometer
Week 8	Experiments with a spiral spring
Week 9	The coefficients of (1) Static and (2) dynamic friction for wood on – wood
Week10	The velocity of Sound
Week 11	The Central Force
Week 12	The Specific Gravity

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Physics for Scientists and Engineers with modern physics/ Douglas C. Giancoli (2009) 2- Physics for Scientists and Engineers with modern physics/ Raymond A. Serway and John W. Jewett, Jr. (2016).	Yes Yes

	3. Physics part 1/ Jearl Walker. (2010)	No
Recommended Texts	1- fundamentals of Physics, 8th edition, by Jearl Walker 2- Fundamentals of College Physics Updated Fifth Edition Volume I: Mechanics, Vibratory Motion, Wave Motion, Fluids, and Thermodynamics Dr. Peter J. Nolan	No No
Websites	https://ocw.aprende.org/courses/physics/8-01-physics-i-classical-mechanics-fall-1999/video-lectures/	

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	Mechanics and properties of matter II			Module Delivery	
Module Type	**Core**			☒ Theory ☒ Lecture ☒ Lab ☒ Tutorial ☐ Practical ☐ Seminar	
Module Code	PHY1214				
ECTS Credits	**8**				
SWL (hr/sem)	**200**				
Module Level	1		Semester of Delivery	2	
Administering Department	Physics		College	Science	
Module Leader	Dr. Samir Mahmmod Ahmad		e-mail	dr.samir@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	PhD	
Module Tutor			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	Mechanics and properties of matter I	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- Introduce students to the importance of matter in physics by explaining the states of matter and studying their properties 2- Enabling students to distinguish between ways to transfer a matter from one state to another 3- Develop students' knowledge about the most important properties of matter (mass, density, pressure). 4- Accustom students to linking the theoretical side of the module with the daily practical life of the student, by giving him examples related to ordinary life. 5- Study the elasticity property of solid materials by studying the elasticity, stress, and compliance parameters. 6- Enabling the student to know the basic concepts of fluids at rest through studying fluid pressure, Pascal rule and Archimedes principle in buoyancy 7- Overall, the aim of an module is to provide scientists with powerful tools for understanding, analyzing, and optimizing matter properties
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1-Properties of Matter: matter classified to four states. Also can characterized a state of matter by phase transitions 2- Fluid Static: The study of fluids from two different approaches. First, we will consider only fluids that are at rest. This portion of the study of fluids is called fluid statics or hydrostatics. Second, a study the behavior of fluids when they are in motion. This part of the study is called fluid dynamics or hydrodynamics. 3-pressure and Density: how calculte the density of mateial, pressure measurements, pressure units 4-Pascal,s Principal and Archimedes Principal: defination, example of the use of Pascal's principle, study the hydraulic lift, 5- The Equation of Continuity: The study of fluids in motion 6-Bernoulli,s Equation: The study of fluids in motion through change the height of the pipe 7-Elasticity: defination, study the Elasticity Modulus
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Indicative content includes the following. Part A – Theoretical lectures Properties of matter, Pressure and Pressure in fluid of uniform density, Pressure in fluid of varies density, pressure measurements, Pascal law, and Archimedes' principle, The Bernoulli Equation, surface tension, capillary Atmospheric pressure and Gauge pressure, Buoyancy Force, The Continuity Equation, Elasticity, stress, strain, elastic modulus, Young's modulus, Shear modulus, Bulk modulus Part B – Practical labs Rigidity modulus-static torsion, Rigidity modulus of the suspension wire of a torsion pendulum, Bernoulli's theory, The moment of inertia of a fly wheel, Compound pendulum, Investigate how the frequency of vibration of a stretched string depends upon: the length and tension, Determined the frequency of a tuning fork by means of a sonometer, The surface tension of

	water by the capillary tube method, Flow of water through a capillary tube, Central force, The specific gravity, The fall of a body through a viscous medium

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Expanding students' perceptions about this science and its contents it includes that help in understanding the properties of matter, fluids in hydrostatics and hydrodynamics states. In addition, the explain different methods to pressure measurement. also, explain the elasticity property of solid materials by studying the elasticity, stress, and compliance parameters. This will be achieved through lectures, labs, and interactive tutorials and by types of practical diagnostic methods for matter and involving some 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	94	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	81	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					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	5% (5)	7,9 and 15	LO #1, #2 and #10, #11
	Assignments	2	2.5% (2.5)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	15% (15)	Continuous	All
	Report	1	2.5% (2.5)	13	LO #5, #8 and #10
Summative assessment	Midterm Exam	2hr	15% (15)	7	LO #1 - #7
	Final Exam	3hr	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week 1	Introduction to properties of matter
Week 2	Density and Pressure
Week 3	Measurement of Pressure and Pressure in fluid of uniform density
Week 4	The variation of pressure in a fluid
Week 5	Pascal's principle
Week 6	Archimedes principle
Week 7	Discussion and Quiz
Week 8	The equation of continuity
Week 9	Bernoulli's theorem and Quiz
Week 10	Discussion and Mid-term Exam
Week 11	Elasticity
Week 12	Young modulus
Week 13	Shear modulus
Week 14	Bulk modulus
Week 15	Discussion and Quiz

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	
	Material Covered
Week 1	Rigidity modulus-static torsion
Week 2	Rigidity modulus of the suspension wire of a torsion pendulum
Week 3	Bernoulli's theory
Week 4	The moment of inertia of a fly wheel
Week 5	Compound pendulum
Week 6	Investigate how the frequency of vibration of a stretched string depends upon: the length and tension

Week 7	Determined the frequency of a tuning fork by means of a sonometer
Week 8	The surface tension of water by the capillary tube method
Week 9	Flow of water through a capillary tube
Week10	Central force
Week 11	The specific gravity
Week 12	The fall of a body through a viscous medium

Learning and Teaching Resources
مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1-Physics for Scientists and Engineers with modern physics/ Douglas C. Giancoli (2009) 2- Physics for Scientists and Engineers with modern physics/ Raymond A. Serway and John W. Jewett, Jr. (2016). 3. Physics part 1/ Jearl Walker. (2010)	Yes Yes No
Recommended Texts	1- fundamentals of Physics, 8th edition, by Jearl Walker 2- Fundamentals of College Physics Updated Fifth Edition Volume I: Mechanics, Vibratory Motion, Wave Motion, Fluids, and Thermodynamics Dr. Peter J. Nolan	No No
Websites	https://study.com/academy/lesson/physical-property-of-matter-definition-examples-quiz.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	**Modern Physics I**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY2308**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	2		Semester of Delivery	3	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Mohsen Mohammed Hussein		e-mail	Mohsen@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	MSc.	
Module Tutor			e-mail		
Peer Reviewer Name	Name		e-mail	E-mail	
Scientific Committee Approval Date	/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	Modern physics is intended to be used with two - semester courses for student who have already had basic physics and calculus courses .Relativity and quantum ideas are considered first to provide a framework for understanding the physics of atoms and nuclei . The theory of atom is then developed with emphasis on quantum - mechanical notions . Next comes a discussion of the properties of aggregates of atoms , which includes a look at statistical mechanics . Finally atomic nuclei and elementary particles are examined .
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	The balance in this course learns more toward ideas than toward experimental methods and practical applications , because I believe that the beginning student is better served by conceptual framework than by a mass of details . Whenever possible , important subjects are introduced on an elementary level , which enables even relatively unprepared students to understand what is going on from the start and also encourages the development of physical intuition in readers in whom the mathematics (rather modest) inspires no terror. Because the ideas of modern physics represented totally new directions in thought when first proposed rather than extensions of previous knowledge , the story of development is exceptionally interesting .
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A – Theoretical lectures</u> 1 Special relativity, Michelson and Morley experiment , time dilation ,length contraction , twin paradox ,relativistic momentum , relativistic mass , relativistic energy . 2 Particle nature of waves , x- ray , photoelectric effect , x- ray diffraction , Compton effect ,pair production. 3 Wave nature of particles ,wave function , uncertainty principles 4 Atomic structure , atomic spectrum , Bohr atom , energy levels

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	For this course of modern physics the treatment of special relativity , quantum mechanics , and elementary particles received major revisions . There is more material on aspects of astrophysics that nicely illustrate important elements of modern physics , which for this reason are discussed where relevant in the text

	rather than being concentrated in single chapter.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	150	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	10
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	Special relativity, Michelson and Morley experiment
Week 2	time dilation ,length contraction , twin paradox
Week 3	Particle nature of waves
Week 4	x- ray , photoelectric effect , x- ray diffraction.

Week 5	Compton effect ,pair production
Week 6	Wave nature of particles
Week 7	wave functions
Week 8	uncertainty principles
Week 9	Atomic structure
Week 10	Atomic spectrum
Week 11	Bohr atom
Week 12	Energy levels
Week 13	De Broglie waves
Week 14	Phase and Group Velocities
Week 15	Applying the Uncertainty principles

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Concepts of Modern Physics (Second Edition) Arthur Beiser Concepts of Modern Physics (Sixth Edition) Arthur Beiser	Yes Yes
Recommended Texts	مفاهيم في الفيزياء الحديثة : ترجمة د. منعم مشكور .	Yes
Websites	https://courses-lectures.com/2016/12/best-physics-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	**Modern Physics II**			Module Delivery	
Module Type	**Core**			☐Theory ☑Lecture ☐Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY24114**				
ECTS Credits	**6**				
SWL (hr/sem)	**150**				
Module Level	2		Semester of Delivery	4	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Hala Ibrahim Jasem		e-mail	halaibraheem@uomosul.edu.iq	
Module Leader's Acad. Title	Lecturer		Module Leader's Qualification	MSc.	
Module Tutor			e-mail		
Peer Reviewer Name	Name		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	Modern Physics I	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	Modern physics is intended to be used with two - semester courses for student who have already had basic physics and calculus courses .Relativity and quantum ideas are considered first to provide a framework for understanding the physics of atoms and nuclei . The theory of atom is then developed with emphasis on quantum - mechanical notions . Next comes a discussion of the properties of aggregates of atoms , which includes a look at statistical mechanics . Finally atomic nuclei and elementary particles are examined .
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	The balance in this course learns more toward ideas than toward experimental methods and practical applications , because I believe that the beginning student is better served by conceptual framework than by a mass of details . Whenever possible , important subjects are introduced on an elementary level , which enables even relatively unprepared students to understand what is going on from the start and also encourages the development of physical intuition in readers in whom the mathematics (rather modest) inspires no terror. Because the ideas of modern physics represented totally new directions in thought when first proposed rather than extensions of previous knowledge , the story of development is exceptionally interesting .
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part A – Theoretical lectures</u> 1 Quantum mechanics, Schrodinger equation steady state form and time dependent form, particle in a box: Energy Quantization and wave function. 2 Quantum theory of hydrogen atom, Schrodinger equation of hydrogen atom, quantum numbers and selection rules, uncertainty principles. 3 Many electron atoms, conclusion principle, electronic structure, total angular momentum. 4 Molecular physics, rotational spectrum, vibration of spectra, electronic spectra.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	For this course of modern physics the treatment of quantum mechanics , Quantum mechanics, Schrodinger equation steady state form and time dependent form, particle in a box: Energy Quantization and wave function, Quantum theory of hydrogen atom, Schrodinger equation of hydrogen atom, quantum numbers and selection rules, uncertainty principles, Many electron atoms, conclusion principle, electronic structure, total angular momentum, Molecular physics, rotational spectrum, vibration of spectra, electronic spectra and elementary particles received major revisions . There is more material on aspects of astrophysics that nicely illustrate important elements of modern physics , which for this reason are discussed where relevant in the text rather than being concentrated in single chapter.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	150	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	10
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	Quantum mechanics
Week 2	Quantum mechanics
Week 3	Schrodinger equations steady - state
Week 4	Schrodinger equations time dependent form First Quiz
Week 5	Quantum theory of hydrogen atom
Week 6	Quantum theory of hydrogen atom
Week 7	Quantum numbers and selection rules
Week 8	Quantum numbers and selection rules Second Quiz
Week 9	Many electron atoms and electron spin,
Week 10	Many electron atoms and electron spin, uncertainty principles
Week 11	Electronic structure
Week 12	Electronic structure

Week 13	Molecular Physics
Week 14	Molecular spectrum and electronic spectra
Week 15	uncertainty principles and applying the Uncertainty principles Course Final Term Exam

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Concepts of Modern Physics (Second Edition) Arthur Beiser. Concepts of Modern Physics (Sixth Edition) Arthur Beiser . Physics for Scientists and Engineers with Modern Physics, Serway Jewett 6th Edition.	Yes Yes
Recommended Texts	مفاهيم في الفيزياء الحديثة : ترجمة د. منعم مشكور .	Yes
Websites	https://courses-lectures.com/2016/12/best-physics-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	Molecular Physics			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY36029**				
ECTS Credits	**3**				
SWL (hr/sem)	**75**				
Module Level	3		Semester of Delivery	6	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Rana zeyad Alfulayih		e-mail	ranazyaad@uomosul.edu.iq	
Module Leader's Acad. Title	Teacher		Module Leader's Qualification	Master	
Module Tutor			e-mail		
Peer Reviewer Name	Name		e-mail	E-mail	
Scientific Committee Approval Date			Version Number		

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- Molecule study 2- Know the types of bonds 3- Identify molecular spectra
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Molecule 2. Types of Bonding 3. Molecular Energy 4. Shape of the atomic orbital's
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Theoretical lectures Introduction, organisms groups , types of molecules , types of bonding ,types of energy , types of spectra ,molecule of orbital's ,hybrid .

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Expanding students' perceptions about this science and its contents .

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

Module Evaluation
تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10%		
	Assignments	2	5%		
	Projects / Lab.				
	Report				
Summative assessment	Midterm Exam	2hr	25%		
	Final Exam	3hr	60%		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)
المنهاج الأسبوعي النظري

	Material Covered
Week 1, 2	The molecule definition
Week 3,4	Molecular Formation
First Quiz	
Week 5,6	Molecular Orbital's
Week 7,8	Types of Bonding
Second Quiz	
Week 9,10	Molecular Energy
Week 11,12	The Quantum Numbers
Third Quiz	
Week 12, 13	Ionization Energy
Week 14,15	Hybrid Orbital's
Course Final Term Exam	

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

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Atomic and molecular physics lecture tom kirchner1 Atomic , molecule and photons second edition Concepts of modern physics Arthur beiser	Yes Yes
Recommended Texts		
Websites	https://www.sciencedirect.com/topics/physics-and-astronomy/molecular-physics	

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

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Nanophysics**			Module Delivery	
Module Type	**Core**			☒ Theory ☒ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	PHY36030				
ECTS Credits	3				
SWL (hr/sem)	75				
Module Level	3		Semester of Delivery	6	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Ahmed Muneer		e-mail	ahmed.198381@uomosul.edu.iq	
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D.	
Module Tutor			e-mail		
Peer Reviewer Name			e-mail		
Scientific Committee Approval Date	02/06/2023		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. Clarification of nano scales that can make significant and contribute to a wide range of technical applications. 2. Identify the basics of nanotechnology. 3. This course deals with the basic concept of the most important elements in nano such approaches, the structure of nanomaterials, examples of nanomaterials, tools used to investigate materials, experiments and techniques used for preparing and applications of nano technology. 4. Learn about the most important scientific terms (Terminology) and their definitions related to this topic. 5. To understand and comprehend the impact of these elements from Physics point of view.
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. To know about nanotechnology in detail 2. To understand the structures of materials. 3. To comprehend the conditions of obtaining nanotechnologyogy. 4. To go through applications of it. 5. To experience how usage of this technology in developing products. 6. To experience the structures of materials.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Part A – Theoretical lectures Chapter One (Basic Concepts [*10* hrs] Chapter Two (approaches): [*8* hrs] Chapter Three (tools) [10 hrs] Chapter Four (techniques used in nanotechnology) [8 hrs] [4 hrs] Revision problem classes [3 hrs]

Learning and Teaching Strategies استراتيجيات التعلم والتعليم

Strategies	Expanding students' perceptions about this science and its contents. In addition, assisting students in knowledge gathering of basic sound and wave motion principles and concepts through understanding behaviors of certain wave components. Practical work should enhance perceptions of students about particular design and analysis of wave motion.

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	27	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	75		

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

Delivery Plan (Weekly Syllabus) المنهاج الأسبوعي النظري	
	Material Covered
Week 1	Introduction

Week 2	Approaches
Week 3	Tools
Week 4	Tools
Week 5	Experiments
Week 6	Experiments
Week 7	Techniques
Week 8	Techniques
Week 9	Techniques
Week 10	Preparing materials
Week 11	Preparing materials
Week 12	Study materials
Week 13	Study materials
Week 14	Application
Week 15	Revision

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	
Week 10	
Week 11	
Week 12	
Week 13	
Week 14	

Week 15	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Poole, Charles P., and Frank J. Owens. "Introduction to nanotechnology." (2003): 145-150.	Yes
Recommended Texts	Satyanarayana, T. S. V., & Rai, R. (2011). Nanotechnology: the future. Journal of interdisciplinary dentistry, 1(2), 93.	Yes
Websites	• https://www.conted.ox.ac.uk/about/postgraduate-certificate-in-nanotechnology?utm_source=ads&utm_medium=cpc&utm_campaign=2402-pg-nanotechnology-courses&gad_source=1&gclid=EAIaIQobChMI2tuik73LhQMV40hBAh21RAy9EAAYASAAEgIv8PD_BwE • https://www.immerse.education/nanotechnology-summer-school/cambridge/ • https://www.prospects.ac.uk/universities/university-of-cambridge-3692/department-of-physiology-development-and-neuroscience-8557/courses/nanoscience-and-nanotechnology-125983 • https://www.coursera.org/courses?query=nanotechnology&utm_medium=sem&utm_source=gg&utm_campaign=b2c_emea_coursera_ftcof_career-academy_arte_march_24_dr_geo-multi-set3_pmax_gads_lg-all&campaignid=21103949440&adgroupid=&device=m&keyword=&matchtype=&network=x&devicemodel=&adposition=&creativeid=&hide_mobile_promo&gad_source=1&gclid=EAIaIQobChMI8LGXyb3LhQMV6KBoCR1Mpgw_EAAYAiAAEgIg__D_BwE	

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	**Nuclear Physics I**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY47031**				
ECTS Credits	7				
SWL (hr/sem)	175				
Module Level		4	Semester of Delivery		7
Administering Department		Type Dept. Code	College	Type College Code	
Module Leader	Firas Mohammed Ali		e-mail	dr.firas@uomosul.edu.iq	
Module Leader's Acad. Title		Professor	Module Leader's Qualification		Ph.D.
Module Tutor			e-mail		
Peer Reviewer Name		Name	e-mail	E-mail	
Scientific Committee Approval Date		06/06/2023	Version Number		1.0

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	1 . Nuclear properties of nuclei: the unit aims to provide a comprehensive understanding of the properties of stable nuclei (such as charge, mass, binding energy, dipole, angular momentum, spin, symmetry, quantum statistics ... etc.) and dynamic properties (such as transition potential and reaction rates 2. The phenomenon of radioactivity of the elements is the self-dissolution of nuclei with the emission of alpha, beta, or gamma rays, etc., and it is either natural or artificial. 3. Radiation interactions with matter have different mechanisms depending on the type and nature of radiation and whether it is charged or uncharged. 4. Alpha Decay: Until the discovery of spontaneous fission, alpha decay was the only known type of radioactivity decay, as dissolved nuclei give off relatively heavy particles, which are alpha and nascent particles. This process is a Coulomb repulsion that occurs inside the nucleus and increases by increasing the square of the atomic number. 5. Beta decay: its decay by the natural and artificial radioactive nuclei in it has added a lot in order to understand the structures of the different nuclei and their properties. Negative electrons (β^-) or positive electrons (β^+) can be emitted, or the opposite process, such as electronic capture, can occur from atomic orbits, accompanied by the emission of X-rays that are emitted when the gap is filled. So the beta decay process is creating an electron from the available decay energy. 6. Gamma decay: It is an electromagnetic radiation that has no electric charge. Its nature does not differ from light, X-rays, braking rays, or radio waves except by wavelength. It is represented by the fluctuation of an electric and magnetic field. Thus, it is generated by multipolar electric and magnetic radiation, and gamma rays remain an important source of information about energy levels (energy, spin, symmetry, etc.), and thus information about the nuclear structure. 7. Nuclear reactions: a process in which a change occurs in the composition of the target nucleus and its energy or in one of them only after bombarding the target nucleus with charged or uncharged particles. A large percentage of information related to the nuclear composition can be obtained. The mechanism of nuclear interaction and the type of interaction between the missile and the target, as well as the internal structure of the nuclei participating in the interaction, produce other radioactive isotopes that have dynamic properties different from the target nucleus that can be harnessed in the field of nuclear medicine and the treatment and diagnosis of cancers. 8. Nuclear models: Nuclear models still lack a coherent and comprehensive theory through which all nuclear phenomena can be explained. Also, the nature of the nuclear forces between nucleons still represents one of the difficulties to deal with. Therefore, attempts were required to link the nuclear data through a number of nuclear models: the crust model, the liquid drop model, the collective model, and then the visual model. And that each of these models is based on a set of assumptions.

Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Knowledge and understanding: A - Preparing trained and qualified cadres to work in scientific institutions, health and industrial centers. B- Enable the student to know and understand the nuclear material and the properties of the nuclei (theoretical and practical) and use them in community service. 2. 2- Special skills: A- Acquires skill in dealing with all types of nuclear radiation and its sources B- Work in the field of radiation shielding and ways of protection from radiation. C -Work in the field of combating radioactive contamination in any area exposed to radiation D- Working in the field of radiotherapy and nuclear medicine, as a person who possesses skill in the basis of the mechanism of action of medical devices, especially in scans and diagnostics with magnetic separators, in addition to CT-SCAN diagnostics in positron emission. E- Express the basic concepts of nuclear physics. F- It can tell the chronology of some major events in nuclear physics. G- Familiarize yourself with some introductory terms Units and dimensions can be used. H- It can express radioactive decay, and it can show some quantities that characterize decay such as half-life, decay constant. I -Able to express Successive Decays. J - Can tell the growth of the daughter's activities, and it can tell about the radiative balance. K- Can express reaction equation and Q values and Energy of alpha particles, can explain the alpha process by using quantum theory. Can calculate the half-times based on quantum theory. L- Can list the types of beta decays and can express reaction equations and related Q values and energy of beta particles. Can explain the beta decay process by using the Fermi theory. Can express the selection rules and its applications. Can tell about the allowed and forbidden transitions. M- Can express the types of gamma decay. Can tell about selection rules .Can write the lowest permitted multipoles. N - Can express nuclear binding energy and nuclear masses. Can write semi empirical mass formula. Can explain the terms in the semi empirical mass formula. O- Can write types of reactions and conservation laws. Can write energies of observable products .Can express the threshold energy. Can express reaction cross section. P- Can express the nuclear models ,as shell model, liquid drop model, collective model, and optical model.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. 1 Nuclear Properties : charge of nuclei ,radius of nuclei, distance of closest approach, mass of nuclei , mass excess , mass spectroscope , nuclear binding energy , separation energy , semi empirical mass formula , magnetic dipole moment ,quadrupole electric moment , parity , fermi Dirac , and Bose Einstein statistics.

	2- Radioactivity: Law decay , half life , mean life , total number of radioactive nuclei , mixture of radioactive samples , production of radioactive isotopes by a decaying parent , transient equilibrium , ideal equilibrium , time of maximum activity of daughter product , multi processes decay , width of decaying states , units of radioactivity . 3- Interaction of radiation with matter: Breaking radiation , interaction of charged particle with matter , heavy charged particle , energy loss by collision , electron interaction , neutron slowing down . 4- Alpha decay : The radiation series , energetic of alpha decay , alpha decay systematic , theory of alpha emission , hindrance factor , rang – energy relationship . 5 – Beta –Decay : Neutrino hypothesis , parity non conservation , energy release in beta decay , fermi theory in beta decay , shape of beta spectrum ,neutrino mass measurement , total decay rate and life time of beta decay selection rules . 6- Gamma decay : interaction of gamma ray with matter , annihilation electromagnetic transition probability , selection rules , internal conversion , Mossbauer effect. 7- Nuclear reaction : type of nuclear reaction , energetic of nuclear reaction , exoergic reactions , endoergic reactions , threshold energy , nuclear reaction cross-section , theories of nuclear reaction , compound – nucleus reactions , direct reaction resonance reactions , cross –section and Breit – Wigner formula. 8- Nuclear Models: Shell Model , Liquid Drop Model , shell model potential , Collective Model , Optical Model.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Teaching strategies vary according to the grade level and subject being taught. The most common teaching strategies are: direct instruction, indirect instruction, interactive instruction, independent study and experimental learning. Simply put, a teaching strategy is the way an instructor chooses to convey information and facilitate learning. Generally, teaching strategies fall into one of two categories: active learning or inclusive teaching. Active learning involves directing students to analyze course material. For example, giving a lecture, assigned readings, group discussions and class activities that involve problem solving are all active learning teaching strategies. Direct instruction, indirect instruction, independent study and interactive instruction are all teaching strategies that are considered to be active learning. On the other hand, inclusive teaching means instructors vary their teaching strategy according to the learning styles of their students to include all students in the learning process. A teacher may employ a number of active learning methods to teach students; the difference is that active learning involves using one method for

	all students and inclusive teaching involves using several different active learning strategies simultaneously. Because the goal of inclusive teaching is adapting to learning styles, experimental learning is most often used for inclusive teaching.

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	81	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					
		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 (الكورس الأول)	
	Material Covered
Week 1	Introduction to nuclear properties .
Week 2	Stable properties and dynamic properties :

Week 3	Magnetic dipole moment and electric quadrupole moment
Week 4	Parity and Statistics , Discussion and Quiz :
Week 5	Introduction to radioactivity Law decay , half life , mean life , total number of radioactive nuclei , , transient equilibrium , ideal equilibrium , time of maximum activity of daughter product , multi processes decay , width of decaying states , units of radioactivity .
Week 6	Mixture of radioactive samples , production of radioactive isotopes by a decaying parent
Week 7	Transient equilibrium , ideal equilibrium , time of maximum activity of daughter product , multi processes decay , width of decaying states , units of radioactivity .
Week 8	Interaction of radiation with matter: Breaking radiation , interaction of charged particle with matter
Week 9	Heavy charged particle , energy loss by collision ,
Week 10	Electron interaction , neutron slowing down .
Week 11	Discussion and Quiz
Week 12	Alpha decay : The radiation series , energetic of alpha decay .
Week 13	Alpha decay systematic , theory of alpha emission
Week 14	Hindrance factor , rang – energy relationship .
Week 15	Discussion and Quiz

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	1- Nuclear and Particle Physics B. R. Martin # 2006 John Wiley & Sons, Ltd. ISBN: 0-470-01999-9 2- 2-Introductry nuclear physics, Sixth Edition, Samuel_S._M._Wong, Washington University Press, 2006.	Yes Yes
Recommended Texts	An Introduction to Nuclear Physics Second edition W. N. COTTINGHAM University of Bristol D. A. GREENWOOD University of Bristol. Cambridge University Press 1986, 2004.	Yes
Websites	1- https://www.googleadservices.com/pagead/aclk?sa=L&ai=DChcSEwjOudmM-bX_AhVOh9UKHZnqCbUYABAEGgJ3cw&ohost=www.google.com&cid=CAESbeD2PPoqoHQgZvYn88kL70JmUq-C-MHL2XeyHkcl-NboHZeOacm1QloWyCu4Xy39naNO6WaMX5V25wPfaoLcxdlAZy5ujcp-Wi9N0-UkolT5b0qphQ2eLOkURcTJNGpUfiy2CYTJeS2hRXRaXJA&sig=AOD64_3iXS7Qe3FxLIINUXVdAPfCBIz_wg&q&adurl&ved=2ahUKEwjR1dKM-bX_AhW3XfEDHaWMCoQQ0Qx6BAgCEAE 2- https://www.googleadservices.com/pagead/aclk?sa=L&ai=DChcSEwjOudmM-bX_AhVOh9UKHZnqCbUYABAGGgJ3cw&ohost=www.google.com&cid=CAESbeD2PPoqoHQgZvYn88kL70JmUq-C-MHL2XeyHkcl-NboHZeOacm1QloWyCu4Xy39naNO6WaMX5V25wPfaoLcxdlAZy5ujcp-Wi9N0-UkolT5b0qphQ2eLOkURcTJNGpUfiy2CYTJeS2hRXRaXJA&sig=AOD64_1WWke3gB5usSCwZRSF33Woil79Zg&q&adurl&ved=2ahUKEwjR1dKM-bX_AhW3XfEDHaWMCoQQ0Qx6BAgIEAE 3- https://www.energy.gov/science/np/nuclear-physics	

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	**Nuclear Physics II**			Module Delivery	
Module Type	**Core**			☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	**PHY47031**				
ECTS Credits	7				
SWL (hr/sem)	175				
Module Level	4		Semester of Delivery	8	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Firas Mohammed Ali		e-mail	dr.firas@uomosul.edu.iq	
Module Leader's Acad. Title	Professor		Module Leader's Qualification	Ph.D.	
Module Tutor			e-mail		
Peer Reviewer Name	Name		e-mail	E-mail	
Scientific Committee Approval Date	06/06/2023		Version Number	1.0	

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	PHY47031	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 . Nuclear properties of nuclei: the unit aims to provide a comprehensive understanding of the properties of stable nuclei (such as charge, mass, binding energy, dipole, angular momentum, spin, symmetry, quantum statistics ... etc.) and dynamic properties (such as transition potential and reaction rates 2. The phenomenon of radioactivity of the elements is the self-dissolution of nuclei with the emission of alpha, beta, or gamma rays, etc., and it is either natural or artificial. 3. Radiation interactions with matter have different mechanisms depending on the type and nature of radiation and whether it is charged or uncharged. 4. Alpha Decay: Until the discovery of spontaneous fission, alpha decay was the only known type of radioactivity decay, as dissolved nuclei give off relatively heavy particles, which are alpha and nascent particles. This process is a Coulomb repulsion that occurs inside the nucleus and increases by increasing the square of the atomic number. 5. Beta decay: its decay by the natural and artificial radioactive nuclei in it has added a lot in order to understand the structures of the different nuclei and their properties. Negative electrons (β^-) or positive electrons (β^+) can be emitted, or the opposite process, such as electronic capture, can occur from atomic orbits, accompanied by the emission of X-rays that are emitted when the gap is filled. So the beta decay process is creating an electron from the available decay energy. 6. Gamma decay: It is an electromagnetic radiation that has no electric charge. Its nature does not differ from light, X-rays, braking rays, or radio waves except by wavelength. It is represented by the fluctuation of an electric and magnetic field. Thus, it is generated by multipolar electric and magnetic radiation, and gamma rays remain an important source of information about energy levels (energy, spin, symmetry, etc.), and thus information about the nuclear structure. 7. Nuclear reactions: a process in which a change occurs in the composition of the target nucleus and its energy or in one of them only after bombarding the target nucleus with charged or uncharged particles. A large percentage of information related to the nuclear composition can be obtained. The mechanism of nuclear interaction and the type of interaction between the missile and the target, as well as the internal structure of the nuclei participating in the interaction, produce other radioactive isotopes that have dynamic properties different from the target nucleus that can be harnessed in the field of nuclear medicine and the treatment and diagnosis of cancers. 8. Nuclear models: Nuclear models still lack a coherent and comprehensive theory through which all nuclear phenomena can be explained. Also, the nature of the nuclear forces between nucleons still represents one of the difficulties to deal with. Therefore, attempts were required to link the nuclear data through a number of nuclear models: the crust model, the liquid drop model, the collective model, and then the visual model. And that each of these models is based on a set of assumptions.

Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Knowledge and understanding: A - Preparing trained and qualified cadres to work in scientific institutions, health and industrial centers. B- Enable the student to know and understand the nuclear material and the properties of the nuclei (theoretical and practical) and use them in community service. 2. 2- Special skills: A- Acquires skill in dealing with all types of nuclear radiation and its sources B- Work in the field of radiation shielding and ways of protection from radiation. C -Work in the field of combating radioactive contamination in any area exposed to radiation D- Working in the field of radiotherapy and nuclear medicine, as a person who possesses skill in the basis of the mechanism of action of medical devices, especially in scans and diagnostics with magnetic separators, in addition to CT-SCAN diagnostics in positron emission. E- Express the basic concepts of nuclear physics. F- It can tell the chronology of some major events in nuclear physics. G- Familiarize yourself with some introductory terms Units and dimensions can be used. H- It can express radioactive decay, and it can show some quantities that characterize decay such as half-life, decay constant. I -Able to express Successive Decays. J - Can tell the growth of the daughter's activities, and it can tell about the radiative balance. K- Can express reaction equation and Q values and Energy of alpha particles, can explain the alpha process by using quantum theory. Can calculate the half-times based on quantum theory. L- Can list the types of beta decays and can express reaction equations and related Q values and energy of beta particles. Can explain the beta decay process by using the Fermi theory. Can express the selection rules and its applications. Can tell about the allowed and forbidden transitions. M- Can express the types of gamma decay. Can tell about selection rules .Can write the lowest permitted multipoles. N - Can express nuclear binding energy and nuclear masses. Can write semi empirical mass formula. Can explain the terms in the semi empirical mass formula. O- Can write types of reactions and conservation laws. Can write energies of observable products .Can express the threshold energy. Can express reaction cross section. P- Can express the nuclear models ,as shell model, liquid drop model, collective model, and optical model.

Indicative Contents المحتويات الإرشادية	Indicative content includes the following. 1 Nuclear Properties : charge of nuclei ,radius of nuclei, distance of closest approach, mass of nuclei , mass excess , mass spectroscope , nuclear binding energy , separation energy , semi empirical mass formula , magnetic dipole moment ,quadrupole electric moment , parity , fermi Dirac , and Bose Einstein statistics. 2- Radioactivity: Law decay , half life , mean life , total number of radioactive nuclei , mixture of radioactive samples , production of radioactive isotopes by a decaying parent , transient equilibrium , ideal equilibrium , time of maximum activity of daughter product , multi processes decay , width of decaying states , units of radioactivity . 3- Interaction of radiation with matter: Breaking radiation , interaction of charged particle with matter , heavy charged particle , energy loss by collision , electron interaction , neutron slowing down . 4- Alpha decay : The radiation series , energetic of alpha decay , alpha decay systematic , theory of alpha emission , hindrance factor , rang – energy relationship . 5 – Beta –Decay : Neutrino hypothesis , parity non conservation , energy release in beta decay , fermi theory in beta decay , shape of beta spectrum ,neutrino mass measurement , total decay rate and life time of beta decay selection rules . 6- Gamma decay : interaction of gamma ray with matter , annihilation electromagnetic transition probability , selection rules , internal conversion , Mossbauer effect. 7- Nuclear reaction : type of nuclear reaction , energetic of nuclear reaction , exoergic reactions , endoergic reactions , threshold energy , nuclear reaction cross-section , theories of nuclear reaction , compound – nucleus reactions , direct reaction resonance reactions , cross –section and Breit – Wigner formula. 8- Nuclear Models: Shell Model , Liquid Drop Model , shell model potential , Collective Model , Optical Model.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Teaching strategies vary according to the grade level and subject being taught. The most common teaching strategies are: direct instruction, indirect instruction, interactive instruction, independent study and experimental learning. Simply put, a teaching strategy is the way an instructor chooses to convey information and facilitate learning. Generally, teaching strategies fall into one of two categories: active learning or inclusive teaching. Active learning involves directing students to analyze course material. For example, giving a lecture, assigned readings, group discussions and class activities that involve problem solving are all active learning teaching strategies.

	Direct instruction, indirect instruction, independent study and interactive instruction are all teaching strategies that are considered to be active learning. On the other hand, inclusive teaching means instructors vary their teaching strategy according to the learning styles of their students to include all students in the learning process. A teacher may employ a number of active learning methods to teach students; the difference is that active learning involves using one method for all students and inclusive teaching involves using several different active learning strategies simultaneously. Because the goal of inclusive teaching is adapting to learning styles, experimental learning is most often used for inclusive teaching.

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	81	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

		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 (الكورس الثاني)	
	Material Covered
Week 1	Beta –Decay : Neutrino hypothesis , parity non .
Week 2	, energy release in beta decay , fermi theory in beta decay ,
Week 3	shape of beta spectrum ,neutrino mass measurement , total decay rate and life time of beta decay selection rules .
Week 4	Parity and Statistics , Discussion and Quiz :
Week 5	Gamma decay : interaction of gamma ray with matter , annihilation , electromagnetic transition probability , selection rules , internal conversion , Mossbauer effect.
Week 6	Annihilation, electromagnetic transition probability ,
Week 7	selection rules , internal conversion , Mossbauer effect.
Week 8	Discussion and Quiz :
Week 9	Nuclear reaction : type of nuclear reaction , energetic of nuclear
Week 10	Exoergic reactions , endoergic reactions , threshold energy , nuclear reaction cross- section , theories of nuclear reaction , compound – nucleus reactions .
Week 11	Direct reaction , resonance reactions , cross –section and Breit – Wigner formula. Discussion and Quiz :
Week 12	Nuclear Models: Shell Model , shell model potential .
Week 13	Liquid Drop Model ,
Week 14	Collective Model , Optical Model.
Week 15	Discussion and Quiz

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	1- Nuclear and Particle Physics B. R. Martin # 2006 John Wiley & Sons, Ltd. ISBN: 0-470-01999-9 2- 2-Introductry nuclear physics, Sixth Edition, Samuel_S._M._Wong, Washington University Press, 2006.	Yes Yes
Recommended Texts	An Introduction to Nuclear Physics Second edition W. N. COTTINGHAM University of Bristol D. A. GREENWOOD University of Bristol. Cambridge University Press 1986, 2004.	Yes

Websites	1- https://www.googleadservices.com/pagead/aclk?sa=L&ai=DChcSEwjOudmM-bX_AhVOh9UKHZnqCbUYABAEGgJ3cw&ohost=www.google.com&cid=CAESbeD2PPoqoHQgZvYn88kL70JmUq-C-MHL2XeyHkcI-NboHZeOacm1QIoWyCu4Xy39naNO6WaMX5V25wPfaoLcxdIAZy5ujcp-Wi9N0-UkoIT5b0qphQ2eLOkURcTJNGpUfiy2CYTJeS2hRXRaXJA&sig=AOD64_3iXS7Qe3FxLIINUXVdAPfCBIz_wg&q&adurl&ved=2ahUKEwjR1dKM-bX_AhW3XfEDHaWMCoQQ0Qx6BAgCEAE 2- https://www.googleadservices.com/pagead/aclk?sa=L&ai=DChcSEwjOudmM-bX_AhVOh9UKHZnqCbUYABAGGgJ3cw&ohost=www.google.com&cid=CAESbeD2PPoqoHQgZvYn88kL70JmUq-C-MHL2XeyHkcI-NboHZeOacm1QIoWyCu4Xy39naNO6WaMX5V25wPfaoLcxdIAZy5ujcp-Wi9N0-UkoIT5b0qphQ2eLOkURcTJNGpUfiy2CYTJeS2hRXRaXJA&sig=AOD64_1WWke3qB5usSCwZRSF33Woil79Zg&q&adurl&ved=2ahUKEwjR1dKM-bX_AhW3XfEDHaWMCoQQ0Qx6BAgIEAE 3- https://www.energy.gov/science/np/nuclear-physics

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

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

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	**Physical Optics**			Module Delivery	
Module Type	**C**			☒ Theory ☒ Lecture ☒ Lab ☒ Tutorial ☒ Practical ☐ Seminar	
Module Code	PHY36025				
ECTS Credits	7				
SWL (hr/sem)	175				
Module Level	3		Semester of Delivery	6	
Administering Department	Type Dept. Code		College	Type College Code	
Module Leader	Marwa Thamer Mahmood		e-mail	marwathamer@uomosul.edu.iq	
Module Leader's Acad. Title	Teacher		Module Leader's Qualification	Ph.D.	
Module Tutor			e-mail		
Peer Reviewer Name	Name		e-mail	E-mail	
Scientific Committee Approval Date	/ /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.It aims to study the hypotheses and theories that studied the nature of light, the phenomena that it explained, and the things that failed to do so. 2. Study the wave nature of light. 3. Study of the particulate nature of light. 4. Study the phenomenon of polarization, which is one of the most important characteristics of magnetic waves because it is a transverse wave. It is worth noting that longitudinal waves do not become polarized as in sound waves. 5. Understanding the practical applications of polarization. 6. Optics are divided into two main branches, geometrical optics and physical optics, where the geometrical optics branch focuses on studying optical phenomena that deal with light as particles such as reflection and refraction, while the physical optics branch is interested in studying optical phenomena that deal with light as a wave such as diffraction and interference and polarization.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	This course introduces the basic concepts to provide the student with the cognitive and skill capabilities of the course, *Cognitive goals: 1- Enable students to know the basics of light and optics 2- Enabling students to understand visual phenomena 3- Enabling the student to keep pace with scientific development 4- Enabling students to obtain knowledge and understanding of the laws of optics, logical and scientific analysis, and interpretation of phenomena optical *The soft skills objectives of the course 1 - Enhancing the student's ability to think and imagine in dealing with the impact of invisible or tangible things 2 - Developing the student's skills in mathematics, which he needs to solve the required calculations 3 - Enhancing the student's ability to apply the theoretical and practical experience gained from his studies in various fields of life 4 - Enhancing the student's ability to constructive scientific discussion and expressing opinions
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. * Introduction to properties of light: We may roughly group the study of optics into three broad subfields of study , study the theories that study the nature of light, and the failure of the theories. *electromagnetic wave: A electromagnetic wave is an electric and magnetic field perpendicular to one another (with each other), the electromagnetic wave is a transverse wave example light and longitudinal wave example sound wave. *Doppler phenomenon or the Doppler effect: is an apparent change in the frequency or wavelength of the light due to relative motion between source of light and the observer. *Electromagnetic energy flow: poynting vector, poynting theorem: states that the vector ($\vec{S}$) gives the time rate for the passage of electromagnetic energy per unit area. The vector is called a Poynting vector, which is known as the cross multiplication of both the electric field ($\vec{E}$) and the magnetic field ($\vec{H}$).

	*Polarization: One of the most important characteristics of electromagnetic waves is that they are a transverse wave with respect to the direction of their propagation, where an electric field ripples perpendicular to a magnetic field, and both of them ripple perpendicular to the direction of propagation of the electromagnetic wave. * In nature, the oscillation of these fields is random, meaning that their direction is in full directions and not limited to a specific direction, and therefore it is said that this electromagnetic wave (or light) is unpolarized. * Matrix Representing of Polarization: This topic is to facilitate the equations of types of polarization *Reflectivity It is defined as that reflected part of the incident light energy and symbolized by symbol (R_(s),R_p) the polarization TE,TM respectively. Since the energy is directly proportional to the square of the field amplitude, *Types of reflection: External reflection: This happens when it is (n>1), that is, when the light falls from the medium of the lowest light density to the medium of the highest light density (for example, "when light falls from the air towards the water). Internal reflection: This happens when it is (n<1), that is, when light falls from the medium with the highest light density to the medium with the lowest light density (from glass to the air). *Coherence sources : The sources of light which emits continuous light waves of the same frequency, same wavelength and in same phase or having a constant phase difference *Interference phenomena: When two waves of exactly same frequency (coming from two coherent sources) travels in medium, in the same direction simultaneously then due to their superposition, at some points intensity of light is maximum while at some other points intensity is minimum. This phenomenon is called interference of light. * Diffraction of the Light It is the phenomena of bending of light around the corners of obstacle / aperture of the size of the wavelength of the light.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Conceptual Understanding: Start by providing an overview of nature of the light, and Help students understand how this principles and methods are used to analyze and interpret data in these areas. Use real-world examples and case studies to illustrate the significance of optics techniques. Problem-Solving Practice: Include problem-solving activities and assignments that require students to apply this theory to practical scenarios. Present them with real or simulated data and challenge them to analyze and interpret the information using appropriate optics techniques. This will develop their problem-solving skills and reinforce their understanding of the subject matter. Supplemental Resources: Recommend supplementary resources such as textbooks, research articles. Encourage students to explore these resources to gain a deeper

	understanding of the subject matter. Provide a curated list of recommended readings and online tools to support their learning. Assessment and Feedback: Regularly assess students' understanding through quizzes, tests, or projects. Provide constructive feedback to guide their learning and address any misconceptions. Consider incorporating formative assessments to gauge understanding before major evaluations, allowing for timely intervention and support. Collaboration and Discussion: Foster collaboration among students by organizing group discussions, case studies, or problem-solving sessions. Encourage them to share their perspectives, ideas, and experiences related to nature of the light. This collaborative environment promotes active learning, critical thinking, and knowledge sharing.

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	5.26
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	71	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	4.73
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	Light propagation & Elementary optical and the nature of the light.
Week 2	Electrical constants and speed of light & Plane harmonic waves. Phase velocity, Group velocity.
Week 3	Doppler's effect in light and its applications.
Week 4	The Victorial (Directional) Nature of Light.
Week 5	Electromagnetic Energy Flow: Poynting Vector.
Week 6	Polarization and its types, Matrix Representing of Polarization & Representing polarization plates with Jones matrix.
Week 7	Quiz
Week 8	Reflection and refraction at a plane boundary.
Week 9	Brewster Angle.
Week 10	The evanescent wave in total reflection.
Week 11	Fresnel rhomb.
Week 12	Coherence and Interference. The principle of linear superposition.
Week 13	Young Experiment, Alternative ways to see interference patterns.
Week 14	Theory of partial coherence. Diffraction of the light.
Week 15	Quiz

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	1.Halliday, Resnick and Walker; Fundamentals of Physics; 8th edition 2008. 2. F. Sears, Addison-Wesley publishing company, Optics 1964 . 3. F. Jenkins& H. White, Fundamentals of Optics by, McGraw Hill book company, 4th edition, 1985.	yes Yes
Recommended Texts	1. Grant R. Fowles, Introduction to modern optics, 2nd ed. 1975	Yes yes
Websites	https://sciences-library.blogspot.com/2018/03/Book-of-Optics-pdf.html?m=1.	

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.