Faculty: Faculty of Science	
Department: Physics	**Program: Bachelor's Program**
Semester: First semester	**Academic year: 2023/2024**

Course Plan

First: Course Information

Course Name:	***Quantum Mechanics 1***			***Course No. 0302360***	
Credit Hours:	***3 hrs***	***Theoretical***	***3***	***Practical***	***0***
Prerequisite:	***0302262***	***Class Number: 1***		***Lecture Time:***	
Level in JNQF	*7*				
Course Nature:	☐ *Mandatory Faculty Requirement* ☐ *Mandatory University Requirement* ☐ *Optional Specialty Requirement*		☐ *Optional University Requirement* ☐ *Ancillary Course* ☑ *Mandatory Specialization requirement*		
Type Of Educatin:	■ *Face-to-Face Learning* ☐ *Blended Learning(2 Face-to-Face + 1Asynchronous)* ☐ *Online Learning (2 Synchronous+1Asynchronous)*				

Second: Instructor's Information

***Name*:**	***Academic Rank :***	
***Office Number*:**	***Phone Number*:**	***Email:***
Office Hours:		

Third: Short Description of the Course

The course will start with a brief review of the experiments (blackbody radiation, photoelectric effect, Compton effect, etc.) that cannot be explained by classical physics, thereby providing the necessity for quantum mechanics. This will be followed by a discussion of the wave function and its properties, leading to Schrödinger's equation. Next will be various applications of the 1-D Schrödinger equation (Infinite and finite square wells, free particle, harmonic oscillator, δ-function potential, potential barriers). This will be followed by a treatment of the mathematical formalism of quantum mechanics (Hilbert space, observables and Hermitian operators, eigenvalues and eigenfunctions, uncertainty principle, and Dirac bra and ket notation).

Fourth: Course Aims

- To introduce the Quantum Mechanical postulates for physical systems
- To introduce the Quantum Mechanical concepts of measurements for physical systems
- To introduce the role of Quantum Mechanics on evolution of the physical systems in our Universe
- To introduce the concept of Quantum Mechanics in simple microscopic systems and its connection to actual observable.

Fifth : Learning Source

Designated Book:	***Introduction to Quantum Mechanics***	***Cambridge university press***
Author: **D. J. Griffiths**	**edition: 2nd ed.**	**Year: 2005**
Additional Sources: ***Website:***	• Elementary Quantum Mechanics - (Dover Books on Physics) by David S Saxon • Modern Introductory Quantum Mechanics with Interpretation by Dr. David R Thayer	
Teaching Type:	■ ***Classroom*** ☐ ***Laboratory*** ☐ ***Workshop*** ☐ **MS Teams** ☐ **Moodle**	

Sixth : Learning Outcomes

Level descriptor according to (JNQF)	***CILOs Code***	***CILOs*** If any CILO will not be assessed in the course, mark NA.	***Associated PILOs Code*** *Choose one PILO for each CILO**	***Assessment method**** *Choose at least two methods*	***Scores out of 100*** State the total score identified for each CILO	***Minimum acceptable Score/percentage (%)*** *The percentage should not be less than 50%* ***
Knowledge	K1	Understanding of Wave-Particle Duality. Wavefunctions and their role in describing the probability distribution of particles in quantum systems.	P. K1	First exam Final exam	20	10 (50%)
	K2	Quantum States and the representation of state vectors. Schrödinger Equation and its time-dependent	P. K2	Second exam Final exam	20	10 (50%)

		and time-independent solutions. Quantum Operators and their role in representing observables. Quantum Measurement principles. Heisenberg Uncertainty Principle. Critical Thinking skills to understand and interpret quantum phenomena.				
	K3	Formalism of quantum mechanics, including bra-ket notation and matrix representation. Quantum Tunneling phenomenon Application of quantum mechanics principles to simple systems.	P. K3		20	10 (50%)
Skills	S1	Solving the time-dependent and time-independent Schrödinger equations. Understanding the measurement	P. S1	First exam Quiz	10	5 (50%)

		of observables in quantum systems. Mathematical proficiency, including linear algebra and calculus for problem-solving.				
	S2	Applying quantum mechanics principles to analyze simple systems. Grasping the formalism of quantum mechanics, including bra-ket notation.	P. S2	Final exam Quiz assingment	10	5 (50%)
	S3	Developing problem-solving skills in the context of perturbation theory. Interpretation and application of the Heisenberg Uncertainty Principle.	P. S3		10	5(50%)
Competencies	C1	Quantum Mechanics Formalism - Understanding the abstract mathematical structure of quantum theory.	P. C1	Assignment First exam	5	3 (60%)
	C2	Critical Thinking - Analyzing and interpreting quantum phenomena beyond mathematical manipulation.	P. C2	Second exam Quizz, assignment	5	3(60%)

Seventh : Course Structure

Lecture Date	Learning Outcome	Topics	Teaching Procedures	Teaching Methods	References
15/10/2023	K1	Course Review	Direct	Lecture, Data Show, Simulation, Whiteboard	
17/10/2023	K1,C1	THE SCHRODINGER EQUATION	Direct	Lecture, Data Show, Simulation ,Whiteboard	1
19/10/2023	K1,C1	THE STATISTICAL INTERPRETATION	Direct	Lecture, Data Show, Simulation, Whiteboard	2
22/10/2023	K1,S2,C1	PROBABILITY: Discrete Variables	Direct	Lecture, Data Show, Simulation ,Whiteboard	5
24/10/2023	K1,S2,C1	PROBABILITY: Continuous Variables	Direct	Lecture, Data Show, Simulation, Whiteboard	9
26/10/2023	K1,S2,C1	PROBABILITY: Solving Problems	Direct	Lecture, Data Show, Simulation ,Whiteboard	9-12
29/10/2023	K1,K2,K3,S1,S2,S3	NORMALIZATION	Direct	Lecture, Data Show, Simulation, Whiteboard	12
31/10/2023	K1,K2,K3,S1,S2	NORMALIZATION: Examples and Problems	Direct	Lecture, Data Show, Simulation ,Whiteboard	15
2/11/2023	K1,K2,K3,S1,S2	MOMENTUM	Direct	Lecture, Data Show, Simulation, Whiteboard	15
5/11/2023	K1,K2,K3,S1,S3	THE UNCERTAINTY PRINCIPLE	Direct	Lecture, Data Show, Simulation ,Whiteboard	18
7/11/2023	K1,K2,K3,S1,S2,S3	STATIONARY STATES	Direct	Lecture, Data Show, Simulation, Whiteboard	25-31
9/11/2023	K1,K2,K3,C1,C2,S1,S2,S3	STATIONARY STATES	Direct	Lecture, Data Show, Simulation ,Whiteboard	25-31
12/11/2023	K1,K2,K3,S1,S3	STATIONARY STATES: Problems	Direct	Lecture, Data Show, Simulation, Whiteboard	31

14/11/2023		1St Exam			
16/11/2023	K1,K2,K3,C1,C2,S1,S2,S3	THE INFINITE SQUARE WELL			31-41
19/11/2023	K1,K2,K3,S1,S2,S3	THE INFINITE SQUARE WELL	Direct	Lecture, Data Show, Simulation ,Whiteboard	31-41
21/11/2023	K1,C1	THE INFINITE SQUARE WELL	Direct	Lecture, Data Show, Simulation, Whiteboard	31-41
23/11/2023	K1,S2,C1	THE INFINITE SQUARE WELL: Problems	Direct	Lecture, Data Show, Simulation ,Whiteboard	41
26/11/2023	K1,S2,C1	THE HARMONIC OSCILLATOR: Algebraic Method	Direct	Lecture, Data Show, Simulation, Whiteboard	41-51
28/11/2023	K1,S2,C1	THE HARMONIC OSCILLATOR: Algebraic Method	Direct	Lecture, Data Show, Simulation ,Whiteboard	41-51
30/11/2023	K1,K2,K3,S1,S2,S3	THE HARMONIC OSCILLATOR: Problems	Direct	Lecture, Data Show, Simulation, Whiteboard	51
3/12/2023	K1,K2,K3,S1,S2	THE HARMONIC OSCILLATOR: Analytic Method	Direct	Lecture, Data Show, Simulation ,Whiteboard	52-58
5/12/2023	K1,K2,K3,S1,S2	THE HARMONIC OSCILLATOR: Analytic Method	Direct	Lecture, Data Show, Simulation, Whiteboard	52-58
7/12/2023	K1,K2,K3,S1,S3	THE HARMONIC OSCILLATOR: Analytic Method	Direct	Lecture, Data Show, Simulation ,Whiteboard	52-58
10/12/2023	K1,K2,K3,S1,S2,S3	THE HARMONIC OSCILLATOR: Analytic Method: Problems	Direct	Lecture, Data Show, Simulation, Whiteboard	58
12/12/2023	K1,K2,K3,C1,C2,S1,S2,S3	THE FREE PARTICLE	Direct	Lecture, Data Show, Simulation ,Whiteboard	60-68
14/12/2023	K1,K2,K3,S1,S3	THE FREE PARTICLE	Direct	Lecture, Data Show, Simulation, Whiteboard	60-68
17/12/2023	K1,C1	THE FREE PARTICLE	Direct	Lecture, Data Show, Simulation ,Whiteboard	60-68

19/12/2023	K1,S2,C1	THE DELTA-FUNCTION POTENTIAL: Bound States and Scattering States	Direct	Lecture, Data Show, Simulation, Whiteboard	68-70
21/12/2023	K1,S2,C1	THE DELTA-FUNCTION POTENTIAL: Bound States and Scattering States	Direct	Lecture, Data Show, Simulation ,Whiteboard	68-70
24/12/2023	K1,S2,C1	THE DELTA-FUNCTION POTENTIAL: The Delta-Function Well	Direct	Lecture, Data Show, Simulation, Whiteboard	71-77
26/12/2023	K1,K2,K3,S1,S2,S3	THE DELTA-FUNCTION POTENTIAL: The Delta-Function Well	Direct	Lecture, Data Show, Simulation, Whiteboard	71-77
28/12/2023	K1,K2,K3,S1,S2	THE DELTA-FUNCTION POTENTIAL: The Delta-Function Well	Direct	Lecture, Data Show, Simulation, Whiteboard	71-77
31/12/2023	K1,K2,K3,S1,S2	2nd Exam			
2/1/2024	K1,K2,K3,S1,S3	THE FINITE SQUARE WELL:	Direct	Lecture, Data Show, Simulation ,Whiteboard	79-83
4/1/2024	K1,K2,K3,S1,S2,S3	THE FINITE SQUARE WELL:	Direct	Lecture, Data Show, Simulation, Whiteboard	79-83
7/1/2024	K1,K2,K3,C1,C2,S1,S2,S3	HILBERT SPACE	Direct	Lecture, Data Show, Simulation ,Whiteboard	
9/1/2024	K1,K2,K3,S1,S3	OBSERVABLES: Hermitian Operators	Direct	Lecture, Data Show, Simulation, Whiteboard	98
11/1/2024	K1,K2,K3,S1,S3	OBSERVABLES: Determinate States	Direct	Lecture, Data Show, Simulation ,Whiteboard	100
14/1/2024	K1,K2,K3,S1,S2,S3	EIGENFUNCTIONS OF A HERMITIAN OPERATOR	Direct	Lecture, Data Show, Simulation, Whiteboard	102
16/1/2024	K1,K2,K3,	DIRAC NOTATION	Direct	Lecture, Data Show, Simulation ,Whiteboard	120
18/1/2024					

Education procedures: (Direct, synchronous, asynchronous). * * Teaching methods: Lecture, video…..). * * Reference: Pages of the book, recorded lecture, video….).(

Eighth : Assessment methods

Methods	Fully Electronic Education	Integrated Teaching	Face to face	Specific Course Output to be measured *State the score identified for each CILO for each method of assessment out of 100 **If any CILO will not be assessed in the course, mark NA.												
				K1	K2	K3	S1	S2	S3	S4	S5	C1	C2	C3	C4	C5
First exam			20	5	5	2	2	2	1			2	1			
Second exam			20	4	6	4	2	3	1			1	0			
Final Exam			50	9	8	9	2	5	8			2	4			
Quizzes			5	2	1	0	2	0	0			0	0			
Assignment			5	3	0	0	2	0	0			0	0			
Total out of 100			100	20	20	20	10	10	10			5	5			

* Refer to document (CC-2023-03)

Ninth : Course Polices

- **All course policies are applied on all teaching patterns (online, blended, and face-to-face Learning) as follows:**

  a. **Punctuality.**
  b. **Participation and interaction.**
  c. **Attendance and exams.**

- **Academic integrity: (cheating and plagiarism are prohibited).**

Approval	Name	Date	Signature
Head of Department			
Faculty Dean			