UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Izbrana poglavja iz kvantne mehanike
Course title:	Selected topics from Quantum Mechanics

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
Fizika 2. st.		1,2	2,3
Physics 2nd degree		1,2	2,3

Vrsta predmeta / Course type izbirni/ optional

Univerzitetna koda predmeta / University course code:

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Laboratory work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
45	0	15	0	0	90	**5**

Nosilec predmeta / Lecturer: Jure Dobnikar

Jeziki / Languages:	
Predavanja / Lectures:	Slovenski/slovene
Vaje / Tutorial:	Slovenski/slovene

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Formalno ali neformalno znanje iz moderne fizike, osnov algebre in analize, uvoda v kvantno mehaniko.

Prerequisits:

Formal or informal knowledge of the Modern Physics, basic Algebra and Calculus, Introduction to Quantum Mechanics.

Vsebina:

Skalarni, vektorski in tenzorski operatorji.
Rotacije v kvantni mehaniki, vrtilna količina, seštevanje vrtilnih količin, sklopitev spin-tir.
Sistem več delcev: sistem ločljivih in neločljivih delcev, Paulijevo izključitveno načelo.
Približne metode za stacionarna stanja: časovno neodvisna teorija motenj, variacijska metoda.
Časovno odvisna teorija motenj: verjetnost za prehod v konstantnem in v periodičnem potencialu, adiabatska aproksimacija, interakcija atomov z EM valovanjem, izbirna pravila za električni dipol.
Teorija sipanja: sipalni presek, sipalna amplituda, Bornova aproksimacija.

Content (Syllabus outline):

Scalar, vector and tensor operators.
Rotations in quantum mechanics, angular momentum, addition of angular momentum, coupling of orbital and spin angular momentum.
Many-particle systems: systems of distinguishable and identical particles. Pauli exclusion principle.
Approximation methods for stationary states: time independent perturbation theory, the variational method.
Time dependent perturbation theory: transition probability for a constant and for a harmonic perturbation, adiabatic approximation, interaction of atoms with radiation, the electric dipole selection rules.
Scattering theory: scattering crosssection, scattering amplitude, the Born approximation.

Temeljni literatura in viri / Readings:

1. N. Zettili, Quantum Mechanics – Concepts and Applications (Wiley, Chichester, 2003).
2. M. C. Rogalski, S. B. Palmer, Quantum Physics (Gordon and Breach, Amsterdam, 1999).
3. D. J. Griffits, Introduction to Quantum Mechanics (Prentice Hall, Upper Saddle River, 1994).
4. Y. Peleg, R. Pnini, E. Zaarur, Schaum's outlines – Quantum Mechanics (McGraw Hill, New York, 1998).
5. katerakoli knjiga, ki ima v naslovu Kvantna mehanika ali Uvod v kvantno mehaniko ali Osnove kvantne mehanike…

Cilji in kompetence:	**Objectives and competences:**
Študenti nadgradijo osnovno znanje iz kvantne mehanike z vsebinami, ki so osnova za razumevanje in obravnavo pojavov v fiziki trde in mehke snovi ter v biofiziki.	Students enrich the basic knowledge in quantum mechanics with topics, which are elemental for understanding and studying the phenomena in solid state physics, in soft mater physics and in biophysics.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Kvalitativno in kvantitativno razumejo osnovne principe in metode nerelativistične kvantne mehanike. Prenesljive/ključne spretnosti in drugi atributi: Pridobijo orodje za kvantitativno obravnavo problemov moderne fizike ob uporabi dostopnih uporabniških matematičnih programov.	Knowledge and Understanding: Qualitative and quantitative understanding of basic principles and methods in nonrelativistic Quantum Mechanics. Transferable/Key Skills and other attributes: Students achieve the tools to describe quantitatively the problems of modern physics. They become versatile in programming with mathematical software.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja Seminarske vaje	Lectures Theoretical excercises

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
izračun teoretičnih nalog in njihov zagovor	80%	Solving of theoretical exercises and their defense
ustni izpit	20%	Oral exam

Reference nosilca / Lecturer's references:

KANDUČ, Matej, DOBNIKAR, Jure, PODGORNIK, Rudolf. Counterion-mediated electrostatic interactions between helical molecules. *Soft matter*, 2009, issue 5, vol. 5, str. 868-877, doi: 10.1039/b811795k. [COBISS.SI-ID 2149988]

TRIZAC, Emmanuel, EL SHAWISH, Samir, DOBNIKAR, Jure. Dimeric and dipolar ground state orders in colloidal molecular crystals. *An. Acad. Bras. Cienc.*, 2010, vol. 82, no. 1, str. 87-94. [COBISS.SI-ID23483687]

EL SHAWISH, Samir, DOBNIKAR, Jure, TRIZAC, Emmanuel. Colloidal ionic complexes on periodic substrates : ground-state configurations and pattern switching. *Phys. rev., E Stat. nonlinear soft matter phys. (Print)*, 2011, vol. 83, no. 4, str. 041403-1-041403-10. [COBISS.SI-ID 24653095]

MATTHÄUS, Franziska, MOMMER, Mario S., CURK, Tine, DOBNIKAR, Jure. On the origin and characteristics of noise-induced Lévy Walks of E. Coli. *PLoS one*, 2011, vol. 6, no. 4, str. e18623-1-e18623-8.http://www.plosone.org/article/info:doi/10.1371/journal.pone.0018623. [COBISS.SI-ID 25045031]

CURK, Tine, HOOGH, Anouk de, MARTINEZ-VERACOECHEA, Francisco J., EISER, Erika, FRENKEL, Daan, DOBNIKAR, Jure, LEUNISSEN, Mirjam E. Layering, freezing, and re-entrant melting of hard spheres in soft confinement. *Phys. rev., E Stat. nonlinear soft matter phys. (Online)*. [Online ed.], 2012, vol. 85, iss. 2, str. 021502-1-021502-5. http://link.aps.org/doi/10.1103/PhysRevE.85.021502, doi:10.1103/PhysRevE.85.021502. [COBISS.SI-ID 518221081]