Subject information sheet

Subject name: Nanoelectronics	**Subject code: GKNM_FKTA012**
Responsible for teaching the subject: Dr. Miklós BERTA **Department name: Department of Physics and Chemistry**	
Name, academic degree, and position of the subject teacher: Dr. Miklós BERTA PhD. Associate Professor	
Number of meetings : 2	**Lectures: 2**
	Practice: 0
	Laboratory practice: 0
Credit score: 3	**Semester:** autumn **spring** autumn and spring
Reporting form (underline): **exam** continuous assessment report (3-level) report (5-level)	
Prerequisites: -	

Majors where the subject is taught:

Name / code / specialization	Type	Credits
Electrical Engineering MSc/full-time and correspondence	**mandatory core material**	**3**
Mechatronics Engineer MSc/full-time and correspondence	**mandatory core material**	**3**

Short content description (annotation):

Week 1 The history of the development of nanoelectronics. Summary of the classical and quantum description of reality, the importance of quantum phenomena in nanoelectronics.
Week 2 The mathematical foundations of the quantum mechanical description method. The physical meaning of the state vector (wave function). The fundamental dynamical equation of quantum mechanics (Schrödinger equation).
Week 3 Description of electron motion in potential fields. Eigenstates and the principle of superposition. Discrete energy levels.
Week 4 The quantum mechanical tunneling effect. Reflection and transmission coefficients. The importance of the tunneling effect in nanoelectronics.
Week 5 Electron in a crystal lattice. The concept of a forbidden band. Classical and quantum mechanical description of electrical conduction. The role of statistics.
Week 6 Properties of electrical conductors, insulators and semiconductors. Electron and hole conduction. Hall effect.
Week 7 Properties of materials used in nanoelectronics and their production methods. Formation of semiconductor heterostructures, organic semiconductors
Week 8 Growth and production technology of nanostructures. Nanolithography, laser etching and other technologies
Week 9 Measurement methods and control of nanostructures. Electron microscopes. Sample preparation
Week 10 Electron transport in nanostructures. Quantum dot, quantum wire, quantum trenches
Week 11 Fundamentals of resonant tunneling diode operation
Week 12 FET transistors

Required reading:

Date: February 20, 2023.	**Signature of initiator: Dr. Ferenc Giczi**