STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
(-)	**1010401271010431243**

Field of study	Profile of study (general academic, practical)	Year /Semester
TECHNICAL PHYSICS	**(brak)**	**4 / 7**
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: **-** Classes: **2** Laboratory: **-** Project/seminars: **-**	**10**

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**	the knowledge of a properties and new technologies, as well as various experimental techniques focused on nanotechnology and quantum engineering being used in characterization and studies of the physical phenomena in different nanostructures, functional materials and structures covering the proper research subject connected with the study program of the course on first ? cycle studies in Technical Physics.
2	**Skills**	The ability to solve basic problems of physics on the basis of prior knowledge, the ability to obtain information from the recommended sources
3	**Social competencies**	Understanding the need to broaden own competences, willingness to work in a team.

Assumptions and objectives of the course:

Cource objectives:

1. Advancing the student?s basic knowledge of a new technologies and experimental techniques focused on nanotechnology, solid state physics and solid state spectroscopy used in characterization and studies of physical phenomena existing in different materials and physical structures.
2. Presentation in seminar form different technologies and experimental techniques used in study connected with the research subject of diploma thesis being prepared.
3. Presentation and discussion of the results obtained ? connected with the research subject of engeneering diploma thesis.
4. Developing student?s temwork skills.

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

Knowledge:

1. Has basic knowledge of electrical power engineering, electronics, optics and automatic control enabling him or her to understand operation principles of measurement instruments and research equipment - [K_W08]
2. Has basic knowledge of metrology, knows and understands methods of measuring physical quantities and analysing results of such measurement - [K_W09]
3. Knows the current state of and is versed in the latest development trends in the area of nanotechnology, optoelectronics, bioelectronics, quantum engineering and computer simulations of physical processes - [K_W13]
4. Has basic knowledge of the operation and lifespan of measurement and research instruments and technical systems - [K_W15]
5. Has basic knowledge of standards, patents and copyright law; knows and understands - [K_W19]

Skills:

1. Is able to extract information from the literature, databases and other sources, interpret it and draw conclusions, formulate and justify opinions - [KU_02]
2. Is able to plan and arrange self-education process - [KU_03]
3. Is able to prepare a schedule of technical and experimental activities and manage their implementation carried both on his or her own or as a team - [KU_06]
4. Is able to carry out initial economic analysis of undertaken engineering activities and assess their labour intensity - [K_U13]
5. Is able to plan and carry out standard measurement, analyse and record results of research concerning classic and quantum physical phenomena at the macro-, micro- and nanoscale; is able to identify and assess the importance of basic factors disturbing a measurement - [K_U17]
6. Is able to prepare a technical specification of basic measurement systems, research systems and technical diagnosis systems based on phenomena related to various branches of physics, using standard computer-aided design tools - [K_U21]
7. Is able to express achievements in physics described in the literature in technical language - [K_U22]
8. Is able to discern the social, economic and legal aspects when formulating and solving engineering problems - [K_U23]
9. Is able to plan and arrange self-education process - [K_U03]
10. Is able to prepare and give an oral presentation in Polish and in a foreign language and a well-documented treatise regarding specific problems related to technical physics - [K_U04]

Social competencies:

1. Understands the need of and opportunities for continuous self-improvement (first- and second-cycle studies, postgraduate studies) ? raising his or her professional, personal and social competences - [K_K03]
2. Follows the rules of professional ethics, is responsible for the reliability of results obtained in his or her work and their interpretation, and the assessment of work done by others - [K_K02]
3. Is aware of the importance of and understands nontechnical aspects and results of engineering, including its environmental impact, and responsibility for the decisions taken in relation to this - [K_K06]

Assessment methods of study outcomes

	Assessment method	Marketing criteria
W01	Assessmrnt of the oral	3 50.1% - 70.0%
W02	presentation with the use	4 70.1% - 90.0%
W03	of power point computer program	5 from 90.1%
U01	Oral presentation with	3 50.1% - 70.0%
U02	the use of power point	4 70.1% - 70.0%
U03	computer program	5 from 90.1%
K01	Activity and discussion	3 50.1% - 70.0%
K02	assessment during seminar classes and engagement during preparation of the presentation	4 70.1% - 90.0% 5 from 90.1%

Course description

Course description:

Students should obtain the knowledge of a new technologies, as well as various experimental techniques focused on nanotechnology and quantum engineering being used in characterization and studies of the physical phenomena in different materials and structures. Presentation in seminar form different technologies and experimental techniques used in study being the subject of diploma thesis prepared.

Presentation and discussion of the results obtained ? connected with the research subject of diploma thesis being prepared.

Basic bibliography:

1. A.Oleś ? ?Metody eksperymentalne fizyki ciała stałego?, Warszawa, WNT 1998.
2. ?Spektroskopia Ciała Stałego?, wyd. II popr. I uzup., pod red. M. Drozdowski, Wyd.Politechniki Poznańskiej 2001?Spektroskopia Ciała Stałego?, wyd. II popr. I uzup., pod red. M. Drozdowski, Wyd.Politechniki Poznańskiej 2001.
3. Z. Kęcki, ?Podstawy spektroskopii molekularnej?, Warszawa, PWN 1992.
4. H.Barańska, A.Łabuzińska, J.Trepiński, ?Laserowa spektrometria laserowa ? zastosowania analityczne?, Warszawa PWN 1981.
5. G.M.Barrow, ?Wstęp do spektroskopii molekularnej?, Warszawa, PWN 1968.
6. C. Kittel, ?Wstęp do fizyki ciała stałego?, Warszawa, PWN 1976.
7. J.I. Pankowe, ?Zjawiska optyczne w półprzewodnikach?, Warszawa, PWN 1974.
8. J.Stankowski, B.Czyżak, ?Nadprzewodnictwo?, Warszawa, WNT 1994.
9. H.J. Guntherodt, R. Wiesendanger (Eds.), ?Scanning Tunneling Microscopy? ? I, II and III, Berlin Springer-Verlag 1992.
10. B. Ziętek, ?Optoelektronika?, Wyd. UMK Toruń 2005.

Additional bibliography:

1. D. Curie, Luminescencja fosforów krystalicznych, Warszawa, PWN 1965.
2. D.Wróbel, ?Podstawy fotonowych procesów molekularnych?, Wydawnictwo Politechniki Poznańskiej 1998.
3. K. Booth, S. Hill, ?Optoelektronika?, Wyd. Komunikacji i Łączności sp.z o.o. Warszawa 2001.
4. ?Mikroskopia elektronowa?, pod. red. A. Barbackiego Rozdz. VI pt. ?Mikroskopia sond skanujących?, Wyd. Politechniki Poznańskiej, Wydanie III, 2007.
5. J.A. Barltrop, J.D.Coyle, ?Fotochemia ? podstawy?, Warszawa, PWN 1987.
6. E Meyer, H.J.Hug, R. Bennewitz, ?Scanning Probe Microscopy? ? The Lab on a Tip, Springer ? Verlag, Berlin.
7. B.A. Auld, Acoustic Fields and Waves in Solids?, Vol. 1, Inc., New York, John Willey and Sons 1973.

Result of average student's workload

Activity	Time (working hours)
1. Participating in diploma seminar	30
2. Preparing for the diploma seminar	20
3. Participating in course consultance	2
4. Preparing experimentalresults obtained associated with the engineering dissertation	168
5. Preparing for the presentation	30
6. Total time of working hours	250

Student's workload

Source of workload	hours	ECTS
Total workload	250	10
Contact hours	32	0
Practical activities	218	0