STUDY COURSE DESCRIPTION FORM

Name of the course:	Code
Molecular electronics	
Name of the doctoral school	Year /Semester
Poznan University of Technology Doctoral School	
Specialty/Discipline	Type (obligatory, elective):
Materials Engineering	**elective**
No. of hours	No. of credits
Lectures: **4** Classes: **-** Laboratories: **-** Seminars: **-**	**1**

Cycle of study:	**Form of study:**	**Assessment:** (written exam, presentation, etc.)
Third-cycle studies (Polish Qualifications Framework level eight)	Full-time	Written exam

Responsible for the course/lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge:** Basic knowledge in modern physics (primarily solid state physics), and electronics. Basic chemistry is useful but not a formal requirement. Molecular Physics is recommended, especially for students who also intend to follow Organic Electronics.
2	**Skills:** Student should have ability to find a solution to basic scientific and technological problems. Student should be able to read and understand the scientific papers. Student should be able to self-education.
3	**Social competencies:** Understanding the need of self-education in terms of reading literature in field of molecular physics and teamwork.

Objectives of the course:

Course lectures will cover topics such as: introduction to organic electronic materials and their basic properties; charge transport and energy structure of organic electronics; case studies on specific materials used in current research; optical properties (energy levels, color changes, light emission and absorption); organic electronic circuit components (diodes, transistors); structural properties of organic electronic materials, and applications of organic materials in inorganic electronic devices; techniques used in preparation of nano-electronics elements: self-assembly monolayers (SAM), Langmuir-Blodgett monomolecular films, printed and painted electronics, organic photovoltaics (solar cells); an overview of current applications and commercialization.

Educational results (Study outcomes)

Knowledge: After finishing the course, the students should be able to:

P8S_WG	explain charge transport, energy levels in organic electronic materials, and how they compare to metals and inorganic semiconductors	**SzD_W01**
P8S_WG	exemplify specific organic electronics materials, their properties, and applications	**SzD_W02**
	summarize the optical properties and applications of organic electronic materials, such as in displays exemplify the architecture, characterization, and utilization of electronic components based on organic electronic materials (such as diodes, transistors)	
P8S_WK	explain and motivate the use of organic electronic materials in applications summarize device fabrication techniques	**SzD_W05**

Skills:		
P8S_UW	students can explain the fundamentals of nano-science, its applications for various fields of technology	**SzD_W05**
P8S_UW	can describe new developments, including new optoelectronic devices, new materials and new applications in commercial devices	**SzD_W05**
P8S_UK	can use the English language to allow active participation in the international scientific community	**SzD_W08**
Social competencies:		
P8S_KK	critically assess the achievements within a given scientific discipline	**SzD_K01**
P8S_UO	fulfilling the social obligations of researchers and creators	**SzD_K04**

Compulsory literature:

1. Encyclopedia of nanoscience and nanotechnology, Edited by H.S. Nalwa, American Scientific Publishers, 2007
2. Nanostructures and Nanomaterials: synthesis, properties and applications, G. Cao and Y. Wang, World Scientific, 2nd edition, 2011
3. Introduction to Molecular Electronics, Edited by M. C. Petty, M. R. Bryce, and D. Bloor (University of Durham, U.K.). Oxford University Press: New York. 1995

Additional literature:

1. Nanoelectronics- principles and devices, M. Dragoman and D. Dragoman, Artech House publishers, 2005

COURSE DESCRIPTION

	General issues	**Specific issues**	**No. of hours**
1	Introduction to organic electronics:	What is organic electronics? - brief history, properties of individual organic molecules	0.75
2	Electron properties:	– from single monomolecular layers to bulk - structures, textures and optical properties	1.0
3	Fundamentals of surface and interfacial physics:	monolayers and self-assembly, micelles (structure and properties)	1.0
4	Fabrication techniques:	SAM, spin-coating (lithography), layer-by-layer, Langmuir-Blodgett films, printing, chemical functionalization	0.75
5	Applications:	application of organic molecules in nano-electronics and sensors	0.5

Assessment methods of educational results

final written examination/oral examination at the end of the semester

STUDENT'S WORKLOAD

Activity	**Hours**
Participation in lectures, classes, seminars and laboratories	4

Contact hours with lecturers	4
Self-study	10
Exam	1
TOTAL	**19**
TOTAL NUMBER OF ECTS POINTS FOR THE COURSE	1