Course Information Sheet

University: *University of Prešov in Prešov*	
Faculty: *Faculty of Humanities and Natural Sciences*	
Code: *2FYZ/mKVAME/22*	**Title of Course:** *THEORETICAL PHYSICS 1 - QUANTUM MECHANICS*
Form of Study: *Lectures, seminars* **Number of contact hours:** *48* **per week:** *3/1* **per level/semester:**	
Number of credits: *6*	
Semester: *winter*	
Degree/Level: *1. level*	
Prerequisities: *Atomic and nuclear physics from the general course of Physics. Mastering the differential and integral calculus.*	
Grading Policy (Assessment/Evaluation): *individual work, written assignments, oral exam*	
Aims and Objectives: *To show the principle difference between the description of the micro-world phenomena and the classical description manifested in the basic principles of quantum mechanics: the principle of superposition, correspondence, uncertainty, complementarity and microcausality. To find the solution of Schrodinger's equation in the individual potential fields.*	

Syllabus/Indicative Content:

1. *Introduction to Quantum Physics – origin, experiments, history. Fundamental principles of quantum mechanics (superposition, uncertainty, complementarity, correspondence, microcausality).*
2. *Quantum mechanics postulates: wave function; operators in quantum physics; quantization – operators eigen functions and eigen values; wave function reduction; Schrodinger time-dependent equation.*
3. *Continuity equation in quantum mechanics.*
4. *Connection of quantum and classic mechanics: Hamilton – Jacobi equation; Bohr's quantum condition; operator of time derivation, quantum Poisson brackets.*
5. *Quantum equation of motion – Ehrenfest motion equations.*
6. *The laws of conservation in quantum mechanics: motion integrals; law of energy conservation; motion in central field.*
7. *Schrödinger time-independent equation.*
8. *Solving of Schrödinger equation for free particle.*
9. *Solving of Schrödinger equation in wave pocket shape.*
10. *Solving of Schrödinger equation for one-dimensional and three-dimensional potential well of the infinite deep.*
11. *Solving of Schrödinger equation for one-dimensional and three-dimensional potential well of the finite deep.*
12. *Discrete spectrum for potential well of the finite deep.*
13. *Continuous spectrum, reflection and transition coefficient of potential well of the finite deep.*
14. *Solving of Schrödinger equation for the potential barrier of infinite and finite width, reflection and transition coefficient.*
15. *Tunnel effect, its applications and utilization.*
16. *Solving of Schrödinger equation for harmonic oscillator.*
17. *Notation of Schrödinger's equation in the spherical coordinates.*
18. *Solving of Schrödinger equation for hydrogen atom and hydrogen-like atoms, discrete and continuous spectrum.*
19. *Magnetic moment and angular momentum.*
20. *Electron spin. Pauli matrixes.*
21. *Perturbation theory - stationary perturbation theory.*
22. *Stark and Zeeman effect.*
23. *Helium atom.*

Suggested readings: 1. Skála, L. 2005. *Úvod do kvantové mechaniky*. Praha: Academia. 2. Pišút, J., Gomolčák, L., Černý, V. 1984. *Úvod do kvantovej mechaniky*. Bratislava: Alfa. 3. Davydov, A. S. 1978. *Kvantová mechanika*. Praha: SPTV. 4. Beiser, A. 1978. *Úvod do moderní fyziky*. Praha. 5. Lendel, V. I., Salák, M. 1984. *Výberové prednášky z fyziky*. Bratislava: SPN. 6. Pišút, J., Černý, V., Prešnajder, P. 1985. *Zbierka úloh z kvantovej mechaniky*. Bratislava/Praha: Alfa/SNTL. 7. Salák, M. *Kvantová mechanika*. CD záznam prednášok. Univerzitná knižnica PU. 8. Shankar, R. 1994. *Principles of Quantum Mechanics*. Sprinter. ISBN 978-0-306-44790-7
Language of Instruction: *English*
Other course information:
Lecturer/Instructor: *prof. RNDr. Marián Reiffers, DrSc.*
Last update: *3. mája 2024*
Approved by: *prof. RNDr. Marián Reiffers, DrSc.*