Kielce University of Technology

FACULTY OF MECHATRONICS AND MECHANICAL ENGINEERING

Annex 9
to the Rector's Ordinance No. 35/19
of 12 June 2019

COURSE SPECIFICATION

Course code	**M#1-S1-ME-211a**
Course title in Polish	**Mikro/Nanotechnika**
Course title in English	**Micro and Nanotechnology**
Valid from (academic year)	**2019/2020**

GENERAL INFORMATION

Programme of study	**MECHANICAL ENGINEERING**
Level of qualification	**first-cycle**
Type of education	**academic**
Mode of study	**full-time**
Specialism	**all**
Department responsible	**Department of Mechanics**
Course leader	**Dr hab. inż. Monika Madej, prof. PŚk**
Approved by	

COURSE OVERVIEW

Course type	**basic**
Course status	**elective**
Language of instruction	English
Semester of delivery	**semester 2**
Pre-requisites	**None**
Examination required (YES/NO)	YES
ECTS value	**3**

Mode of instruction	**lecture**	**class**	**laboratory**	**project**	**seminar**
No. of hours per semester	**15**		**15**		

LEARNING OUTCOMES

Category of outcome	Out-come code	Course learning outcomes	Corresponding programme outcome code
Knowledge	W01	The student has the knowledge needed to organize work in accordance with health and safety	MiBM1_W04
	W02	Has basic knowledge of nanotechnology and micro- and nanotechnology, with particular emphasis on their application in mechanics and machine construction	MiBM1_W13
	W03	Has a comprehensive knowledge of surface engineering, including various related issues, e.g. modeling of the surface layer, assessment of the condition and durability of the surface, tribological tests	MiBM1_W22
Skills	U01	He can perform measurements of basic geometrical, mechanical and electrical quantities and others related to the process of manufacturing machine parts, is able to interpret the obtained results, analyze the measurement uncertainty and draw conclusions	MiBM1_U11
	U02	Can use analytical, numerical and simulation methods to formulate and solve engineering tasks in the field of mechanics and machine construction, can properly interpret and use the results of the experiment	MiBM1_U12
	U03	The student is able to choose the appropriate engineering materials to ensure the correct operation of the machine	MiBM1_U14
Competence	K01	Is aware of the importance and understands the relationship between engineering and non-technical activities, in terms of the effects of environmental impact and responsibility for the decisions made	MiBM1K03
	K02	Can think and act in an entrepreneurial way, understanding the needs of society and the laws governing the natural environment	MiBM1_K05
	K03	Is aware of the social role of a technical university graduate and understands the need to provide public opinion in an understandable way with information on achievements related to the field of mechanics and machine building	MiBM1_K06

COURSE CONTENT

Type of instruction*	Topics covered
lecture	1. The concept of micro / nanotechnology, the genesis of micro / nanotechnology, definitions, world situation, development trends, the importance of micro / nanotechnology used in the construction of machines and devices.
	2. Material issues, fullerenes, nanotubes, polymers, nanocomposites in micro / nanotechnology, manufacturing techniques, micro / nanomachining.
	3. Micro / nanodevices and their application. Construction and principles of operation.
	4. Fundamentals of adaptronics and biomimetics, biological micro / nanostructures, rotary and linear biological nanomotors.
	5. Basic devices for micro / nano research: confocal microscope with interferometric mode, AFM, nano hardness testers, micro / nanoscratch tester, other research equipment, applications. Construction and their operation.
	6. Applications of micro / nano-devices in everyday life, research techniques as well as mechanics and machine building in various industries.

laboratory	1. Introduction to the laboratory classes, tools and research environment of micro / nanotechnology.
	2. Basic methods, structure and operation of apparatus for structure studies on the nano scale (AFM atomic force microscopy, confocal microscopy with interferometric mode, SEM microscopy).
	3. Basic methods, structure and operation of apparatus for tribological tests.
	4. Basic methods, structure and operation of apparatus for testing mechanical properties in the nano-scale: hardness, adhesion.
	5. Studies of tribological properties in the nanoscale.
	6. Studies of micro / nanostructures: confocal microscopy with interferometric mode, AFM microscopy, scanning electron microscopy.
	7. Mechanical tests in the nano scale: hardness, adhesion.
	8. Investigation of the adhesive ability and energy state of the surface: wettability, surface energy, adhesion.

*) Please delete rows in the table above that are not applicable.

ASSESSMENT METHODS

Outcome code	Methods of assessment *(Mark with an X where applicable)*					
	Oral examination	Written examination	Test	Project	Report	Other
W01			x			
W02		x	x			
W03		x	x		x	
U01					x	
U02					x	
U03		x	x		x	
K01			x			
K02			x			
K03					x	

ASSESSMENT TYPE AND CRITERIA

Mode of instruction*	Assessment type	Assessment criteria
lecture	**examination assessment**	The pass mark is a minimum of 50% for the final in-class test.
class	non-examination assessment	The pass mark is a minimum of 50% for each in-class-test.

*) Please delete rows in the table above that are not applicable.

OVERALL STUDENT WORKLOAD

ECTS weighting								
	Activity type	**Student workload**					**Unit**
1.	Scheduled contact hours	L	C	Lab	P	S	h
		15		15			
2.	Other contact hours (office hours, examination)	4		2			h
3.	**Total number of contact hours**	**36**					h
4.	**Number of ECTS credits for contact hours**	**1,4**					ECTS

5.	**Number of independent study hours**	**39**	h
6.	**Number of ECTS credits for independent study hours**	**1,6**	ECTS
7.	**Number of practical hours**	**38**	h
8.	**Number of ECTS credits for practical hours**	**1,5**	ECTS
9.	**Total study time**	**75**	h
10.	**ECTS credits for the course** *1 ECTS credit = 25-30 hours of study time*	**3**	ECTS

READING LIST

1. Nanonauki i nanotechnologie' praca zbiorowa pod red. Adama Mazurkiewicza (wersja elektroniczna), Instytut Technologii Eksploatacji ITEE - PIB / 2007
2. K. Kurzydłowski, M. Lewandowska: Nanomateriały inżynierskie – konstrukcyjne i funkcjonalne" Wydawnictwo Naukowe PWN Warszawa 2010
3. Nanoscale Science and Technology, eds. R.W. Kelsall, I.W.Hamley, M.Geoghegan.John Wiley & Sons Ltd, Chichester 2005.
4. Handbook of Nanotechnology, ed,. Bushan, Springer Science + Biznes Media. Springer Berlin Heildelberg, New York 2007
5. Kapuścik A. Produkcja w skali „nano". Inspektor Pracy 2006, 10, 11-13
6. Rymuza Z.: Konstrukcja i eksploatacja mikrołożysk ślizgowych, Rozdział w monografii pod redakcją Ozimina D.: Tarcie, zużycie, smarowanie wybranych węzłów tribologicznych, 2013, Wydawnictwo Politechniki Świętokrzyskiej w Kielcach, ss. 66-78
7. Rymuza Z.: Tribology of Miniature Systems, w: Encyclopedia of Tribology, eds. Wang Q. Jane, Chung Yip-wah, 2013
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