BACHELOR 'S PROGRAMME
2nd YEAR OF STUDY, 2nd SEMESTER

COURSE TITLE	QUANTUM MECHANICS
COURSE CODE	
COURSE TYPE	full attendance
COURSE LEVEL	1st cycle (bachelor's degree)
YEAR OF STUDY, SEMESTER	2nd year of study, 2nd semester
NUMBER OF ECTS CREDITS	6
NUMBER OF HOURS PER WEEK	5 (3 lecture hours + 2 seminar hours)
NAME OF LECTURE HOLDER	PROF. PH. D. MARINA-AURA DARIESCU
NAME OF SEMINAR HOLDER	PROF. PH. D. MARINA-AURA DARIESCU
PREREQUISITES	Advanced level of English

A GENERAL AND COURSE-SPECIFIC COMPETENCES

General competences:

- → Achievement of professional tasks efficiently and responsibly, in compliance with the field-specific deontology legislation, with qualified assistance.
- → Application of efficient work techniques in a multi-disciplinary team, on various hierarchical levels.
- → Effective use of information sources and communication resources and assisted professional training, both in Romanian and in a foreign language.

Course-specific competences:

- → Derivation of working formulas for calculations with physical quantities using appropriate principles and laws of Physics.
- → Description of physical systems, using specific theories and tools (theoretical models, algorithms, schemes, etc.)
- → Application of the principles and laws of Physics in solving theoretical or practical problems, under qualified assistance conditions.
- → Comparison of the results given by numerical models or simulations of physical phenomena with data provided by literature and/ or experimental measurements.
- → Critical assesment of the results obtained by employing a physical model, including the degree of uncertainty of the obtained experimental results.
- → Presentation of scientific and popularization seminars on topics such as Elementary Particles Physics, Quantum Mechanics, Field Theory.
- → Elaboration of reports and presentations, the construction of logical and coherent arguments, the support of these arguments in front of an informed audience, on subjects of General Physics.
- → Responsible performing independent work tasks and interdisciplinary approach of topics.

B LEARNING OUTCOMES

- Ability to use theoretical physics methods in various fields;
- application of knowledge to practical situations;
- Ability in extracting information from a large variety of sources.
- Use of specific software for analyzing and processing experimental data.

C LECTURE CONTENT

The prerequisites of quantum mechanics.
The wave-particle duality. The de Broglie hypothesis.
The Schrődinger equation.
The continuity equation. The interpretation of the wave function.
The free particle. The rigid rotor.
The linear harmonic oscillator.
The hydrogen atom.
The mathematical formalism of Quantum Mechanics.
The expectation values. The uncertainty relations.
The theory of orbital angular momentum in Quantum Mechanics.
The spin. The Pauli matrices.
The total angular momentum.
Time-independent perturbation theory.

D RECOMMENDED READING FOR LECTURES

1. Cohen-Tannoudji, B.Diu, F.Lalőe, Mécanique Quantique, Tome I. Collection Einseignement des sciences, Ed. Herman, Paris, 1977.
2. I.Gottlieb, C.Dariescu, Marina-Aura Dariescu, Fundamentarea Mecanicii Cuantice, Ed. Tehnica, Chisinau, 1994.
3. I.Gottlieb, Marina-Aura Dariescu, C. Dariescu, Mecanica Cuantica", Ed. BIT, Iasi, 1999.

	4. C.Dariescu, Marina-Aura Dariescu, I. Gottlieb, Capitole de baza in Mecanica Cuantica. Microparticule si Campuri , Ed. Venus, Iasi, 2007. 5. B. H. Bransden, C. J. Joachain, Introducere in mecanica cuantica, Ed. Tehnica, Bucuresti, 1995. 6. L.Landau, E.Lifchitz, Mécanique Quantique, Theorie Non Relativiste, III, Ed. MIR, Moscou, 1980. 7. C. Kittel, Introduction to Solid State Physics, 8-th Ed., Wiley Press, 2005. 8. P.J.E.Peebles, Quantum Mechanics , Princeton University Press, New Jersey, 1992 9. C. Dariescu, I.Gottlieb, Marina-Aura Dariescu, Campuri Cuantice Libere, Ed. BIT, Iasi, 1998
E	SEMINAR CONTENT
	The photoelectric effect. The Compton effect. The de Broglie relations and the semiclassical expression of the wave function. Particle in a well and resonances Significant types of wells of potential. The rectangular potential barrier. The Gamow factor. The mathematical formalism of Quantum Mechanics. Hilbert spaces, self-adjoint operators, commutators. The Dirac formalism. The expectation values. The Ehrenfest theorems. The uncertainty relations. Applications. Angular momentum problems. Time-independent perturbation theory. Applications. The electron in static magnetic fields. Para- and diamagnetic properties.
F	RECOMMENDED READING FOR SEMINARS
	1. F. Constantinescu, E. Magyari, Mecanica cuantica. Probleme, Ed. Tehnica, Bucuresti, 1968. 2. B. H. Bransden, C. J. Joachain, Introducere in mecanica cuantica,Ed. Tehnica, Bucuresti, 1995. 3. C.Dariescu, Marina-Aura Dariescu, I. Gottlieb: "Capitole de baza in Mecanica Cuantica. Microparticule si Campuri " (Ed. Venus, Iasi, 2007).
G	EDUCATION STYLE
LEARNING AND TEACHING METHODS	Exposition. Co-operative problem solving. Debate. Problematization. Directed discovery.
ASSESSMENT METHODS	• Written exam • Participation in seminar activities.
LANGUAGE OF INSTRUCTION	English