Title	Code
Fundamentals of Quantum Engineering (Pods.inż.kwantowej)	**1010401251010420786**
Field: **Fizyka Techniczna**	Year / Semester: **3 / 5**
Specialty: **-**	Course: **core**
Hours: Lectures: **2** Classes: **-** Laboratory: **1** Projects / seminars: **-**	Number of credits: **4**
	Language: **polish**

Lecturer:

dr Gustaw Szawioła
Katedra Inżynierii i Metrologii Kwantowej
Poznań, ul. Nieszawska 13B
Tel.: 61 6653231
Gustaw.Szawiola@put.poznan.pl

Faculty:

Faculty of Technical Physics
ul. Nieszawska 13A
60-965 Poznań
tel. (061) 665-3160, fax. (061) 665-3201
e-mail: office_dtpf@put.poznan.pl

Status of the course in the study program:

Core course of the study for Technical Physics, Faculty of Technical Physics.

Assumptions and objectives of the course:

-The course sketches the principles of current and emerging technology: quantum engineering. From the quantum-information perspective it emphasizes the use of quantum mechanics to actively alter the quantum face of our physical and technological world rather than just to explain natural exiting physical objects. The lectures should prepare undergraduate students to study more advanced and specialized problems of the field.

Contents of the course (course description):

-The fabric of the course is weaved out of technologically-oriented discussion of elementary quantum concepts and phenomena: qubit, superposition of quantum states, quantum measurement and state tomography, entanglement and decoherence, teleportation. The lectures explains the fundamental issues concerning control of quantum states of isolated physical systems, quantum computation and communication, quantum-enhanced metrology and imaging. The detailed course content includes: engineering of states and dynamics of qubits; basic correlations in complex systems induced by entanglement; operation of quantum gates; interaction of quantum systems with environment; tasks for a quantum computer, protocols of quantum cryptography. Simultaneously with quantum ?software? the selected topics are presented concerning quantum ?hardware? such as state of art of potential implementation of a quantum processors, the basics of engineering of extraordinary (e.g. coherent) properties of matter; quantum control of motion, essentials of coherent quantum electronics, spintronics and photonics. The course is concluded with debate on open questions and issues of quantum engineering and related problems.

Introductory courses and the required pre-knowledge:

-undergraduate course on classical physics, elementary quantum and atomic physics, mathematics including fundamentals of linear algebra, calculus.

Courses form and teaching methods:

-lectures supported by multimedia presentation,
-classes,
-laboratory exercises,

Form and terms of complete the course - requirements and assessment methods:

-Lectures: written final exam

-Classes and laboratory exercises/projects: average of the final grades of classes and laboratory exercises. (Classes: continuous assessment of problem solutions and final test. Laboratory exercises: continuous assessment of accomplishment of exercises/projects and assessment of laboratory final report.)

Basic Bibliography:

-

Additional Bibliography:

-