Univerza v Mariboru
University of Maribor

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / SUBJECT SPECIFICATION	
Predmet:	**Uvod v kvantno mehaniko**
Subject Title:	Introduction to Quantum Mechanics

Študijski program Study programme	Študijska smer Study field	Letnik Year	Semester Semester
Fizika Physics		3	6

Univerzitetna koda predmeta / University subject code:

Predavanja Lectures	Seminar Seminar	Sem. vaje Tutorial	Lab. vaje Labor work	Teren. vaje Field work	Samost. delo Individ. work	ECTS
30		30			90	**5**

Nosilec predmeta / Lecturer: Nataša Vaupotič

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

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

predznanje iz moderne fizike in osnov algebre.

Prerequisits:

preknowledge of the Modern Physics and basic Algebra.

Vsebina:

Matematična orodja v kvantni mehaniki: Hilbertov prostor in valovne funkcije, Diracova notacija, operatorji, delta-funkcija, reprezentacija v diskretni in zvezni bazi, transformacija med bazami
Postulati v kvantni mehaniki: stanje sistema, verjetnostna gostota, princip superpozicije, opazljivke in operatorji, merjenja v KM, pričakovane vrednosti, princip nedoločenosti, časovni razvoj sistema, simetrije in ohranitveni zakoni
1D primeri: potencialni skok, potencialna jama, harmonični oscilator, numerično reševanje Schroedingerjeve enačbe
Vrtilna količina: orbitalna, spinska, skupna
3D primer: vodikov atom

Content (Syllabus outline):

Mathematical methods in quantum mechanics: Hilbert space and wave functions, Dirac notation, operators, delta function, representation in discrete and continuous bases, change of bases.
Postulates in quantum mechanics: state of the system, probability density, principle of superposition, observables and operators, measurements in QM, expectation values, uncertainty relations, time evolution of the system's state, symmetries and conservation laws.
One-dimensional problems: potential step, potential well, harmonic oscillator, numerical solutions of the Schrödinger equation.
Angular momentum: orbital angular momentum, spin, addition of angular momentum
Three-dimensional problems: H-atom.

Temeljni literatura in viri / Textbooks:

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:	**Objectives:**
Študenti usvojijo osnovna matematična orodja kvantne mehanike.	Students obtain the basic mathematical principles of Quantum Mechanics.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Kvalitativno in kvantitativno razumejo matematično orodje in postulate, na katerih temelji kvantna mehanika. 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 mathematical tools and the postulates of 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