STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Quantum Physics		**1011101251011103578**
Field of study	Profile of study (general academic, practical)	Year /Semester
Engineering Management - Full-time studies -	**(brak)**	**3 / 5**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
-	**Polish**	**elective**
Cycle of study:	Form of study (full-time,part-time)	
First-cycle studies	**full-time**	

No. of hours					No. of credits
Lecture: **15**	Classes: **-**	Laboratory: **15**	Project/seminars: **-**		**2**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
(brak)	**(brak)**

Education areas and fields of science and art	ECTS distribution (number and %)

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge on physics and mathematics
2	**Skills**	Ability to solve simple problems from the area of physics and mathematics, ability to collect information from suggested sources
3	**Social competencies**	Understanding and necessity of expanding own competences from the range of modern science and technology in order to have the ability to work in a team; understanding the necessity of cooperation with other students; understanding of the necessity of taking decisions in favor of the academic society and society as a whole.

Assumptions and objectives of the course:

1. Presentation of the knowledge from the range of basics of modern quantum physics and the correlation between physics and managerial skills
2. Presentation of the knowledge on the importance of modern physics in the development of the society
3. Giving knowledge on fundamental quantum phenomena and presentation during lectures
4. Interactive lectures realized in cooperation with students and forming the skill of teamwork

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. knows basic methods, techniques, instruments and materials applied for solving simple engineer tasks from the range of machine construction and implementation - [K04-InzA_W02]
2. knows typical industrial technologies and deeply knows technologies of machine construction and implementation - [K07-InzA_W5]

Skills:

1. is able to identify project tasks and solve simple project tasks from the range of machine construction and implementation - [K01-InzA_U6]
2. is able to apply typical methods of solving simple tasks from the range of machine construction and implementation - [K01-InzA_U7]

Social competencies:

1. is aware of the importance of physics and it consequences in the engineer activity - [K01-InzA_K1]

Assessment methods of study outcomes

Forming assessment:

a) laboratories: on basis of the current progress in realization of topics evaluated on basis of written reports

b) lectures: on basis of responses to questions concerning subjects from former lectures,

Final assessment:

a) laboratories: on basis of the average of fragmentary evaluations formulating evaluations

b) lectures: final assessment in written form of a test. Entering the test is possible after passing the final assessment of laboratory classes

Course description

Wave - corpuscular duality. De Broglie's hypothesis. Photoelectric phenomenon. Compton's phenomenon. Creation of pairs. Rutherford's experiment. Model of hydrogen atom. Ideal black body radiation. Schroedinger's equation. Wave functions. Quantum -mechanical oscillator. Tunnelling. EPR paradox. Hidden variable hypothesis. Quantum - based teleportation

Lecture - informative and conversational lecture

Laboratory - laboratory method

Basic bibliography:

1. Wykład z fizyki cz. 2 Elementy fizyki współczesnej, Sylwester Kania , Wydawnictwo Politechniki Łódzkiej, 2012

2. Wprowadzenie do mechaniki kwantowej i fizyki statystycznej, Robert Kosiński, Oficyna Wydawnicza Politechniki Warszawskiej, 2013

3. Wykłady z fizyki t.3 Optyka kwantowa. Fizyka atomu. Fizyka ciała stałego. Fizyka jądra atomowego i cząstek elementarnych, I.W. Sawieliew, PWN 2002

Additional bibliography:

1. Podstawy fizyki relatywistycznej i mechaniki kwantowej, Marian Kozielski, Oficyna Wydawnicza Politechniki Warszawaskiej, 1999

Result of average student's workload

Activity	Time (working hours)
1. lecture	15
2. laboratory classes	15
3. consultation	5
4. preparation for laboratories	15
5. final assessment and exam	10

Student's workload

Source of workload	hours	ECTS
Total workload	60	2
Contact hours	45	1
Practical activities	15	1