MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية					
Module Title	Quantum Mechanics in Medicine			**Module Delivery**	
Module Type	C			☒Theory ☒ Lecture ☐Lab ☐ Tutorial ☒ Practical ☒ Seminar	
Module Code	UOMU0301052				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	3		**Semester of Delivery**	5	
Administering Department	Department of Medical Physics		**College**	College of Science/ Al-Mustaqbal University	
Module Leader	Prof.Dr. Fouad Attia Majeed		**e-mail**	fouad.attia.majeed@uomus.edu.iq	
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

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

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	The quantum mechanics start with the reasons and natural phenomena that have led to the emergence of quantum mechanics; this is done by highlighting the difficulty of the classic mechanics to explain many phenomena that indicate duality of the particle and wave. In order for the student to understand these phenomena we discussed: 1. Radiation- Planck's law, photoelectric effect, Compton effect, Wave Nature of matter, De Broglie waves, diffraction of matter waves. 2. Expectation values, principle of superposition; Quantum mechanical operators: Three important quantum mechanical operators, eigenfunctions and eigenvalues, properties of operators, measurability of different observables at equal times, Heisenberg's uncertainty principle. 3. Solution of Schrodinger Equation, free particle, harmonic oscillator, particle in a box, Hydrogen atom, Wavefunctions, energy spectrum. 4. The eigenstates of Spin 1/2, addition of two spins, the addition of spin 1/2 and orbital angular momentum, and general rules for addition of angular momenta.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. A brief summary of the knowledge or skill the course is intended to develop. 2. A description of the teaching strategies to be used in the course to develop that knowledge or skill. 3. The methods of student assessment to be used in the course to evaluate learning outcomes in the domain concerned. 4. Learn to be acquainted with the historical background of quantum mechanics, wave-particle description-the uncertainty principle and Schrodinger equation. 5. Understand the physics of quantum mechanics and their applications mentioned in the text. 6. Use mathematical formulation to describe the physical principle or phenomena. 7. Explain how things are working.
Indicative Contents المحتويات الإرشادية	Use quantum mechanics to understand and design the principles of operation of elementary devices such as transistors and lasers in traditional information technologies, also in relation to studying the behavior of very small objects. Also, an application of the principle of superposition of waves (constructive interference) within quantum mechanics, where the principle of superposition is one of its basic

	principles. Solve problems related to the Schrödinger equation & Solve problems related to the Hamiltonian effect, eigenvalue and eigenvalue problems, and the quantum harmonic oscillator.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1. Demonstrating the basic information and principles through lectures and the achieved applications. 2. Discussing phenomena with illustrating pictures and diagrams. 3. Lecturing method: a. Blackboard b. Power point 4. Revisit concepts. 5. Discussions. 6. Brain storming sessions. 7. Start each chapter by general idea and the benefit of it. 8. Learn the student background of the subject. 9. Show the best ways to deal with the problem. 10. Keep the question "why" or "how" to explain always there. 11. Build a strategy to solve the problem

Student Workload (SWL) الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	60	**Structured SWL (h/w)** الحمل الدراسي المنتظم للطالب أسبوعيا	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	65	**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 الاسبوعي النظري

	Material Covered
Week 1	1. Introduction to Quantum Theory.
Week 2	2. Radiation as Particles, Electrons as Waves, Plane Waves and Wavepackets.
Week 3	3. The Probability Interpretation of the Wavefunction &The Heisenberg Uncertainty Relations.
Week 4	4. Expectation Values and the Momentum in Wave Mechanics; The Momentum in Wave Mechanics, Wavefunction in Momentum Space.
Week 5	5. Eigenvalues, Eigenfunctions and the Time-Independent Schrodinger Equation.
Week 6	6. Free Particle & Normalization of the Free Particle Wave Function.
Week 7	7. First Exam.
Week 8	8. One-Dimensional Potential, the Potential Barrier and the Potential Well.

Week 9	9. Tunneling and the Harmonic Oscillator.
Week 10	10. The General Structure of Wave Mechanics.
Week 11	11. Vector Spaces and Operators.
Week 12	12. The Hamiltonian Operator.
Week 13	13. The Schrodinger Equation in Three Dimensions and the Hydrogen Atom
Week 14	14. The Energy Spectrum & spin.
Week 15	**15.** Second exam.

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

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	1. S. Gasiorowicz, "Quantum Mechanics", John Wiley & Sons, Inc., 3rd Ed. (2003).	Yes

	2. David J. Griffiths ”Introduction to Quantum Mechanics”, Pearson Prentice Hall, New York, USA, (2005). 3. Nouredine Zettili, "Quantum Mechanics: Concepts and Applications", John Wiley & Sons, Inc. (2001).	
Recommended Texts	Quantum Machines / Nouredine Zettili Copyright hc 2009 John Wiley & Sons, Ltd.	Yes
Websites	http://en.wikipedia.org/wiki/Quantum Mechanics/ http://www.dmoz.org/Science/Physics/Quantum Mechanics/	

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.

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