UNIVERSIDAD YACHAY TECH

YACHAY TECH UNIVERSITY

SYLLABUS

1. General Information					
A.	**School**	School of Physical Sciences and Nanotechnology	**B.**	**Major**	Physics Nanotechnology
C.	**Course**	Quantum Mechanics I	**D.**	**Code**	ECFN1009
E.	**Level**	6th	**F.**	**Academic Term**	Second Semester 2025
G.	**Curricular Unit**	Professional	**H.**	**Study Mode**	In person
I.	**Total Hours**	160	**J.**	**Professors**	Wladimir Eduardo Banda Barragán
K.	**Weekly Class Schedule**	17:00 - 19:00 Tuesday 13:00 - 15:00 Wednesday 13:00 - 15:00 Thursday	**L.**	**Weekly Tutoring Schedule**	11:00 - 12:00 Monday 11:00 - 12:00 Thursday

2. Prerequisites and Corequisites

Prerequisites		Corequisites	
Course	**Code**	**Course**	**Code**
Mathematical Physics I	ECFN1004		
Classical Mechanics	ECFN1006		
Modern Physics	ECFN1007		

3. Course Description

This course provides an introduction to the formal mathematical treatment of Quantum Mechanics. The course introduces the Schrödinger Equation and its solutions for different potentials, emphasising on the statistical interpretation of the wave function and its importance for the description of experiments at quantum scales. Topics range from quantum experiments, wave functions, the time-independent Schrödinger's equation, through Hilbert spaces and the mathematical formalism of quantum mechanics, to the description of the hydrogen atom and two-particle systems. The course includes examples of different applications of quantum mechanics, and guides students into writing Hamiltonians for different physical systems and extracting information about them.

4. Learning Outcomes of the Course

- Understand the fundamental ideas and experiments that led to the formulation of quantum mechanics.
- Learn the mathematical skills and formalism needed to solve Schrödinger's equation and interpret its solutions.
- Study the Hamiltonians of quantum systems in 1D, 2D, and 3D for different potentials and coordinates, and provide a detailed quantum description of the hydrogen atom and two-particle systems.
- Use quantum mechanics to analyse real microscopic phenomena and interpret experimental data.

5. Units / Contents / Hours / Evaluation Instruments and Schedule

Curricular Units	Contents	Teaching Hours	Hours of Internship and Experimental Learning		Hours of Independent Learning	Evaluation Instruments and Schedule
			Hours in Contact	Hours not in Contact		
Unit 1. The Schrödinger equation	Review of quantum experiments and mathematical tools.	3	2	0	2	In-class quizzes and homework assignments with dates shared in a timely manner by the lecturer. Midterm exam (September 29 to October 7). Final exam (December 5 to 10).
	The wave function and the Schrödinger equation.	3	2	0	2	
	Statistical interpretation of the wave function and probability.	3	2	0	2	
	Normalisation, momentum, and the uncertainty principle.	3	2	0	2	
Unit 2. Quantum Mechanics in 1D	Stationary states and the time-independent Schrödinger equation.	3	3	0	3	In-class quizzes and homework assignments with dates shared in a timely manner by the lecturer. Midterm exam (September 29 to October 7). Final exam (December 5 to 10).
	Free particles and wave packets.	3	3	0	3	
	Finite, Infinite potential wells, and the harmonic oscillator.	3	3	0	3	
	Delta-function potentials, tunnelling and scattering states.	3	3	0	3	

Unit 3. Mathematical formalism of Quantum Mechanics	Linear algebra, Hermitian operators, and Hilbert space	3	2	0	2	In-class quizzes and homework assignments with dates shared in a timely manner by the lecturer. Midterm exam (September 29 to October 7). Final exam (December 5 to 10).
	Eigenfunctions, eigenvectors, and eigenvalues for discrete and continuous spectra.	3	2	0	2	
	Dirac notation and the Generalised statistical interpretation	3	2	0	2	
	Operators of position and momentum and the uncertainty principle	3	2	0	2	
Unit 4. Quantum Mechanics in 3D	Schrodinger Equations in Spherical Coordinates	4	3	0	3	In-class quizzes and homework assignments with dates shared in a timely manner by the lecturer. Midterm exam (September 29 to October 7). Final exam (December 5 to 10).
	Coulomb potential and quantum description of the Hydrogen atom	4	3	0	3	
	Angular momentum and spin	4	3	0	3	
	Larmor precession and the Stern- Gerlach experiment	4	3	0	3	
Unit 5. Two-Particle Systems and quantum applications	Identical particles and introduction to two-particle systems.	3	2	0	2	In-class quizzes and homework assignments with dates shared in a timely manner by the lecturer. Midterm exam (September 29 to October 7). Final exam (December 5 to 10).
	Exchange interactions, spin, and the generalised symmetrisation principle	3	2	0	2	
	Atoms, the periodic table, and introduction to solids	3	2	0	2	
	Applications of quantum mechanics	3	2	0	2	
	Total	64	48	0	48	160

6. Teaching Methodology

Learning Environments

Learning Environment	Characteristics
Real: Digital or printed materials designed by the lecturer.	**Real:** Classroom equipped with a white board, which promotes the development of communication skills through interactive in-person activities. Virtual laboratory with applets and specific software for data analysis or quantum mechanics simulations.
Virtual: MOODLE platform, GitHub, the Internet, websites, theoretical classes via ZOOM or Google Meet, seminars/workshops, tutoring, and other technological resources.	**Virtual:** Educational platform for sharing presentations, homework, code, assessments, and student participation forums.
Classroom: Theoretical classes, seminars/workshops, exercise classes, tutoring.	

Learning Tools

Learning Tools	Characteristics
Interactive lectures including theory and exercises. Classwork including exercises and quizzes based on reading material and online laboratory applets. Individual and group projects including problem sets and bibliographic research.	These tools help students to develop the mathematical skills needed to create realistic models of quantum systems.

7. Information Sources (Bibliography)

7.1 Main

Author/s	Title of Work	Edition	Year of Publication	Publishing house - Country
Griffiths, David	Introduction to Quantum Mechanics	2nd	2017	Cambridge University Press – United States
Resnick, Robert & Halliday, David	Basic Concepts in Relativity and Early Quantum Theory	2nd	1985	John Wiley & Sons, Inc

7.2 Complementary				
Author/s	**Title of Work**	**Edition**	**Year of Publication**	**Publishing house - Country**
Townsend, John	A Modern Approach to Quantum Mechanics	2nd	2012	University Science Books – United States
Tong, David	Lectures on Quantum Mechanics	--	2021	http://www.damtp.cam.ac.uk/user/tong/quantum.html

8. Student's Evaluation

8.1 First Term of the Period*

Formative Evaluation		Laboratory**		Midterm Evaluation		Total
Homework average (problem sets, project reports, and online laboratory)	10%	Classwork average (reading tasks, concept quizzes, and online laboratory)	10%	1 Midterm Exam	30%	50 %
Subtotal	**10%**	**Subtotal**	**10%**	**Subtotal**	**30%**	

8.2 Second Term of the Period

Formative Evaluation		Laboratory**		Final Evaluation		Total
Homework average (problem sets, project reports, and online laboratory)	10%	Classwork average (reading tasks, concept quizzes, and online laboratory)	10%	1 Final Exam	30%	50 %
Subtotal	**10%**	**Subtotal**	**10%**	**Subtotal**	**30%**	

Evaluation Considerations

Make Up Exam

According to Article 61 of the UITEY Academic Regulations, "if students have a final grade point average of 4.8 to 5.9 in the subject, they will be entitled to a make-up exam at the end of the term. The content of this exam must reflect all aspects covered in the subject during the academic term. (…).

A passing grade on a make-up exam will raise the student's total grade to 6.0 (the minimum passing grade)."

Student Attendance to Academic Activities

Students must comply with Articles 82 and 83 of the UITEY Academic Regulations, which state:
*"**Article 82.- Student Attendance at Academic Activities**. – Students must attend all academic activities, both synchronous and asynchronous, such as classes, assessments, laboratory practices, and other activities that contribute to their overall education, on the established dates and times. Academic*

staff must ensure compliance with the attendance criteria and the learning components in contact with the faculty and experimental practice through attendance records in accordance with the mechanisms defined by the Academic Vice-Rectorate.

For second language learning subjects, a minimum attendance of eighty percent (80%) is required for passing. The minimum attendance required for passing the other subjects will be seventy percent (70%).
Article 83.- Justification for absence. *- Students who are absent must present supporting documents within a maximum period of five (5) days, counting from the date of absence.*

The justifications will be validated by the teacher or the competent unit. Once the justification has been approved, the teacher, in his or her discretion, may define the criteria for making up activities missed due to non-attendance."

(*) Teaching staff will record the scores generated up to the first term of the period in Moodle, by the deadline established in the academic calendar. To determine the weights of each item, the provisions of Article 63 of the UITEY Academic Regulations must be observed.
(**) For courses without a laboratory component, indicate: N/A.

9. General Considerations

- Students are responsible for ensuring the academic integrity of their submitted assignments and exams.
- Cheating in exams, plagiarising, and copying solutions from other students, from chatbots automated by artificial intelligence, from solution manuals, or from previous years' solutions are all breaches of academic integrity.
- Academic misconduct will be penalised according to the University's regulations.
- Assignment deadlines and exam dates will be discussed and agreed upon in class. Once fixed, they are hard deadlines.

Prepared by	Reviewed by	Approved by
Professor - Professors	**Designated Personnel**	**Dean – Language Director**
Signature and Date: Firmado electrónicamente por: WLADIMIR EDUARDO BANDA BARRAGAN Validar únicamente con FirmaEC	**Signature and Date:** Firmado electrónicamente por: CLARA INES ROJAS CELY Validar únicamente con FirmaEC	**Signature and Date:**