Universidad Carlos III de Madrid

COURSE: QUANTUM PHYSICS		
DEGREE: PHYSICS ENGINEERING	year: 2nd	SEMESTER: 1st

WEEKLY PROGRAMMING

WEEK	SESSION	DESCRIPTION	GROUPS		GROUPS	Special room for session (computer classroom, audio-visual classroom… (*)	WEEKLY PROGRAMMING FOR STUDENT		
			LECTURES	SEMINAR			DESCRIPCIÓN	CLASS HOURS	HOMEWORK HOURS Maximum 7 H
1	1	**T1. Foundations of quantum mechanics** Stefan-Planck law. Photoelectric effect. Compton effect. De Broglie principle. Atom models: Rutherford and Bohr.	X				- Reading of the corresponding chapters in the proposed literature. - Study and personal work on the lecture	1.83	5
1	2	Includes a short review: mathematical prerequisites for quantum mechanics.		X			- Solve the proposed exercises. - Participation in discussions and activities.	1.83	
2	3	**T2. Schrödinger equation.** Formulation. Wave function. Born interpretation. Probability. Expected values. Measurements and wave collapse.	X				- Reading of the corresponding chapters in the proposed literature. - Study and personal work on the lecture	1.83	5
2	4			X			- Solve the proposed exercises. - Participation in discussions and activities.	1.83	
3	5	**T3. Schrödinger equation.** Momentum in quantum mechanics. Operators.	X				- Reading of the corresponding chapters in the proposed literature. - Study and personal work on the	1.83	5

		Heisenberg's uncertainty principle. Ehrenfest's theorem.					lecture		
3	6			X			- Solve the proposed exercises. - Participation in discussions and activities.	1,83	
4	7	**T4. Time-independent Schrödinger equation.** Stationary states. Energy in quantum mechanics. Hamiltonian. Energy eigenstates.	X				- Reading of the corresponding chapters in the proposed literature. - Study and personal work on the lecture	1,83	5
4	8	- Test exam #1: Quantum mechanics fundamentals.		X			- Test exam - Solve the proposed exercises. - Participation in discussions and activities.	1,83	
5	9	**T5. Time-independent Schrödinger equation. One dimensional problems.** Infinite square well potential.	X				- Reading of the corresponding chapters in the proposed literature. - Study and personal work on the lecture	1,83	5
5	10			X			- Solve the proposed exercises. - Participation in discussions and activities.	1,83	
6	11	**T6. Time-independent Schrödinger equation. One dimensional problems.** The quantum harmonic oscillator.	X				- Reading of the corresponding chapters in the proposed literature. - Study and personal work on the lecture	1,83	5
6	12			X			- Solve the proposed exercises. - Participation in discussions and activities.	1,83	
7	13	**T7. Time-independent Schrödinger equation. One dimensional problems.** The free particle. Heisenberg's principle revisited.	X				- Reading of the corresponding chapters in the proposed literature. - Study and personal work on the lecture	1,83	5
7	14			X			- Solve the proposed exercises. - Participation in discussions and activities.	1,83	
8	15	**T8.a Time-independent Schrödinger**	X				- Reading of the corresponding	1,83	5

		equation. One dimensional problems. Scattered and bound states. Tunneling. Finite square well potential.					chapters in the proposed literature. - Study and personal work on the lecture		
8	16	- Numerical Lab: Gaussian package collision with barrier.		X			- Presentation of numerical lab. - Solve the proposed exercises. - Participation in discussions and activities.	1,83	
9	17	**T8.b Time-independent Schrödinger equation. One dimensional problems.** Finite square well barrier. Scattering matrix.	X				- Reading of the corresponding chapters in the proposed literature. - Study and personal work on the lecture	1,83	5
9	18			X			. - Solve the proposed exercises. - Participation in discussions and activities.	1,83	
10	19	**T9. Time-independent Schrödinger equation. Three dimensional problems.** Review of spherical coordinates. Differential operators in 3D. Schrödinger equation in 3D. Central forces.	X				- Reading of the corresponding chapters in the proposed literature. - Study and personal work on the lecture	1,83	5
10	20	- Test exam #2: One-dimensional problems in Quantum Mechanics.		X			- Test exam. - Solve the proposed exercises. - Participation in discussions and activities.	1,83	
11	21	**T10. Time-independent Schrödinger equation. Three dimensional problems.** Separation of variables for central potentials. Spherical harmonics. Angular momentum.	X				- Reading of the corresponding chapters in the proposed literature. - Study and personal work on the lecture	1,83	5
11	22			X			- Solve the proposed exercises. - Participation in discussions and	1,83	

							activities.		
12	23	**T11. Time-independent Schrödinger equation. Three dimensional problems.** Radial equation for central potentials. Centrifugal forces. Infinite spherical well.	X				- Reading of the corresponding chapters in the proposed literature. - Study and personal work on the lecture	1,83	5
12	24			X			- Solve the proposed exercises. - Participation in discussions and activities.	1,83	
13	25	**T12. Time-independent Schrödinger equation. Three dimensional problems.** The hydrogen atom. Bohr's formula for the energy spectrum. Hydrogen spectroscopy.	X				- Reading of the corresponding chapters in the proposed literature. - Study and personal work on the lecture	1,83	5
13	26			X			- Solve the proposed exercises. - Participation in discussions and activities.	1,83	
14	27	- Test exam #3: Three-dimensional problems in Quantum Mechanics.	X				- Test exam	1,83	
SUBTOTAL								**49,41 + 65 = 114,4**	
14		Tutorials						2	2
15		Assessment						3	10
TOTAL								**131,4**	

(*) Dates of the test exams are provisional.

LABORATORY SESSIONS						
SESSION	WEEK	DESCRIPTION	ROOM	WEEKLY PROGRAMMING FOR STUDENT		
				DESCRIPTION	CLASS HOURS	HOMEWORK HOURS Maximum 7 H
1		Quantum phenomena	4.SB01-4.SB02-4.SB03	- Reading of the guideline document. - Data acquisition - Analysis of results - Preparation of the report	1,5	3
2		Quantum phenomena	4.SB01-4.SB02-4.SB03	- Reading of the guideline document. - Data acquisition - Analysis of results - Preparation of the report	1,5	3
3		Quantum phenomena	4.SB01-4.SB02-4.SB03	- Reading of the guideline document. - Data acquisition - Analysis of results - Preparation of the report	1,5	3
4		Numerical solution of Schrödinger equation.		- Reading of the guideline document. - Preparation of code. - Analysis of results - Preparation of the report	1,5	3
TOTAL					18	