-       Polish       obligatory         Cycle of study:       Form of study (full-time,part-time)       Form of study (full-time,part-time)         Vector of hours       part-time       No. of credits         Lecture:       20       Classes:       -       Laboratory:       -       Project/seminars:       1         Status of the course in the study program (Basic, major, other)       (university-wide, from another field)       (brak)       ECTS distribution (number and %)         Education areas and fields of science and art       ECTS distribution (number and %)       2       100%         Education areas and fields of sciences       2       100%       2       100%         Responsible for subject / lecturer:       dr hab. in2. Slawomir Borysiak       2       100%       2       100%         dr hab. in2. Slawomir Borysiak       put-poznan.pl       Education areas of knowledge, skills and social competencies:       2       100%         Prerequisites in terms of knowledge, skills and social competencies:       1       Knowledge       The ability to acquire information from literature, database, other carefully selected sources.       3         2       Skills       The ability to acquire information from literature, database, other carefully selected sources.       3         3       Social competencies       Understanding the need for further e			STUDY MODULE D	ESCRIPTION FORM		
Chemical Technology         (general academic, practical) (trak)         4 / 8           Elective path/specially         Subject offend in: Polish         Course (computancy, elective; obligatory)           Cycle of study:         First-cycle studies         part-time           Vector function         part-time         No. of redits           Status of the course in the study program (Basic, maier, other) (track)         (university-wide, from anthrefield) (university-wide, from anthrefield)           Education areas and fields of science and at technical sciences         ECTS distribution (number and %)         2         100%           Responsible for subject / lecturer:         dr hab. in2. Slaworin' Borysiak email: Slaworin			ourity and nanomaterials			
Chemical Technology         (trak)         4 / 8           Elective path/specialty         -         Polish         Course (computeory, elective)           Subject of study:         -         Polish         Course (computeory, elective)           System         Porm of study (full-time,part-time)         max         part-time           System         Porm of study (full-time,part-time)         No. of oredits         Lecture:         Course (computeory, elective)           Status of the course in the study program (Basic, major, other)         (university-wide, from another field)         No. of oredits           Lecture:         20         Classes:         -         Project/seminars:         1           Status of the course in the study program (Basic, major, other)         (university-wide, from another field)         (Drak)           Education areas and fields of science and at         ECTS distribution (number and %)         2         100%           Technical Sciences         2         100%         2         100%           Preferequisites         In terms of knowledge, skills and social competencies:         2         100%           Status         The ability to acquire information from literature, database, other carefully selected sources.         3           1         Knowledge related to structure, method of preparation and unique properties of mate	Field of	study				
-     Polish     obligatory       Cycle of study:     Form of study (full-time,part-time)     Part-time       Status of the course in the study program (Basic, major, other)     (university-wide, from another field)     No. of oresits       Lecture:     20     Classes:     -     Project/seminars:     1       Status of the course in the study program (Basic, major, other)     (university-wide, from another field)     (torak)       Education areas and fields of science and at     ECTS distribution (number and %)     2     100%       Education areas and fields of science and at     ECTS distribution (number and %)     2     100%       Responsible for subject / lecturer:     dr hab. inz. Slawomir Bonysiak     2     100%       Responsible for subject / lecturer:     dr hab. inz. Slawomir Bonysiak     2     100%       U. Berdychowa 4, 60 965 Paznain     Ectivation     Ectivation     2     100%       Prerequisites in terms of knowledge of chemistry, physics and mathematics.     1     Knowledge     Basic knowledge of preparation from literature, database, other carefully selected sources.       2     Skills     The ability to acquire information from literature, database, other carefully selected sources.       1     Knowledge related to structure, method of preparation and unique properties of materials, biomaterials and nanomaterials.       3     Social competencies     Understanding the need	Cher	nical Technolog	у			
First-cycle studies       part-time         No. of nours       No. of credits         Lecture:       20       Classes:       -       Laboratory:       Project/seminars:       -       1         Status of the course in the study program (Basic, major, other)       (university-wide, from another field)       (brak)       ECTS distribution (number and %)         Education areas and fields of sciences and art       ECTS distribution (number and %)       2       100%         Etechnical sciences       2       100%       2       100%         Responsible for subject / lecturer:       (r hab. inz. Slawomir Borysiak       2       100%       2       100%         Praculty of Chemical Technology       u.u. Berdychowo 4, 60-965 Poznan       Prefequisites in terms of knowledge, skills and social competencies:       -         1       Knowledge       Basic knowledge of chemistry, physics and mathematics.       -       -         2       Skills       The ability to acquire information from literature, database, other carefully selected sources.       -         3       Social       Understanding the need for further education and improve their professional competences.       -         4       Knowledge related to structure, method of preparation and unique properties of materials, biomaterials and nanomaterials.       -         3       Social	Elective path/specialty			-	Course (compulsory, elective) obligatory	
No. of hours Lecture: 20 Classes: - Laboratory: - Project/seminars: - 1 No. of credits Lecture: 20 Classes: - Laboratory: - Project/seminars: - 1 Status of the course in the study program (Basic, major, other) (brak) ECTS distribution (number and %) 2 100% 2 10	Cycle of	study:		Form of study (full-time,part-time)		
Lecture:       20       Classes:       -       Laboratory:       -       Project/seminars:       1         Status of the course in the study program (Basic, major, other) (brak)       (university-wide, from another field)       ECTS distribution (number and %)         Education areas and fields of science and art       (brak)       (brak)       2       100%         Education areas and fields of science and art       ECTS distribution (number and %)       2       100%         Responsible for subject / lecturer:       dr hab. inz. Slawomir. Borysiak email: Slawomir. Borysiak @put.poznan.pl tei. 61 665-54-9       2       100%         Precupisites in terms of knowledge, skills and social competencies:       1       Knowledge       1         1       Knowledge       The ability to acquire information from literature, database, other carefully selected sources.       3         3       Social competencies       Understanding the need for further education and improve their professional competences.         4.       Knowledge related to structure, method of preparation and unique properties of materials, biomaterials and nanomaterials.         2.       Skills       Understanding the field of structure and applications of materials, biomaterials and nanomaterials.         3.       Social competencies       1       Study outcomes and reference to the educational results for a field of study Knowledge:         4.		First-cyc	ele studies	part-time		
Control       Laboratory       The program (Basic, major, other)       (university-wide, from another field)         Control       (brak)       (university-wide, from another field)         Education areas and fields of science and at       (brak)       (brak)         Education areas and fields of sciences       (university-wide, from another field)       2         Education areas and fields of sciences       (brak)       2       100%         Technical sciences       2       100%       2       100%         Responsible for subject / lecturer:       (drabs.inz. Slawomir Borysiak       2       100%       2       100%         Faculty of Chemical Technology       (u.Berdychowo 4, 60-965 Poznań       Prerequisites in terms of knowledge, skills and social competencies:       1       Knowledge         1       Knowledge       Basic knowledge of chemistry, physics and mathematics.       1         2       Skills       The ability to acquire information from literature, database, other carefully selected sources.         3       Social       Understanding the need for further education and improve their professional competences.         2.       Skudy outcomes and reference to the educational results for a field of study         3       Social       Understanding the need of structure and applications of materials, biomaterials and nanomaterials.         <	No. of h	ours		No. of credits		
(brak)         (brak)           Education areas and fields of science and art         ECTS distribution (number and %)           technical sciences         2           Technical sciences         2           dr hab. inz. Slawomir Boryslak gut, poznan. pl tel. 61 665-35-49         2           Faculty of Chemical Technology u.l. Berdychowo 4, 60-965 Poznań         4           Prerequisites in terms of knowledge, skills and social competencies:         5           1         Knowledge         Basic knowledge of chemistry, physics and mathematics.           2         Skills         The ability to acquire information from literature, database, other carefully selected sources.           3         Social competencies         Understanding the need for further education and improve their professional competences.           1.         Knowledge related to structure, method of preparation and unique properties of materials, biomaterials and nanomaterials.           2.         Skills         Understanding the need to further educational results for a field of study Knowledge related to structure, method of preparation and unique properties of materials, biomaterials and nanomaterials.           2.         Knowledge related to the properties and latest technologies of advanced materials and nanomaterials.           3.         Social competencies         1           4.         Knowledge in the field of technology of advanced materials and nanomaterials.	Lectur	e: 20 Classes	s: - Laboratory: -	Project/seminars:	- 1	
Education areas and fields of science and art       ECTS distribution (number and %)         technical sciences       2         Technical sciences       2         dr hab. inż. Slawomir. Borysiak @put.poznan.pl       2         teil. 61 665-35-49       Faculty of Chemical Technology         ul. Berdychowo 4, 60-965 Poznań       Prerequisites in terms of knowledge, skills and social competencies:         1       Knowledge       Basic knowledge of chemistry, physics and mathematics.         2       Skills       The ability to acquire information from literature, database, other carefully selected sources.         3       Social competencies       Understanding the need for further education and improve their professional competences.         Assumptions and objectives of the course:       Knowledge related to structure, method of preparation and unique properties of materials, biomaterials and nanomaterials.         2.       Kudy outcomes and reference to the educational results for a field of study         Knowledge related to the properties and latest technology of advanced materials with special properties, sionmaterials [K_W09]         2.       Study outcomes and reference to the educations of materials, biomaterials, and nanomaterials [K_W113]         3.       The stubished knowledge in the field of structure and applications of materials, biomaterials, - [K_W12]         2.       Studen thas a well-established knowledge in the field of technology of advanced material	Status o	f the course in the study	program (Basic, major, other)			
and %)       2       100%       2       100%         Responsible for subject / lecturer:       dr hab. inż. Sławomir Borysiak       2       100%       2       100%         Responsible for subject / lecturer:       dr hab. inż. Sławomir Borysiak       dr hab. inż. Sławomir Borysiak       2       100%         I hab. inż. Sławomir Borysiak       email: Sławomir.Borysiak@put.poznan.pl       1       16.65-35-49       Faculty of Chemical Technology         ul. Berdychowo 4, 60-965 Poznań       Basic knowledge, skills and social competencies:       1       Knowledge         1       Knowledge       Basic knowledge of chemistry, physics and mathematics.       1         2       Skills       The ability to acquire information from literature, database, other carefully selected sources.         3       Social       Understanding the need for further education and improve their professional competencies.         4       Knowledge related to structure, method of preparation and unique properties of materials, biomaterials and nanomaterials.         5       Ktudy outcomes and reference to the educational results for a field of study         Knowledge       In the field of structure and applications of materials with special properties, siomaterials and nanomaterials.         1       Study outcomes and reference to the educational results for a field of study         Knowledge       In student has a well-est			(brak)		(brak)	
technical sciences       2 100%         Technical sciences       2 100%         Responsible for subject / lecturer:       dr hab. inż. Sławomir. Borysiak @put.poznan.pl         tei. 61 665-35-49       Faculty of Chemical Technology         ul. Bertychowo 4, 60-965 Poznań       Prerequisites in terms of knowledge, skills and social competencies:         1       Knowledge       Basic knowledge of chemistry, physics and mathematics.         2       Skills       The ability to acquire information from literature, database, other carefully selected sources.         3       Social competencies       Understanding the need for further education and improve their professional competences.         4       Knowledge related to structure, method of preparation and unique properties of materials, biomaterials and nanomaterials.         2.       Kluy outcomes and reference to the educational results for a field of study         Knowledge related to the properties and latest technologies of advanced materials with special properties, notimaterials.         1.       Study outcomes and reference to the educational results for a field of study         Knowledge:       1         1.       Study outcomes and reference to the educations of materials, biomaterials, and nanomaterials.         2.       Study outcomes and reference to the educations of materials, biomaterials, and nanomaterials.         3.       Toty outcomes and reference to the educations of mat	Educatio	on areas and fields of sci	ence and art			
Technical sciences       2 100%         Responsible for subject / lecturer:       dr hab. in2. Slawomir Borysiak @put.poznan.pl teil. 61 665-354-9         Faculty of Chemical Technology       ul. Berdychowo 4, 60-965 Poznań         Prerequisites in terms of knowledge, skills and social competencies:         1       Knowledge         2       Skills         1       The ability to acquire information from literature, database, other carefully selected sources.         2       Skills         3       Social competencies         Assumptions and objectives of the course:         1.       Knowledge related to structure, method of preparation and unique properties of materials, biomaterials and nanomaterials.         2.       Kudy outcomes and reference to the educational results for a field of study         Knowledge       Inte field of structure and applications of materials, biomaterials, and nanomaterials.         2.       Study outcomes and reference to the educational results for a field of study         Knowledge       Inte field of structure and applications of materials, biomaterials, and nanomaterials.         2.       Studen has a well-established knowledge in the field of technology of advanced materials, biomaterials, and nanomaterials.         3.       Studen has a well-established knowledge in the field of technology of advanced materials, biomaterials, and nanomaterials.         3.       Studen has	techn	ical sciences			-	
Responsible for subject / lecturer:         dr hab. in2. Slawomir Borysiak         email: Slawomir Borysiak @put.poznan.pl         tel. 61 665-35-49         Faculty of Chemical Technology         ul. Berdychowo 4, 60-965 Poznań         Prerequisites in terms of knowledge, skills and social competencies:         1       Knowledge         2       Skills         3       Social competencies         4       The ability to acquire information from literature, database, other carefully selected sources.         3       Social competencies         Assumptions and objectives of the course:         1.       Knowledge related to structure, method of preparation and unique properties of materials, biomaterials and nanomaterials.         2.       Knowledge related to the properties and latest technologies of advanced materials and nanomaterials         3.       Study outcomes and reference to the educational results for a field of study         Knowledge:       I. Studen thas a well-established knowledge in the field of structure and applications of materials, biomaterials, and nanomaterials (K_W09]         2.       Studen thas a well-established knowledge in the field of technology of advanced materials, biomaterials, and nanomaterials (K_W09]         3.       The student chas explain the basic phenomena associated with technological processes of preparation of materials, with special properties and also can explain phenomenon dur	com		ances			
dr hab. inž. Slawomir Borysiak         email: Slawomir Borysiak@put.poznan.pl         tel. 61 665-35-49         Faculty of Chemical Technology         ul. Berdychowo 4, 60-965 Poznań         Prerequisites in terms of knowledge, skills and social competencies:         1       Knowledge         2       Skills         3       Social competencies         3       Social competencies       Understanding the need for further education and improve their professional competences.         6       Study outcomes and objectives of the course:       Nowledge related to structure, method of preparation and unique properties of materials, biomaterials and nanomaterials.         2.       Knowledge related to the properties and latest technologies of advanced materials and nanomaterials.         2.       Knowledge related to the properties and latest technology of advanced materials, biomaterials and nanomaterials.         3.       Study outcomes and reference to the educational results for a field of study         Knowledge:       1.         1.       Studen thas a well-established knowledge in the field of technology of advanced materials, biomaterials, and nanomaterials. • [K_W09]         2.       Studen thas a well-established knowledge in the field of technology of advanced materials, biomaterials, .• K_W09]         3.       The student has knowledge in the field the latest technology of advanced materials, biomaterials, .•		rechincar scie	511003		2 10078	
Knowledge         Basic knowledge of chemistry, physics and mathematics.           Skills         The ability to acquire information from literature, database, other carefully selected sources.           Social competencies         Understanding the need for further education and improve their professional competences.           Assumptions and objectives of the course:         Inderstanding the need for preparation and unique properties of materials, biomaterials and nanomaterials.           Knowledge related to the properties and latest technologies of advanced materials and nanomaterials.         Study outcomes and reference to the educational results for a field of study           Knowledge:         1. Student has a well-established knowledge in the field of structure and applications of materials with special properties, oiomaterials [K_W09]           2. Student has a well-established knowledge in the field of technology of advanced materials, biomaterials, and nanomaterials [K_W13]           3. The student has a well-established knowledge in the field of technology of materials with special properties and nanomaterials [K_W09]           2. Student has a well-established knowledge in the field of technology of materials with special properties and nanomaterials [K_W13]           3. The student has a well-established knowledge in the field of technology solutions for advanced materials, biomaterials, and nanomaterials - [K_U12]           2. The student can explain the basic phenomena associated with technological processes of preparation of materials with special properties and also can explain phenomenon during their functioning - [K_U16]	dr ha ema tel. 6 Facu	ab. inż. Sławomir Bory il: Slawomir.Borysiak 61 665-35-49 ulty of Chemical Tech	∕siak @put.poznan.pl nology			
1       Knowledge         2       Skills       The ability to acquire information from literature, database, other carefully selected sources.         3       Social competencies       Understanding the need for further education and improve their professional competences.         Assumptions and objectives of the course:       Nowledge related to structure, method of preparation and unique properties of materials, biomaterials and nanomaterials.         2.       Knowledge related to the properties and latest technologies of advanced materials and nanomaterials         3.       Study outcomes and reference to the educational results for a field of study         Knowledge:       1.         1.       Student has a well-established knowledge in the field of structure and applications of materials with special properties, oiomaterials and nanomaterials [K_W09]         2.       Student has a well-established knowledge in the field of technology of advanced materials, biomaterials, and nanomaterials [K_W09]         3.       The student has knowledge in the field of technology of materials with special properties and nanomaterials [K_W09]         2.       Student has a well-established knowledge in the field of technology solutions for advanced materials, biomaterials [K_W09]         3.       The student has a well-established knowledge in the field of technology solutions for advanced materials, biomaterials, and nanomaterials - [K_U12]         2.       The student can explain the basic phenomena associated with technological processes o	Prere	quisites in term	s of knowledge, skills an	d social competencies:		
2       Skills         3       Social competencies         Assumptions and objectives of the course:       Inderstanding the need for further education and improve their professional competences.         Assumptions and objectives of the course:       Knowledge related to structure, method of preparation and unique properties of materials, biomaterials and nanomaterials.         2.       Knowledge related to the properties and latest technologies of advanced materials and nanomaterials         2.       Knowledge:         1.       Study outcomes and reference to the educational results for a field of study         Knowledge:       Instructure and applications of materials with special properties, piomaterials and nanomaterials [K_W09]         2.       Student has a well-established knowledge in the field of technology of advanced materials, biomaterials, and nanomaterials [K_W13]         3.       The student has knowledge in the field the latest technology of materials with special properties and nanomaterials [K_W09]         2.       Skills:         1.       Student has a well-established knowledge in the field of technology of materials with special properties and nanomaterials [K_U12]         2.       The student has a well-established knowledge in the field of technology solutions for advanced materials, biomaterials, and nanomaterials - [K_U12]         2.       The student can explain the basic phenomena associated with technological processes of preparation of materials with special properties and also can ex	1	Knowledge	Basic knowledge of chemistry, p	hysics and mathematics.		
Solution       Competencies         Assumptions and objectives of the course:       1.         Knowledge related to structure, method of preparation and unique properties of materials, biomaterials and nanomaterials.         2.       Knowledge related to the properties and latest technologies of advanced materials and nanomaterials         Study outcomes and reference to the educational results for a field of study         Knowledge:         1.       Student has a well-established knowledge in the field of structure and applications of materials with special properties, piomaterials and nanomaterials [K_W09]         2.       Student has a well-established knowledge in the field of technology of advanced materials, biomaterials, and nanomaterials [K_W13]         3.       The student has knowledge in the field the latest technology of materials with special properties and nanomaterials [K_W09]         Skills:       1.         1.       Student has a well-established knowledge in the field of technology solutions for advanced materials, biomaterials, - K_W09]         Skills:       1.         1.       Student has a well-established knowledge in the field of technology solutions for advanced materials, biomaterials, and nanomaterials - [K_U12]         2.       The student can explain the basic phenomena associated with technological processes of preparation of materials with special properties and also can explain phenomenon during their functioning - [K_U16]         Social competencies:       1.    <	2	Skills	The ability to acquire information	n from literature, database, othe	er carefully selected sources.	
<ol> <li>Knowledge related to structure, method of preparation and unique properties of materials, biomaterials and nanomaterials.</li> <li>Knowledge related to the properties and latest technologies of advanced materials and nanomaterials         Study outcomes and reference to the educational results for a field of study     </li> <li>Knowledge:         1. Student has a well-established knowledge in the field of structure and applications of materials with special properties, biomaterials and nanomaterials [K_W09]         2. Student has a well-established knowledge in the field of technology of advanced materials, biomaterials, and nanomaterials [K_W13]         3. The student has knowledge in the field the latest technology of materials with special properties and nanomaterials [K_W09]         Skills:         1. Student has a well-established knowledge in the field of technology solutions for advanced materials, biomaterials, - [K_W09]         Schult has a well-established knowledge in the field of technology solutions for advanced materials, biomaterials, - [K_U02]         2. The student has a well-established knowledge in the field of technology solutions for advanced materials, biomaterials, and nanomaterials - [K_U12]         2. The student can explain the basic phenomena associated with technological processes of preparation of materials with special properties and also can explain phenomenon during their functioning - [K_U16]      </li> </ol>	3		Understanding the need for furth	ner education and improve their	professional competences.	
Ananomaterials.     Knowledge related to the properties and latest technologies of advanced materials and nanomaterials     Study outcomes and reference to the educational results for a field of study     Knowledge:     Student has a well-established knowledge in the field of structure and applications of materials with special properties,     biomaterials and nanomaterials [K_W09]     Student has a well-established knowledge in the field of technology of advanced materials, biomaterials, and     hanomaterials [K_W13]     The student has knowledge in the field the latest technology of materials with special properties and nanomaterials     K_W09]     Skills:     Student has a well-established knowledge in the field of technology solutions for advanced materials, biomaterials, and     hanomaterials - [K_U12]     Student has a well-established knowledge in the field of technology solutions for advanced materials, biomaterials, and     hanomaterials - [K_U12]     The student can explain the basic phenomena associated with technological processes of preparation of materials with     special properties and also can explain phenomenon during their functioning - [K_U16]     Social competencies:	Assu	mptions and obj	ectives of the course:			
Study outcomes and reference to the educational results for a field of study         Knowledge:         1. Student has a well-established knowledge in the field of structure and applications of materials with special properties, biomaterials and nanomaterials [K_W09]         2. Student has a well-established knowledge in the field of technology of advanced materials, biomaterials, and nanomaterials [K_W13]         3. The student has knowledge in the field the latest technology of materials with special properties and nanomaterials [K_W09]         Skills:         1. Student has a well-established knowledge in the field of technology solutions for advanced materials, biomaterials, - [K_W09]         Skills:         1. Student has a well-established knowledge in the field of technology solutions for advanced materials, biomaterials, and nanomaterials - [K_U12]         2. The student can explain the basic phenomena associated with technological processes of preparation of materials with special properties and also can explain phenomenon during their functioning - [K_U16]         Social competencies:	1. nanom	0	to structure, method of preparatio	on and unique properties of mat	terials, biomaterials and	
<ul> <li>Knowledge:</li> <li>1. Student has a well-established knowledge in the field of structure and applications of materials with special properties, piomaterials and nanomaterials [K_W09]</li> <li>2. Student has a well-established knowledge in the field of technology of advanced materials, biomaterials, and nanomaterials [K_W13]</li> <li>3. The student has knowledge in the field the latest technology of materials with special properties and nanomaterials [K_W09]</li> <li>Skills:</li> <li>1. Student has a well-established knowledge in the field of technology solutions for advanced materials, biomaterials, and nanomaterials - [K_U09]</li> <li>Skills:</li> <li>2. The student can explain the basic phenomena associated with technological processes of preparation of materials with special properties and also can explain phenomenon during their functioning - [K_U16]</li> <li>Social competencies:</li> </ul>	2.		• •			
<ol> <li>Student has a well-established knowledge in the field of structure and applications of materials with special properties, piomaterials and nanomaterials [K_W09]</li> <li>Student has a well-established knowledge in the field of technology of advanced materials, biomaterials, and nanomaterials [K_W13]</li> <li>The student has knowledge in the field the latest technology of materials with special properties and nanomaterials [K_W09]</li> <li>Skills:         <ol> <li>Student has a well-established knowledge in the field of technology of materials with special properties and nanomaterials [K_W09]</li> </ol> </li> <li>Student has a well-established knowledge in the field of technology solutions for advanced materials, biomaterials, and nanomaterials - [K_U12]</li> <li>The student has a well-established knowledge in the field of technology solutions for advanced materials, biomaterials, and nanomaterials - [K_U12]</li> <li>The student can explain the basic phenomena associated with technological processes of preparation of materials with special properties and also can explain phenomenon during their functioning - [K_U16]</li> <li>Social competencies:</li> </ol>		Study outco	mes and reference to the	educational results for	a field of study	
<ul> <li>biomaterials and nanomaterials [K_W09]</li> <li>2. Student has a well-established knowledge in the field of technology of advanced materials, biomaterials, and nanomaterials [K_W13]</li> <li>3. The student has knowledge in the field the latest technology of materials with special properties and nanomaterials [K_W09]</li> <li>Skills:</li> <li>1. Student has a well-established knowledge in the field of technology solutions for advanced materials, biomaterials, and nanomaterials - [K_U12]</li> <li>2. The student can explain the basic phenomena associated with technological processes of preparation of materials with special properties and also can explain phenomenon during their functioning - [K_U16]</li> <li>Social competencies:</li> </ul>	Know	ledge:				
hanomaterials [K_W13] 3. The student has knowledge in the field the latest technology of materials with special properties and nanomaterials K_W09] <b>Skills:</b> 1. Student has a well-established knowledge in the field of technology solutions for advanced materials, biomaterials, and hanomaterials - [K_U12] 2. The student can explain the basic phenomena associated with technological processes of preparation of materials with special properties and also can explain phenomenon during their functioning - [K_U16] <b>Social competencies:</b>			0	ucture and applications of mate	rials with special properties,	
<ul> <li>K_W09]</li> <li>Skills:</li> <li>1. Student has a well-established knowledge in the field of technology solutions for advanced materials, biomaterials, and nanomaterials - [K_U12]</li> <li>2. The student can explain the basic phenomena associated with technological processes of preparation of materials with special properties and also can explain phenomenon during their functioning - [K_U16]</li> <li>Social competencies:</li> </ul>			shed knowledge in the field of tecl	nnology of advanced materials,	biomaterials, and	
<ol> <li>Student has a well-established knowledge in the field of technology solutions for advanced materials, biomaterials, and nanomaterials - [K_U12]</li> <li>The student can explain the basic phenomena associated with technological processes of preparation of materials with special properties and also can explain phenomenon during their functioning - [K_U16]</li> <li>Social competencies:</li> </ol>			e in the field the latest technology	of materials with special prope	erties and nanomaterials	
nanomaterials - [K_U12] 2. The student can explain the basic phenomena associated with technological processes of preparation of materials with special properties and also can explain phenomenon during their functioning - [K_U16] Social competencies:	Skills	:				
special properties and also can explain phenomenon during their functioning - [K_U16] Social competencies:			shed knowledge in the field of tecl	nnology solutions for advanced	materials, biomaterials, and	
Social competencies:					preparation of materials with	
1. Student is conscious of limitation of his knowledge and understands the need of further continuous education [K_K01]						
	1. <u>St</u> ud	ent is conscious of lim	nitation of his knowledge and unde	erstands the need of further cor	ntinuous education [K_K01]	

## Assessment methods of study outcomes

Rating of completion test

## Course description

Definition and types of purity materials. The importance of purity in the production of materials with special properties. Shaping the purity at the stage of material formation. Structural defects and their relevance to the physico-chemical properties of materials. Diffusion doping. Definitions and types of materials with special properties. Special-purpose materials that are used in electronics, aerospace, printing, aerospace, medicine, classical and digital photography. Technology of materials used in photolithography. Resist polymer using photocrosslinking reactions, photodegradation and transformation of functional groups. Negative and positive photoresists. The application of polymer resists. Technology of integrated circuits and printed circuit boards. Self-organizing materials and their application in the preparation of thin films and liquid crystal displays. Technology of materials used in optoelectronics. Engineering intelligent materials. Intelligent gels. Technology of piezoelectric and pyroelectric materials. Types of piezoelectric materials. Application of piezoelectric and pyroelectric materials. The technology of liquid crystal materials. The liquid crystal compounds in the electric field. Liquid crystal thermography. Application of liquid crystal materials. Biomedical materials. Types of biomedical materials. General information on biomedical materials.

Characteristics of materials used in medicine, dentistry and pharmacy. Types of biomaterials: metallic, ceramic, polymeric, carbon, composite. Criteria for the selection of materials in medicine. Biocompatibility of materials and the main criteria for the production of biomaterials. Technology of dental prostheses, tendons, joints, bones, blood vessels. Materials and methods for the preparation of endoprostheses. Preparation of contact lenses, artificial hearts, heart starters. Angioplasty. Materials for the manufacture of catheters and stents. Bioresorbable implants. Types of implants. Procedures existing during medicines technology, with particular emphasis on methods of improving the quality and effectiveness of medicines and their purity. Drug carriers. Preparation and application of polymer microcapsules and microspheres.

Nanomaterials: types. Properties and application. Methodological basis of nanotechnology - the method of preparation, classification and characterization of nanostructures. Nanometals. Nanoceramics. Nanolayers. Nanofibers. Nanotubes. Nanocomposites. Powder nanomaterials. Methods for the preparation of nanomaterials. Preparation and types of nanostructures. Characterization of nanostructures.

## Basic bibliography:

1. Z. Floriańczyk, S. Penczek, Chemia Polimerów, t.III, Polimery naturalne i polimery o specjal-nych właściwościach, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2001

2. K. Kurzydłowski, M. Lewandowska, Nanomateriały inżynierskie konstrukcyjne i funkcjonalne, PWN, Warszawa 2010

3. A Graja, Niskowymiarowe przewodniki organiczne, WNT, Warszawa 1989.

4. W. Królikowski, Polimerowe materiały specjalne., Wyd. Politechniki Szczecińskiej, 1909.

## Additional bibliography:

1. A.L. Dobrzański, Materiały inżynierskie i projektowanie materiałowe., WNT, Warszawa 2006

2. F. Wojtkun, J.P. Sołncew, Materiały specjalnego przeznaczenia, Wyd. Polit. Radomskiej, 2001.

Result of average stud	dent's workload	
Activity		Time (working hours)
1. The presence at lectures	20	
2. Preparation for completion test	10	
3. Participation in consultations related to the implementation of the	5	
Student's wo	rkload	
Source of workload	hours	ECTS
Total workload	35	2
Contact hours	25	2
Practical activities	0	0