Course title: Computer technologies

Course code: 63221

ECTS: 6

Professor: Denis Golež

Undergradute program

Prerequisite knowledge:

- Introductory physics course: classical mechanics, wave phenomena.
- Introductory mathematics course: complex numbers, differential equations, linear algebra

Short course description:

- Introduction to Modern Physics: The Computer Technology course aims to introduce students to the fundamental principles of modern physics, focusing on concepts relevant to understanding current and future computer technologies, including quantum communication, computing, simulation, and sensing.
- Quantum Mechanics Basics: Detailed discussion on quantum mechanics fundamentals, covering topics such as the structure of matter and electrical, optical, and magnetic properties of materials crucial for technology.
- Application to Computer Science: Emphasis on illustrating basic quantum concepts with examples tailored to computer science, enabling students to understand essential quantum algorithms like quantum teleportation, superdense coding, Grover's algorithm, and Shor's algorithm.
- Quantum Mechanics from an Information Theory Perspective: Quantum mechanics is presented from an information theory standpoint, focusing on discrete spaces (qubit systems), minimising the prerequisite knowledge to basics of linear algebra rather than partial differential equations.
- Electron Movement in Matter and Conductive Properties: Discussion on electron movement in materials leading to conductive properties of metals, semiconductors, topological insulators, and nanotechnological devices like one-electron transistors and spin valves. Also, an overview of optical devices like lasers and photodiodes.
- Building Blocks of Quantum Technologies: Understanding the essential components of emerging quantum technologies, laying the foundation for exploring topics like qubit creation and various physical systems for qubit implementation.
- Practical Implementation of Quantum Algorithms: Focus on concrete quantum algorithms like Grover's algorithm and their practical implementation on quantum computers, along with insights into the advantages and limitations of current technology.