					-	- 55 -	- 3	- 5	
Field of s	tudy	Mate	rials Scienc	e and Engineeri	ng				
Mode of s	study	stati	onary	Level		first o	cycle	VA/T:L	Ch
Graduate	's qualification	inżyr	nier					WTil	Ch
Fields of	science	engii	neering and	technology					_
Discipline	es of science	materials engineering (100%)							<u> </u>
Educatio	nal profile	gene	eral academ	ic					
Module									
Course u	nit	Phys	sical Educa	ition 1					Ci
Code		MSE_	_1A_S_A01a						
Field of s	pecialisation								
Administ	ering faculty	Stud	ium Wychov	wania Fizyczneg	o i Spo	rtu			
ECTS		0,0		ECTS (forms)		0,0			
Form of c	course credit	credi	its	Language		english	l		
Electives				Elective group					
Form of i	nstruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
lecturing	course	Α	1	30	0	,0	1,00	к	credits
Leading t	teacher	Trub	iłko loanna	(Joanna.Walczak	@zut.e	edu.pl)			
Other tea				ara (Tamara.Olsz	-	-	du.pl)		
Prerequis	sites			<u> </u>			1.7		
W-1	no health contrainc	licatio	ns to exercise	2					
W-2	students completel	y exer	npt from phy	sical exercise					
Module/c	ourse unit objective	25							
C-1	C1 - teaching techr C2 - to care for one circulatory, nervou C3 - increasing the C4 - develop the ha organization of spo C5 - to oppose soci physical activity.	s owr s and o value abit of rting a al path	n health throu other system: of motor skill using motor and tourist ev nologies /alco	igh exercise as a p s. ls: strength, speec exercises for recre ents and the rules holism, drug addio	oreventi l, endur ational of basi ction, ni	ve meas ance, ag purpose c sports cotinism	yility, power. s.Transfer of kn disciplines. n/ by proposing	owledge about p participation in w	hysical culture, the idely understood
C-2	respiratory, blood, To acquaint studen transfer of knowled	nervou ts with	us and other. In the history of	Mobilization for pr of physical culture	ro-healt and sp	h attitud ort, the i	les. regulations of se		the systems; motor, ciplines and the
Course co	ontent divided into	vario	us forms of	instruction					Number of hours
T-A-1	- the influenc pressure, breathing - body weight - history of th	dents v s of ph ivity a sical a e of ph g, post c contr e olym	vith semester nysical activit nd addictions activity amon nysical exerci ure defects, i ol npic games	r and full year med y g health determin se on the physiolo	dical ex ants	emption	S;		30
Student v	workload - forms of								Number of hours
A-A-1	Group exercises, sp		-	cipation in tourist	events	and spor	ts camps.		30
Teaching	methods / tools								1
M-1	teaching method for practical method: p delivery method: le activating method;	oresen ecture,	tation; description,	talk, explanation;					

Evaluatio	n meth	ods (F -	progressive, P - final)							
S-1	F	the fiel	t's assesment based on his/he d of selected sports discipline	es/ written test; t	lvement and a est	activity in clas	ses, as	well as moven	nent skil	ls in
5-2	F	colloqu	ium, test on knowledge of ph	ysical culture			1	•		1
	Desig	ned lea	rning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes f or qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course content	Teaching methods	Evaluation methods
Knowledg	е									
Skills										
	kills in se		ms of physical activity - can ments of selected sports	MSE_1A_U10 MSE_1A_U13	P6S_UO P6S_UU		C-1	T-A-1	M-1 M-2	S-1 S-2
Social cor	-	ices								
Knows the re Can select pl gender and p	ty to eng elationshi hysical a promote	ip betweer ctivity acc	pro-healthy lifestyle. n physical activity and health. ording to health condition, age,	MSE_1A_K01	P65_KK	P6S_WK	C-1	T-A-1	M-1 M-2	S-1 S-2
skills in vario activities. He according to everyday life	n apply t ous sport or she c the "fair e.	s discipline an work a	ed motor, technical and tactical es and in tourist and recreational ind cooperate in a group both on the sports field and in	MSE_1A_K03	P65_KO	P6S_WK	C-1	T-A-1	M-1 M-2	S-1 S-2
of sport, regu organize spo active partici environment	s knowle ulations o rt-recrea ipant of s He or s of sport.	of sport dis ational and sports life he promot	e field of physical culture, history sciplines, can organize and co- l tourist events. He or she is an at the university and in his or her tes the social and cultural takes care of their own tastes in	MSE_1A_K03	P6S_KO	P6S_WK	C-1	T-A-1	M-1 M-2	S-1 S-2
Outco	mes	Grade		E	Evaluation cr	iterion				
Knowledg	е	-	1							
Skills										
MSE_1A_A04	-1_U01	2,0 3,0 3,5 4,0 4,5 5,0	The student has basic technical s	skills of various spo	orts disciplines; t	the exercoses a	re carrie	d out with techn	ical errors	;
Other soc	ial com		es							
MSE 1A A04		2,0								
		3,0 3,5 4,0 4,5 5,0	- knows basically the basis conce - he/she can not put his/her skills		arding health pr	romotion;				
MSE_1A_A04	-1_K02	2,0 3,0 3,5 4,0 4,5	- understands the principle of "fa	ir play" at the basi	c level;					
MSE_1A_A04	-1_K03	5,0 2,0 3,0 3,5 4,0 4,5 5,0	- manifests interest in various fo	rms of physical act	ivity at the basic	c level				

Faculty of Chemical Technology and Engineering

Supplementary reading

S.Owczarek, Atlas ćwiczeń korekcyjnych, WSiP, Warszawa, 2005
 R.Trześniowski, Gry i zabawy ruchowe, WSiP, Warszawa, 2005

3. J.Sobotta, Atlas anatomii człowieka, Urban i Partner, Wrocław, 1994

4. G.Gracz, Emocje przedstartowe oraz ich związek z aspiracjami sportowców, AWF Poznań, Poznań, 1980

5. Z.Stawczyk, Gry i zabawy lekkoatletyczne, AWF Poznań, Poznań, 1998

6. J.Mazurek, Gimnastyka podstawowa, WSiT, Warszawa, 1980

7. przekład J.Grabowski, J.Szopa, Eurofit, europejski test sprawności fizycznej, AWF Kraków, Kraków, 1989

8. K.Zuchora, Podstawowy test sprawności fizycznej, 2010

9. I.Talaga, A - Z sprawności fizycznej, Warszawa, 1995

10. J.Talaga, Sprawność fizyczna ogólna - testy, Zysk i S-ka, Poznań, 2004

11. J.Bahrynowicz-Fic, Właściwości ćwiczeń fizycznych, ich systematyka i metodyka, PZWL, Warszawa, 1987

12. R.Karpiński, Nauczanie pływania, AWF Katowice, Katowice, 1995

			-						
Field of	study	Mater	ials Scienc	e and Engineerin	g				
Mode of	study	statio	nary	Level		first o	cycle	VA/T:L	Ch
Graduat	e's qualification	inżyn	ier					WTil	Ch
Fields of	fscience	engin	eering and	technology		_			
Disciplin	nes of science	mate	rials engine	eering (100%)		<u> </u>			
Educatio	onal profile	gener	al academ	ic					
Module									C
Course ι	unit	-	ical Educa						
Code		MSE_	1A_A_A01b						
	specialisation								
	tering faculty		um Wychov	wania Fizycznego	i Spo				
ECTS		0,0		ECTS (forms)		0,0		-	
	course credit	credit	S	Language		english		-	
Elective:	S			Elective group			I		
Form of	instruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
lecturing	g course	A	2	30	0	,0	1,00	К	credits
Leading	teacher	Trubił	ko Joanna	(Joanna.Walczak	@zut.	edu.pl)			
Other te	eachers	Olsze	wska Tama	ara (Tamara.Olsze	ewska	@zut.e	du.pl)		
Prerequi	isites								
W-1	no health contraind								
W-2	Students complete	-	npt from phy	sical exercise					
C-1 C-2	C4 - develop the ha organization of spo C5 - to oppose soci physical activity. To make students a respiratory, circula to acquaint studen	s and o value o abit of u orting an al path aware o tory, ne ts with	ther system of motor skil using motor nd tourist ev ologies /alco of their own l ervous and o the history of	s. Is: strength, speed, exercises for recrea ents and the rules bolism, drug addic health through exe ther systems. of physical culture a	, endur ational of bas tion, n rcise a and sp	ance, ag purpose c sports cotinism s a preve ort, regu	yility, power. Is.Transfer of kn disciplines. If by proposing p entive measure	owledge about p participation in w against diseases	hysical culture, the idely understood of the motor,
	knowledge about o	-			urist e	vents.			
Course o	content divided into 1 - course content				accor	lanco wi	th the curricula .	The student	Number of hours
T-A-1	2 - lectures for stud -health effect - physical act - place of phy - the influenc pressure, breathing - body weigh - history of th	dents w s of phy ivity an vsical ac e of phy g, postu c contro e olym	e sports. ith semeste ysical activit d addictions ctivity amon ysical exerci ire defects, i l pic games	r and full year med y g health determina se on the physiolog	ical ex nts	emption	5;		30
Student	workload - forms of	activit	ty						Number of hours
A-A-1	 1.group exercises, 2. participation in c 							;	30
Teachin	g methods / tools								
M-1	teaching method for practical method: p delivery method: le activating method; reconstructive met peripheral-station p training method;	oresent ecture, didacti hod; ta nethod	ation; description, c discussion sk-oriented; ;	talk, explanation; , task-oriented, dire			·	ement;	
M-2	conversational lect	ure; mı	ultimedia pre	esentation					

Evaluation r	netho	ds (F -	progressive, P - final)							
S-1			's assesment based on his/he d of selected sports discipline			ctivity in clas	ses, as	well as movem	ent skill	s in
5-2	F	colloqui	um, test on knowledge of phy	ysical culture						
C	Design	ed lear	ning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course content	Teaching methods	Evaluation methods
Knowledge				I						
Skills										
	skills in		l forms of physical activity - can nents of selected sports	MSE_1A_U10	P6S_UO		C-1 C-2	T-A-1	M-1 M-2	S-1 S-2
Social comp		es								
Knows the relat Can select phys gender and pro	to engag tionship sical action mote it	between	ro-healthy lifestyle. physical activity and health. ording to health condition, age,	MSE_1A_K01	P6S_KK	P65_WK	C-1 C-2	T-A-1	M-1 M-2	S-1 S-2
	n apply t various		ired movement, technical and isciplines and in tourist and	MSE_1A_K01	P6S_KK	P6S_WK	C-1 C-2	T-A-1	M-1 M-2	S-1 S-2
regulations of s co-organize spo active participa environment.He	e in the sports disports, recu orts, recu ont of sports e/she prosports.H	sciplines, reational orts life a omotes t	hysical culture, history of sports, , he/she is able to organize and and tourist events.He/she is an at the university and in his/her the social and cultural ltivates his/her own tastes in	MSE_1A_K03	P6S_KO	P65_WK	C-1 C-2	T-A-1	M-1 M-2	S-1 S-2
Outcome	es	Grade		E	valuation cri	iterion				
Knowledge										
Skills										
MSE_1A_A04-2_	U01	2,0								
		- / -	The student has basic technical s	kills of various spo	rts disciplines. T	The exercises ar	e carried	l out with technic	al errors	
	-	3,5								
	-	4,0 4,5								
	-	4,5 5,0								
Other social	l comp		<u>م</u>							
MSE 1A A04-2		2,0								
	-	3,0	 knows basically the basis conce he/she can not put his/her skills 		arding health pr	omotion;				
	-	3,5								
		4,0								
	-	4,5								
MEE 14 404 2	K02	5,0								
MSE_1A_A04-2_		2,0	- understands the principle of "fa	ir play" at the basi						
	-	3,0 3,5	- understands the principle of Ta	ir play at the basi	c level;					
	-	4,0								
	-	4,5								
	-	5,0								
MSE_1A_A04-2_	K03	2,0								
		3,0	- manifests interest in various for	ms of physical act	ivity at the basic	c level				
	ŀ	3,5								
	ŀ	4,0								
	F	4,5								
		5,0								

Supplementary reading	
1. S.Owczarek, Atlas ćwiczeń korekcyjnych, WSiP, Warszawa,	2005

Faculty of Chemical Technology and Engineering

Supplementary reading

2. R.Trześniowski, Gry i zabawy ruchowe, WSiP, Warszawa, 2005

3. J.Sobotta, Atlas anatomii człowieka, Urban i Partner, Wrocław, 1994

4. G.Gracz, Emocje przedstartowe oraz ich związek z aspiracjami sportowców, AWF Poznań, Poznań, 1980

5. Z.Stawczyk, Gry i zabawy lekkoatletyczne, AWF Poznań, Poznań, 1998

6. J.Mazurek, Gimnastyka podstawowa, WSiT, Warszawa, 1980

7. przekład J.Grabowski, J.Szopa, Eurofit, europejski test sprawności fizycznej, AWF Kraków, Kraków, 1989

8. K.Zuchora, Podstawowy test sprawności fizycznej, 2010

9. l.Talaga, A - Z sprawności fizycznej, Warszawa, 1995

10. J.Talaga, Sprawność fizyczna ogólna - testy, Zysk i S-ka, Poznań, 2004

11. J.Bahrynowicz-Fic, Właściwości ćwiczeń fizycznych, ich systematyka i metodyka, PZWL, Warszawa, 1987

12. R.Karpiński, Nauczanie pływania, AWF Katowice, Katowice, 1995

		1						7	
Field of st	tudy	Mate	erials Scienc	e and Engineeri	ng				
Mode of s	study	stati	onary	Level		first c	cycle	VA/T:L	
Graduate	's qualification	inży	nier	· ·				WTil(LN
Fields of s	science	engi	neering and	l technology					
Discipline	s of science	mate	erials engine	eering (100%)				1 I _	<u> </u>
Education	nal profile	gene	eral academ	ic					
Module									
Course ur	nit	Euro	opean Hist	ory					C
Code		MSE	_1A_S_A02a	l					
Field of sp	pecialisation								
Administe	ering faculty		artment of C erials	Drganic Chemica	l Tech	nology a	and Polymer		
ECTS		4,0		ECTS (forms)		4,0			
Form of c	ourse credit	cred	its	Language		english			
Electives		1		Elective group					
Form of ir	nstruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
lecture		W	1	45	4	,0	1,00	К	credits
Leading to	eacher	Czec	h Zbigniew	(psa_czech@wp	.pl)			L	I
<i>-</i> <i>Other tea</i>	chers			(psa_czech@wp		bolews	ki Piotr (psobo	lewski@zut.edu	ı.pl)
Prerequis	ites								
						volic roc			
W-1	Basic knowledge o	f Euro	pean history a	at high school grad	duate le	ver is rec	quirea.		
	-		pean history a	at high school grad	duate le		quirea.		
	ourse unit objectiv	es ation of	f the Europea	n History from ca.	800 to		·	he perspective of	political, religious,
Module/co C-1	Durse unit objectiv A concise presenta social, economic, c	es ation of cultura	f the Europea I, diplomatic,	n History from ca. and intellectual h	800 to story.	the pres	ent days, from t	he perspective of	political, religious,
Module/co	Durse unit objectiv A concise presenta social, economic, c Consolidation of kr	es ation of cultura nowled	f the Europea l, diplomatic, ge related to	n History from ca. and intellectual h the basic facts an	800 to story. d interp	the prese	ent days, from t	he perspective of	political, religious,
Module/co C-1 C-2	Durse unit objectiv A concise presenta social, economic, c	es ation of cultura nowled t's abi	f the Europea I, diplomatic, ge related to lity to historic	n History from ca. and intellectual h the basic facts an cal argumentation	800 to story. d interp in writi	the prese pretation. ng and d	ent days, from t iscusing.		^F political, religious,
Module/co C-1 C-2 C-3 C-4	A concise presenta social, economic, c Consolidation of kr Developing studen	es ation of cultura nowled t's abi 's awa	f the Europea I, diplomatic, ge related to lity to historic reness of the	n History from ca. and intellectual h the basic facts an cal argumentation need for continuo	800 to story. d interp in writi	the prese pretation. ng and d	ent days, from t iscusing.		
Module/co C-1 C-2 C-3 C-4	A concise presenta social, economic, c Consolidation of kr Developing student Improving student	es ation of cultura nowled t's abi 's awa <i>vario</i>	f the Europea I, diplomatic, ge related to lity to historic reness of the us forms of	n History from ca. and intellectual h the basic facts an cal argumentation need for continuo instruction	800 to story. d interp in writi us educ	the prese pretation. ng and di cation an	ent days, from t iscusing. d professional d	evelopment.	F political, religious,
Module/co C-1 C-2 C-3 C-4 Course co	A concise presenta social, economic, c Consolidation of kr Developing studen Improving student ontent divided into Medieval Review: I Renaissance: The	es ation of cultura nowled t's abi 's awa vario Manor, Five Ma	f the Europea I, diplomatic, Ige related to lity to historic reness of the <i>us forms of</i> Feudalism, a ain Ideals: Inc	n History from ca. and intellectual h the basic facts an cal argumentation need for continuo <i>instruction</i> and Church, 100 Ye dividualism, Secula	800 to story. d interp in writi us educ ears' Wa arism, H	the pres- pretation. ng and di cation an- car, The B lumanisn	ent days, from t iscusing. d professional d lack Death, The n, Virtu, and His	evelopment. Great Schism; torical	Number of hours
Module/co C-1 C-2 C-3 C-4 Course co T-W-1 T-W-2	A concise presenta social, economic, c Consolidation of kr Developing studen Improving student ontent divided into Medieval Review: I Renaissance: The Consciousness, Art The Reformation: C	es ation of cultura nowled t's abi 's awa vario Manor, Five Ma s and Questio	f the Europea I, diplomatic, Ige related to lity to historic reness of the <i>us forms of</i> Feudalism, a ain Ideals: Inc Sciences, Ita pning the Chu	n History from ca. and intellectual h the basic facts an cal argumentation need for continuo <i>instruction</i> and Church, 100 Ye dividualism, Secula ly's Political Declin urch (Luther, Zwing	800 to story. d interp in writi us educ ears' Wa arism, H ne & Re	the pres- pretation. ng and di cation an- car, The B lumanisn vival of N	ent days, from t iscusing. d professional d lack Death, The n, Virtu, and His 4onarchy in Nor	evelopment. Great Schism; torical thern Europe;	Number of hours 2 2 2
Module/co C-1 C-2 C-3 C-4 Course co T-W-1 T-W-2 T-W-3	A concise presenta social, economic, c Consolidation of kr Developing studen Improving student ontent divided into Medieval Review: I Renaissance: The Consciousness, Art The Reformation; Catho	es ation of cultura nowled t's abi 's awa <i>vario</i> Manor, Five Ma s and Questio olic Co	f the Europea I, diplomatic, Ige related to lity to historic reness of the <i>us forms of</i> Feudalism, a ain Ideals: Inc Sciences , Ita pning the Chu unter-Reform	n History from ca. and intellectual h the basic facts an cal argumentation need for continuo <i>instruction</i> and Church, 100 Ye dividualism, Secula ly's Political Declin urch (Luther, Zwing ation;	800 to story. d interp us educ ears' Wa arism, H ne & Re gli, Calv	the pres- pretation. ng and di cation an- car, The B lumanism vival of N in, and th	ent days, from t iscusing. d professional d lack Death, The n, Virtu, and His Monarchy in Nor he Anabaptists),	evelopment. Great Schism; torical thern Europe; The English	Number of hours 2 2 2
Module/co C-1 C-2 C-3 C-4 Course co T-W-1 T-W-2	Durse unit objectiv A concise presenta social, economic, c Consolidation of kr Developing studen Improving student ontent divided into Medieval Review: I Renaissance: The I Consciousness, Art The Reformation; Cather The Age of Religion Netherlands; Elizal	es ation of cultura nowled t's abi 's awa vario Manor, Five Ma s and Questio olic Co us War pethan	f the Europea I, diplomatic, Ige related to lity to historic reness of the <i>us forms of</i> Feudalism, a ain Ideals: Inc Sciences, Ita pning the Chu unter-Reform s: The French England, The	n History from ca. and intellectual h the basic facts an cal argumentation need for continuo <i>instruction</i> and Church, 100 Ye dividualism, Secula ly's Political Declin urch (Luther, Zwing ation; n Wars of Religion; a 30 Years' War;	800 to story. d interp in writi us educ ears' Wa arism, H ne & Re gli, Calv Spain a	the press pretation. ng and di cation and cation and cation and ar, The B lumanism vival of N in, and th in, and th	ent days, from t iscusing. d professional d lack Death, The n, Virtu, and His Monarchy in Nor he Anabaptists), o II; The Revolt c	evelopment. Great Schism; torical thern Europe; The English of the	Number of hours 2 2 2
Module/co C-1 C-2 C-3 C-4 Course co T-W-1 T-W-2 T-W-3	Durse unit objectiv A concise presenta social, economic, c Consolidation of kr Developing studen Improving student ontent divided into Medieval Review: I Renaissance: The I Consciousness, Art The Reformation; Cathor The Age of Religion	es ation of cultura nowled t's abi 's awa vario Manor, Five Ma s and Questio olic Co us War oethan nstitut	f the Europea I, diplomatic, Ige related to lity to historic reness of the <i>us forms of</i> Feudalism, a ain Ideals: Inc Sciences, Ita pning the Chu unter-Reform s: The French England, The ionalism: Stu	n History from ca. and intellectual h the basic facts an cal argumentation need for continuo <i>instruction</i> and Church, 100 Ye dividualism, Secula ly's Political Declin trch (Luther, Zwing ation; n Wars of Religion; a 30 Years' War; art England and th	800 to story. d interp in writi us educ ears' Wa arism, H ne & Re gli, Calv Spain a ne Engli	the press pretation. ng and di cation and cation and cation and ar, The B lumanism vival of N in, and th in, and th and Philip sh Civil V	ent days, from t iscusing. d professional d lack Death, The n, Virtu, and His Monarchy in Nor he Anabaptists), o II; The Revolt o Var, The Restora	evelopment. Great Schism; torical thern Europe; The English of the ation and the	Number of hours 2 2 2
Module/co C-1 C-2 C-3 C-4 Course co T-W-1 T-W-2 T-W-3 T-W-4	Durse unit objectiv A concise presenta social, economic, c Consolidation of kr Developing studen Improving student Improving student Intent divided into Medieval Review: I Renaissance: The Consciousness, Art The Reformation; Cather The Age of Religion Netherlands; Elizal Absolutism and Co Glorious Revolution Early Modern Thou Philosophers;	es ation of cultura nowled t's abi 's awa vario Manor, Five Manor, Five Manor, Five Manor, Si and Questio Dic Co us War oethan nstitut n, Loui ght an	f the Europea I, diplomatic, Ige related to lity to historic reness of the <i>us forms of</i> Feudalism, a ain Ideals: Inc Sciences, Ita pning the Chu unter-Reform s: The French England, The ionalism: Stu s XIV of Franch d Culture: Th	n History from ca. and intellectual h the basic facts an cal argumentation need for continuo <i>instruction</i> and Church, 100 Ye dividualism, Secula ly's Political Declin urch (Luther, Zwing ation; n Wars of Religion; a 30 Years' War; art England and th ce, Hohenzollerns e Medieval World	800 to story. d interp in writi us educ ears' Wa arism, H ne & Re gli, Calv Spain a ne Engli and Haj View, T	the press pretation. ng and di cation and cation and ar, The B lumanism vival of N in, and th in, and th and Philip sh Civil V osburgs, he Scient	ent days, from t iscusing. d professional d lack Death, The n, Virtu, and His Jonarchy in Nor he Anabaptists), o II; The Revolt o Var, The Restora Russia and Pete tific Revolution,	evelopment. Great Schism; torical thern Europe; The English of the ation and the er the Great; Writers and	Number of hours 2 2 2 2 2
Module/co C-1 C-2 C-3 C-4 Course co T-W-1 T-W-2 T-W-3 T-W-4 T-W-5	Durse unit objectiv A concise presenta social, economic, c Consolidation of kr Developing studen Improving student ontent divided into Medieval Review: I Renaissance: The I Consciousness, Art The Reformation; C Reformation; Cather Age of Religion Netherlands; Elizal Absolutism and Co Glorious Revolution	es ation of cultura nowled t's abi 's awa vario Manor, Five M. s and Questic olic Co us War oethan nstitut n, Loui ght an Econor ery, Pla	f the Europea I, diplomatic, ge related to lity to historic reness of the <i>us forms of</i> Feudalism, a ain Ideals: Inc Sciences, Ita oning the Chu unter-Reform s: The French England, The ionalism: Stu s XIV of Franch d Culture: Th my, Trade Wa antation Syste	n History from ca. and intellectual h the basic facts an cal argumentation need for continuo <i>instruction</i> and Church, 100 Ye dividualism, Secula ly's Political Declin urch (Luther, Zwing ation; n Wars of Religion; a Wars of Religion; a Wars of Religion; e 30 Years' War; art England and th ce, Hohenzollerns e Medieval World rs, and Colonial Re	800 to story. d interp in writi us educ ears' Wa arism, H ne & Re gli, Calv Spain a ne Engli and Haj View, T ebellion	the press pretation. ng and di cation and cation and ar, The B lumanisn vival of N in, and th in, and th and Philip sh Civil V osburgs, he Scient : Mercan	ent days, from t iscusing. d professional d lack Death, The n, Virtu, and His Jonarchy in Nor he Anabaptists), o II; The Revolt o Var, The Restora Russia and Pete tific Revolution, tilism and Early	evelopment. Great Schism; torical thern Europe; The English of the ation and the er the Great; Writers and Colonialism,	Number of hours 2 2 2 2 2 2 2 2 2
Module/co C-1 C-2 C-3 C-4 Course co T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-6	Durse unit objectiv A concise presenta social, economic, c Consolidation of kr Developing studen Improving student Improving student Outent divided into Medieval Review: I Renaissance: The I Consciousness, Art The Reformation; Cath The Age of Religion Netherlands; Elizal Absolutism and Co Glorious Revolution Early Modern Thou Philosophers; The Transatlantic F Black African Slave the American Revolu The French Revolu	es ation of cultura nowled t's abi 's awa vario Manor, Five Ma Suestid olic Co Jus War oethan nstitut n, Loui ght an econor ery, Pla olution tion: Tean Re	f the Europea I, diplomatic, ge related to lity to historic reness of the <i>us forms of</i> Feudalism, a ain Ideals: Inc Sciences, Ita oning the Chu unter-Reform rs: The French England, The ionalism: Stu s XIV of Franch d Culture: Th my, Trade Wa antation Syste he Ancien Re action and Re	n History from ca. and intellectual hi the basic facts an cal argumentation need for continuo <i>instruction</i> and Church, 100 Ye Jividualism, Secula ly's Political Declin urch (Luther, Zwing ation; n Wars of Religion; ant England and th ce, Hohenzollerns e Medieval World rs, and Colonial Re em, and the Atlant gime/Financial Cri esults;	800 to story. d interp in writi us educ ears' Wa arism, H ne & Re gli, Calv Spain a ne Engli and Ha View, T ebellion ic Econ sis, Ear	the press pretation. ng and d cation and cation and ar, The B lumanism vival of N in, and the in, and the and Philip sh Civil V psburgs, he Scient : Mercan pomy, Mid	ent days, from t iscusing. d professional d lack Death, The n, Virtu, and His Monarchy in Nor he Anabaptists), o II; The Revolt of Var, The Restora Russia and Pete tific Revolution, tilism and Early l-Eighteenth Cer	evelopment. Great Schism; torical thern Europe; . The English of the ation and the er the Great; Writers and Colonialism, ntury Wars and on, The Reign of	Number of hours 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
Module/co C-1 C-2 C-3 C-4 Course co T-W-1 T-W-2 T-W-3 T-W-3 T-W-5 T-W-5 T-W-6 T-W-7	Durse unit objectiv A concise presenta social, economic, c Consolidation of kr Developing studen Improving student Improving student Medieval Review: I Renaissance: The I Consciousness, Art The Reformation; C Reformation; Cather The Age of Religion Netherlands; Elizal Absolutism and Co Glorious Revolution Early Modern Thou Philosophers; The Transatlantic F Black African Slave the American Revolu Terror, Thermidore The Napoleonic Erro Napoleon's Empire	es ation of cultura howled t's abi 's awa vario Manor, Five Ma contro Manor, Five Ma contro Manor, Five Ma contro Contro San Manor, Five Ma contro Contro San Manor, Five Ma contro Contro San Manor, Five Ma contro Contro San Manor, San Manor, Five Ma contro Contro San Manor, San Manor, Five Ma contro Contro San Manor, San Manor, Five Ma contro Contro San Manor, San Manor,	f the Europea I, diplomatic, ge related to lity to historic reness of the <i>us forms of</i> Feudalism, a ain Ideals: Inc Sciences , Ita Sciences , Ita Sciences , Ita coning the Chu unter-Reform s: The French a England, The ionalism: Stu s XIV of Franc ad Culture: Th my, Trade Wa antation Syste ; he Ancien Re action and Re Rise of Napol pleon's Defeat	n History from ca. and intellectual hi the basic facts an cal argumentation need for continuo instruction and Church, 100 Ye dividualism, Secula ly's Political Declin urch (Luther, Zwing attion; n Wars of Religion; att England and th ce, Hohenzollerns e Medieval World rs, and Colonial Re em, and the Atlant gime/Financial Cri esults; eon and the Consest t and the Consest	800 to story. d interp in writi us educ ears' Wa arism, H ne & Re gli, Calv Spain a ne Engli and Ha View, T ebellion ic Econ sis, Ear	the press pretation. ng and d cation and ar, The B lumanism vival of N in, and tl and Philip sh Civil V osburgs, he Scient comy, Mid ly Stages France, nna;	ent days, from t iscusing. d professional d lack Death, The n, Virtu, and His Monarchy in Nor he Anabaptists), o II; The Revolt o Var, The Restora Russia and Pete tific Revolution, tilism and Early l-Eighteenth Cer s of the Revolutio Haitian Revoluti	evelopment. Great Schism; torical thern Europe; The English of the ation and the er the Great; Writers and Colonialism, ntury Wars and on, The Reign of on and	Number of hours 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
Module/co C-1 C-2 C-3 C-4 Course co T-W-1 T-W-2 T-W-3 T-W-3 T-W-5 T-W-5 T-W-6 T-W-7 T-W-8	Durse unit objectiv A concise presenta social, economic, c Consolidation of kr Developing student Improving student Improving student Ontent divided into Medieval Review: I Renaissance: The I Consciousness, Art The Reformation; C Reformation, Cather The Age of Religion Netherlands; Elizal Absolutism and Co Glorious Revolution Early Modern Thou Philosophers; The Transatlantic E Black African Slave the American Revolut The French Revolut The Napoleonic Era Napoleon's Empire The Age of Metterr Conservative Orde 1848;	es ation of cultura nowled t's abi 's awa vario Manor, Five Ma s and Questic olic Co us War oethan nstitut n, Loui ght an ery, Pla olution tion: T tion: R a: The t, Napo nich: R r and t	f the Europea I, diplomatic, ge related to lity to historic reness of the <i>us forms of</i> Feudalism, a ain Ideals: Inc Sciences , Ita oning the Chu unter-Reform s: The French England, The ionalism: Stu s XIV of France antation Syste he Ancien Re action and Re Rise of Napol pleon's Defeat omanticism, I the Emergence	n History from ca. and intellectual h the basic facts an cal argumentation need for continuo <i>instruction</i> and Church, 100 Ye dividualism, Secula ly's Political Declin urch (Luther, Zwing ation; n Wars of Religion; a 30 Years' War; art England and th ce, Hohenzollerns e Medieval World rs, and Colonial Re em, and the Atlant gime/Financial Cri esults; eon and the Congress Nationalism, and F ce of Nationalism, and F	800 to story. d interp in writi us educ ears' Wa arism, H ne & Re gli, Calv Spain a ne Engli and Ha View, T ebellion ic Econ sis, Ear ulate of s of Vieu Revolts	the press pretation. ng and di cation and ar, The B lumanism vival of N in, and tl and Philip sh Civil V osburgs, he Scient comy, Mid ly Stages France, nna; The Roma of the 18	ent days, from t iscusing. d professional d lack Death, The n, Virtu, and His Monarchy in Nor he Anabaptists), o II; The Revolt of Var, The Restora Russia and Pete tific Revolution, tilism and Early I-Eighteenth Cer s of the Revolution Haitian Revolution antic Movement B20s and 1830s	evelopment. Great Schism; torical thern Europe; The English of the ation and the er the Great; Writers and Colonialism, ntury Wars and on, The Reign of on and , The , Revolts of	Number of hours 2
Module/co C-1 C-2 C-3 C-4 Course co T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 T-W-7 T-W-8 T-W-9	Durse unit objectiv A concise presenta social, economic, c Consolidation of kr Developing studen Improving student Date of the second student Improving student Developing student Developing student Developing student Date of the second student Developing student Improving student Developing student Developing student Developing student Industrial Change a Revolution, Industri Marxism;	es ation of cultura nowled t's abi 's awa vario Manor, Five Ma s and Questic olic Co us War oethan nstitut n, Loui ght an ery, Pla olution tion: T ean Re- a: The s, Napo nich: R r and to rial Soc	f the Europea I, diplomatic, ge related to lity to historic reness of the <i>us forms of</i> Feudalism, a ain Ideals: Inc Sciences , Ita oning the Chu unter-Reform s: The French England, The cionalism: Stu s XIV of France d Culture: The my, Trade Wa antation Syste he Ancien Re action and Re Rise of Napol oleon's Defeat omanticism, I the Emergence cial Unrest: L ciety and the	n History from ca. and intellectual h the basic facts an cal argumentation need for continuo <i>instruction</i> and Church, 100 Ye dividualism, Secula ly's Political Declin rrch (Luther, Zwing ation; n Wars of Religion; a Wars of Religion; a Years' War; art England and th ce, Hohenzollerns e Medieval World rs, and Colonial Re em, and the Atlant gime/Financial Cri esults; eon and the Congress Nationalism, and F ce of Nationalism, ife in the 18th Cer Labor Force, Socia	800 to story. d interp in writi us educ ears' Wa arism, H ne & Re gli, Calv Spain a sof View, T ebellion ic Econ sis, Ear ulate of s of Vien Revolts Revolts ntury, T alism: U	the press pretation. ng and di cation and ar, The B lumanism vival of N in, and the in, and the in, and the in, and the in, and the in, and the in, and the sh Civil V osburgs, he Scient obsurgs, he Scient omy, Mid ly Stages France, nna; The Roma of the 18 he Agricu	ent days, from t iscusing. d professional d lack Death, The n, Virtu, and His Monarchy in Nor he Anabaptists), o II; The Revolt o Var, The Restora Russia and Pete tific Revolution, tilism and Early I-Eighteenth Cer s of the Revolutio Haitian Revoluti antic Movement B20s and 1830s ultural Revolutio pocialism, Anarch	evelopment. Great Schism; torical thern Europe; The English of the ation and the er the Great; Writers and Colonialism, ntury Wars and on, The Reign of on and , The , Revolts of n, The Industrial ism, and	Number of hours 2
Module/co C-1 C-2 C-3 C-4 Course co T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 T-W-6 T-W-7 T-W-8 T-W-9 T-W-10	Durse unit objectiv A concise presenta social, economic, c Consolidation of kr Developing studen Improving student Developing student Developing student Ontent divided into Medieval Review: I Renaissance: The I Consciousness, Art The Reformation; C Reformation, Cather The Age of Religion Netherlands; Elizal Absolutism and Co Glorious Revolution Early Modern Thou Philosophers; The Transatlantic E Black African Slave the American Revolution The French Revolu Terror, Thermidore The Age of Metterr Conservative Orde 1848; Industrial Change a Revolution, Industri	es ation of cultura nowled t's abi 's awa vario Manor, Five Ma s and Questic olic Co us War oethan nstitut n, Loui oght an conor ery, Pla olution tion: T ean Rea a: The c, Napo nich: R r and to rial Soc States , The F	f the Europea I, diplomatic, ge related to lity to historic reness of the <i>us forms of</i> Feudalism, a ain Ideals: Inc Sciences , Ita oning the Chu unter-Reform s: The French England, The ionalism: Stu s XIV of France d Culture: The s XIV of France d Culture: The s XIV of France antation Syste he Ancien Re action and Ref Rise of Napol oleon's Defeat omanticism, I the Emergence cial Unrest: L ciety and the : The Eastern Habsburg Em	n History from ca. and intellectual hi the basic facts an cal argumentation need for continuo <i>instruction</i> and Church, 100 Ye dividualism, Secula ly's Political Declin rrch (Luther, Zwing ation; n Wars of Religion; a 30 Years' War; art England and th ce, Hohenzollerns e Medieval World rs, and Colonial Re em, and the Atlant gime/Financial Cri esults; eon and the Congress Nationalism, and F ce of Nationalism, ife in the 18th Cer Labor Force, Socia	800 to story. d interp in writi us educ ears' Wa arism, H ne & Re gli, Calv Spain a sof View, T sbellion ic Econo sis, Ear ulate of s of Vieu Revolts Revolts ntury, T alism: U Crimea Great Br	the press pretation. ng and di cation and car, The B lumanism vival of N in, and th in, and th sh Civil V osburgs, he Scient comy, Mid ly Stages France, nna; The Roma of the 18 he Agricu topian Scient itain -To	ent days, from t iscusing. d professional d lack Death, The n, Virtu, and His Monarchy in Nor he Anabaptists), o II; The Revolt of Var, The Restora Russia and Peter tific Revolution, tillism and Early I-Eighteenth Cer s of the Revolutio Haitian Revolutio antic Movement 820s and 1830s, ultural Revolutio pocialism, Anarch calian Unificatior ward Democrac	evelopment. Great Schism; torical thern Europe; The English of the ation and the er the Great; Writers and Colonialism, ntury Wars and on, The Reign of on and , The , Revolts of n, The Industrial ism, and h, German y;	Number of hours 2

	Faculty of Chemi		ology an		eenn	iy			
Course co	ontent divided into various forms of instru						Nun	nber o	f hours
T-W-14	Society and Politics Leading to World War I: Urban Life, Women's Experiences in the Late Socialism, and Politics to WWI;	e Nineteenth Cei	ntury, Jewish E	Emancipation,	Labor,				2
T-W-15	Philosophy and Ideas Pre-WWI: Positivism ar Architecture, Nietzsche and Freud, The Worr	nen's Movement	;		_		2		2
T-W-16	Imperialism, Militarism, and Nationalism Lea Empires of France, Belgium, and others, Bisi Militarism and the New Industrialized War, R	marck and the B	alance of Pow					2	
T-W-17	The Russian Revolution: Lenin and the Bolsh		•						2
T-W-18	The Interwar Years: The Treaty of Versailles, Europe, Russia and the Rise of Stalin, The Ri					stern			2
T-W-19	World War II: Causes, At War, Racism and th								2
T-W-20	The Cold War: Causes and the Emergence o 70s, Decolonization, The Collapse of Europe Russia, Rise of Radical Political Islamism;	an Communism,	The Breakup	of Yugoslavia	, Resurg	jence of			2
T-W-21	Social, Cultural, and Economic Challenges in Movement of Peoples, The Welfare State an Art, Religion, Technology, The European Uni	d Work Patterns, on and Financial	Transformati Crisis;	ons in Knowle	dge and	d Culture,			2
T-W-22	The Poland History: Baptism: The Beginning The Deluge1, Reforms & Constitution of 179 Independence: The Second Polish Republic, Solidarity, The Third Polish Republic.	1, Poland vanish	les from maps	for 123 years	s, Regai	ning			3
Student v	vorkload - forms of activity						Nun	nber o	f hours
A-W-1	Participation in lectures								45
A-W-2	Self-study of the literature								60
A-W-3	Consultations								15
Teaching	methods / tools								
M-1	Lecture								
Evaluatio	n methods (F - progressive, P - final)								
S-1	P Written test								
	Designed learning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course cor	ntent	Teaching methods	Evaluation methods
Knowledg	e								
European His literacy and further histo	a W01 niliarize themselves with the main resources of the story knowledge in order to acquire this basic develop a set of foundational skills to be applied to ry study. The main skills to be focused on this clude those listed in the following learning	MSE_1A_W10	P65_WK	P65_WG	C-1 C-2 C-3 C-4			M-1	S-1
Skills									
of historical sources of a knowledge t well-founded	ta_U01 describe, analyze, and make critical assessments facts. Students will work to recognize the diverse historical knowledge. will be asked to apply this o unfamiliar phenomena in order to be able to make I critical and aesthetic judgments of diverse facts in or professional work.	MSE_1A_U10	P65_UO		C-1 C-2 C-3 C-4			M-1	5-1
Social cor	npetences								
successfully approach the broader cult helps to dev	a_K01 ically about the global context and being able to communicate these thoughts to. Students learn to e relationship between historical knowledge and ural contexts and ideas with a critical mind that elop skills that can be applied to a broad range of lary studies and career activities.	MSE_1A_K01 MSE_1A_K02	P6S_KK	P65_WK	C-1 C-2 C-3 C-4	T-W-2 T- T-W-3 T- T-W-4 T- T-W-5 T- T-W-6 T- T-W-7 T-	-W-19 -W-20 -W-21	M-1	S-1

Outcomes	Grade	Evaluation criterion
Knowledge	•	
MSE_1A_A02a_W01	2,0	
	3,0	Student is able to use the acquired knowledge at a basic level to recognize the basic concepts of historical knowledge.
	3,5	
	4,0	
	4,5	
	5,0	
Skills		
MSE_1A_A02a_U01	2,0	
	3,0	Student is able to use the acquired knowledge at a basic level to recognize the basic concepts of historical knowledge.
	3,5	
	4,0	
	4,5	
	5,0	
Other social con	npetence	25
MSE_1A_A02a_K01	2,0	
	3,0	Student is able to use the acquired knowledge at a basic level to recognize the basic concepts of historical knowledge.
	3,5	
	4,0	
	4,5	
	5,0	
Required readin	g	
1. https://www.e-b	ooksdire	ctory.com/listing.php?category=110
2. https://www.eur	opeana.	20

Field of st	tudy	Mate	erials Scienc	e and Engineer	ing					
Mode of s	study	stati	onary	Level		first o	cycle	\A/T:1/	C _	
Graduate	's qualification	inżyı	nier					WTil	LN	
Fields of s	science	engineering and technology								
Discipline	es of science	mate	erials engine	eering (100%)					<u> </u>	
Educatior	nal profile	gene	eral academ	ic						
Module										
Course ur	nit			C						
Code		MSE	_1A_S_A02b	l l						
Field of s	pecialisation									
Administe			artment of C erials	Drganic Chemica	al Tech	nology a	and Polymer			
ECTS		4,0		ECTS (forms)		4,0				
Form of c	ourse credit	cred	its	Language		english				
Electives		1		Elective group						
Form of in	nstruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit	
lecture		W	1	45	4	,0	1,00	к	credits	
Leading t	eacher	Czec	h Zbigniew	(psa_czech@wp	o.pl)					
Other tea	chers	Czec	h Zbigniew	(psa_czech@wp	o.pl), So	bolews	ki Piotr (psobo	lewski@zut.edu	ı.pl)	
Prerequis	ites									
W-1	Basic knowledge ab	out E	uropean art a	and music at high	school g	graduate	level is recomm	ended, but not r	equired.	
Module/co	ourse unit objective	S								
C-1	Learn new musical r	reper	toire and new	pieces of visual a	art.					
C-2	Grasp the historical	-	-				ial arts.			
С-3	Learn how to think o	critica	ally of arts as	dynamic cultural	product	S.				
Course co	ontent divided into v								Number of hours	
T-W-1	Reflect on the common elements and differences between visual arts and music. The beginnings - Greek and Roman heritage. Basic introduction to the elements of music: Instrumentation, Harmony Tonality, Melody, Rhythm and Metre. Listening: Excerpts from: Promenade. 1. The Gnome from Pictures at an Exhibiton, Modest Mussorgsky (1874) The Sugar Plum Fairy, Act II, from The Nutcracker, Pyotr Ilyich Tchaikovsky (1892) Epitaph of Seikilos, 2nd Century BC, Stasimon of Orestes, 5th Century BC Bolero, Maurice Ravel (1928)									
T-W-2	The Middle Ages: The paintings illustrating Gregorian chant, de cathedrals and the p Ars subtilior Listening: Anonymous, Gregor Anonymous, Gregor Leoninus, Viderunt of Perotinus, Viderunt Guillaume de Macha Baude Cordier, Belle Jacob Senleches, La	ian C ian C ian C ian C omne omne aut, K	hes from the loment of nota els between t hant Puer Nat hant Ut Quea hant Viderunt s (Notre Dam s (Notre Dam yrie from the nne, Sage (14	Bible, manuscript tion in churches a the development tus est Nobis nt Laxis t omnes ie de Paris) (c. 11 Messe de Notre I th C.)	illumina and mor of Gothi 60) 98)	ition, chi asteries c archite	urch architecture . Architecture of ecture and polyph	and sculpture. Gothic nony in France.	4	

Course o	content divided into various forms of instruction	Number of hours
T-W-3	The Renaissance: The Renaissance in arts and its reflection to music in Italy. Court patronage, co- existence of musicians, architects and artists. Leonardo da Vinci, Michelangelo and Raphael. Architects Alberti, Brunelleschi and Bramante. Guillaume Dufay's Nuper Rosarum Flores and the Cathedral of Florence. 'Cori Spezzati': Venetian Polychoral Music at Venice's St. Mark's Cathedral. Palladio's villas in the Veneto. The Sistine Chapel in the Vatican and Palestrina's music. Listening: Guillaume Dufay, Nuper Rosarum Flores (1436) Guillaume Dufay, Lamentatio sanctae matris ecclesiae Constantinopolitanae (1454) Josquin Deprez, Illibata Dei Virgo nutrix (c.1492) Giovanni Pierluigi da Palestrina, Missa Papae Marcelli - Kyrie (1557) Giovanni Gabrieli, Salvator Noster (b.1612) Claudio Monteverdi, Vespro della Beata Vergine, Psalm I - Dixit Dominus (1610)	4
T-W-4	The Baroque Period I: Early Baroque - The birth of Opera, Oratorio and Cantata. Italian court patronage, the academies and the development of monody. Drama, movement and expressivity in visual arts: Caravaggio, Velazquez, Bernini, Borromini. New musical genres in the early 1600s in Italy: Music for the courts (opera and cantata) and music for the prayer hall (oratorio). Public Opera in the 17th Century in Venice. The French Tragedie en musique in the context of Louis IVth's palaces and André Le Notre's garden designs for Versailles and Chantilly. Listening: Excerpts from Claudio Monteverdi, Orfeo (1607): Toccata, Vi ricorda o boschi ombrosi, Ahi, caso acerbo!, Tu sei morta, E la virtute un raggio Monteverdi or colleague, Pur ti Miro from L'Incoronazione di Poppea (1642) Giacomo Carissimi, Historia di Jephta (1648) Luigi Rossi, Occhi Belli (c.1640) Jean-Baptiste Lully, Armide (1686): Ouverture, Les plaisirs ont choisi pour asile (Air) Act 5, Scene 2	4
T-W-5	The Baroque Period II: The High Baroque Music for different performance contexts and spaces, the different cases of J.S Bach, Vivaldi and Handel. Vivaldi in Venice at the Pietà. J.S. Bach in Weimar, Köthen and Leipzig. Handel's music for the Opera and the conception of Oratorios for London. Listening: Antonio Vivaldi, Gloria in excelsis Deo - I (1715) Antonio Vivaldi, Four Seasons, Spring Op. 8 RV 269 (1723) Antonio Vivaldi, Four Seasons, Winter 1st Mov. Op. 8 RV 269 (1723) J.S. Bach, The Toccata and Fugue in D minor, BWV 565 (c.1710) J.S. Bach, Brandenburg Concerto No. 4 in G major, 1. Mov., BWV 1049 (1715–1721) J.S. Bach Ich habe genug, 1. Aria, BWV 82 (1727) J.S. Bach Matthaus Passion, 1. Chorus BWV 82 (1727) J.S. Bach Matthaus Passion, Aria Erbarme Dich (1727) George Friderich Handel, Rinaldo (1711): Cara Sposa, Venti, turbini, Lascia ch'io pianga George Friderich Handel - Hallelujah from the Messiah HWV 56 (1742)	4
T-W-6	 Classical Period: The Enlightenment, balance, clarity and elegance in music, parallel to Neoclassical art and architecture, including Canova's sculptures and Jacques-Louis David's paintings. Sonata, symphony and the sonata form. Haydn's early symphonies composed at the Esterhazy Palace (Neoclassical Architecture). Mozart, the piano concerto and the Singspiel. Transition from Classical to Romantic music with Beethoven. Listening: Joseph Haydn, Symphony No. 6 in D major Le matin (Morning). (Hoboken 1/6) (1761) Joseph Haydn, Symphony No. 94 in G Major (Surprise) II. Andante Joseph Haydn, Symphony No. 45 in F≉ minor (Farewell) IV. Finale Wolfgang Amadeus Mozart, Piano Concerto No. 20 in D Minor I. Allegro Wolfgang Amadeus Mozart, The Magic Flute, Queen of the Night's aria (1791) Ludwig van Beethoven, Symphony No. 3 "Eroica" I. Allegro con brio (1824) Ludwig van Beethoven, Symphony No. 9 "Choral" (Finale) (1824) 	4
T-W-7	 Romanticism I: Expansive symphonies, virtuosic piano music, passionate songs which took inspiration from art and literature. Delacroix's paintings of themes from Romantic poetry. Caspar David Friedrich and J.M.W. Turner, John Constable's romantic landscape painting. First class to concentrate on songs and piano works. Schubert, Mendelssohn, Schumann and Brahms' lieder. Chopin, Schumann and Listz' music for the piano. Listening: Franz Schubert, Erlkönig, D. 328 (1815) Franz Schubert, Du bist die Ruh, D. 776 (1823) Franz Schubert, Gute Nacht from Winterreise (1827) Felix Mendelssohn, Auf Flügeln des Gesanges (On Wings of Song) (1834) Robert Schumann, Im wunderschönen Monat Mai from Dichterliebe Op. 48 (1840) Johannes Brahms Wie Melodien zieht es mir Opus 105 N. 1 (1888) Frédéric Chopin Mazurka No. 5, Op. 7 No. 1 (1830-32) Robert Schumann, Träumerei from Kinderszenen, Op. 15 No. 7 (1838) Franz Liszt - Consolation No. 3, S. 172 (1849-50) 	4

Course c	ontent divided into various forms of instruction	Number of	hours
T-W-8	Romanticism II: Expansive symphonies after Beethoven's 9th, the contributions of Brahms and Mahler. Wagner and the Gesamtkunstwerk - Festspielhaus Bayreuth. Verdi and nationalism in music in Italy. Listening: Richard Wagner, Tannhauser - Overture (1845) Richard Wagner, Tristan und Isolde - Prelude to Act 1 (1857-1859) Richard Wagner, Der Ring des Nibelungen (The Ring of the Nibelung) - Die Walküre (The Valkyrie), WWV 86B - The Ride of the Valkyries (1870) Giuseppe Verdi, Va Pensiero, Nabucco (1842) Giuseppe Verdi, La Traviata, Brindisi (1853) Johannes Brahms, Symphony no. 1 in c minor Op. 68- 1st and 4th movements (1876) Johannes Brahms, Symphony no. 3 in F major Op. 90, 3. Poco Allegretto (1883) Gustav Mahler - Symphony no. 5, c sharp minor, 4. Adagietto (1901-2)		4
T-W-9	Impressionism: Impressionism in fine arts, Monet, Degas, Pissarro and Renoir. The influence of the Gamelan and of Japanese prints. The French composers Claude Debussy, Gabriel Fauré and Maurice Ravel's music in relation with French "Symbolist" literature - Verlaine, Mallarmé, etc. Listening: Claude Debussy, Pagodes from Estampes (Prints), L.100 (1903) Claude Debussy, Nuages (Clouds) from Nocturnes L. 91 (1899) Claude Debussy, Prélude à l'après-midi d'un faune (1894) - on a poem by Mallermé. Gabriel Fauré Clair de lune, Op. 46 No 2 (1887) - melodie/chanson - on a poem by Verlaine. Maurice Ravel, Oiseaux Tristes (Sad birds) from Miroirs (Mirrors) (1904-1905)		4
T-W-10	 Modernism I: Pre-and Post-World War I art experiments: New forms to express modern life. A precursor to Modernism: Art Nouveau in Europe and the Beethoven Frieze at the Secession in Vienna. The German Expressionists and Strauss's Salome. The Austrian Expressionists and the 2nd Viennese School (Arnold Schoenberg, Alban Berg, Anton Webern). Kandinsky's relationship with Schoenberg. Paris and the Ballets Russes (Matisse and Picasso's projects with Diaghilev). Stravinsky's Le Sacre du printemps (1913). Listening: Richard Strauss, Dance of the Seven Veils from the opera Salome (1915) Arnold Schoenberg Pierrot Lunaire (Moonstruck Pierrot), Opus 21, Movement 1, Moondrunk (1912) Alban Berg, Wozzeck (1922) Anton Webern, Symphonie, Opus 21, 1st Movement (1928) Igor Stravinsky, Le Sacre du printemps (1913) 		3
T-W-11	 Modernism II: World War II, post-war art experiments. The Nazi Regime in Germany and Stalin in the U.S.S.R. Abstract Expressionism in art in the USA. John Cage and Chance music in relation with American Abstract Expressionists. New sound materials, electronic music and space as a compositional parameter at the Philips Pavilion in Brussels. Ligeti and new sonorities. Listening: Olivier Messiaen, Quartet for the End of Time (1941) Richard Strauss, Metamorphosen (1945) Dmitri Shostakovich, Lady Macbeth of Mtsensk District (1934) Dmitri Shostakovich, The Suite for Variety Orchestra, Movement 7. Waltz 2 (1956) Krzysztof Penderecki, Threnody to the Victims of Hiroshima (1960) Benjamin Britten, Dies Irae and Lacrimosa from The War Requiem (1961-2) John Cage, 4'33' (1952) Iannis Xenakis, Metastaseis (1953-54) Iannis Xenakis, Concrete PH (1958) Edgard Varèse, Poème électronique (1958) György Ligeti, Atmospheres (1961) and Kyrie (from Requiem (1963-5) 		3
T-W-12	Post-Modernism and after: Minimalism in Music, from the 1970s: Steve Reich, Philip Glass, Terry Riley, John Adams, related to Minimalism in art, which emerged as a movement in the 1950s and continued through the Sixties and Seventies. Ellsworth Kelly, Frank Stella, Dan Flavin, Donald Judd. Opera in the last few decades. Contemporary classic music in film scores.		3
Student v	vorkload - forms of activity	Number of	hours
A-W-1	Participation in lectures		45
A-W-2	Self-study of the literature		60
A-W-3	Consultations		15
Teaching	methods / tools		
M-1	Lecture		
Evaluatio	n methods (F - progressive, P - final)		
S-1	P Written test		
5-1			
	Designed learning outcomes Reference to the learning outcomes Reference to the learning outcomes Reference to the learning outcomes Reference to the learning outcomes learning outcomes Reference to the learning outcomes learning outcomes learning outcomes learning outcomes learning outcomes learning outcomes learning outcomes learning outcomes level 6 or 7 that objectives Course cours	ent Teaching	Evaluation
	designed for the fields of study study stu	methods	methods

Zachodniopomorski Uniwersytet Technologiczny w Szczecinie **Faculty of Chemical Technology and Engineering** MSE 1A A02b W01 Students familiarize themselves with the main resources of the European Art and Music knowledge in order to acquire this C-1 C-2 C-3 understanding and develop a set of foundational skills to be MSE 1A W10 P6S WK P65 WG T-W-1 M-1 S-1 applied to further study. The main skills to be focused on this semester include those listed in the following learning outcomes. Skills MSE_1A_A02b_U01 The ability to describe and analyze a musical and art C-1 T-W-1 C-2 C-3 T-W-12 S-1 phenomenons. Students will work with the diverse sources of MSE_1A_U10 P6S_UO M-1 T-W-2 the art. Will be asked to apply this knowledge to make wellfounded critical and aesthetic judgments of the cultural events. Social competences MSE 1A A02b K01 C-1 C-2 C-3 Open-minded thinking about the global context of the culture MSE_1A_K01 P6S_KK T-W-5 P6S_WK T-W-12 and being able to successfully communicate these thoughts to. M-1 S-1 MSE_1A_K04 P6S_KR T-W-6 Students learn to use these knowledge to further studies and career activities. Outcomes Grade Evaluation criterion Knowledge MSE 1A A02b W01 2,0 3,0 Student is able to use the acquired knowledge at a basic level to recognize the basic concepts of culture. 3,5 4,0 4,5 5,0 Skills MSE 1A A02b U01 2,0 3,0 Student is able to use the acquired knowledge at a basic level to recognize the basic concepts of culture. 3,5 4,0 4,5 5,0 Other social competences MSE 1A A02b K01 2,0 3,0 Student is able to use the acquired knowledge at a basic level to recognize the basic concepts of culture. 3,5 4,0 4,5

Required reading

5,0

1. https://www.europeana.eu

2. http://youtube.com

Field of st	udy	Mate	erials Scienc	e and Engineeri	ng				
Mode of s	tudy	stati	onary	Level		first o	cycle	\ A / T : L	C L
Graduate'	s qualification	inży	nier	, , , , , , , , , , , , , , , , , , ,				WTil	Ch
Fields of s	science	engi	neering and	technology					
Discipline	s of science	mate	erials engine	ering (100%)					
Education			eral academ	-					
Module									
Course un	nit	Inte	llectual Pr	operty and Sta	andari	zation	(ISO, EU)		O
Code			1A_S_A03				···		
Field of sr	pecialisation								
	ering faculty		artment of C erials	Organic Chemica	al Tech	nology	and Polymer		
ECTS		1,0		ECTS (forms)		1,0		-	
Form of co	ourse credit	cred	its	Language		polish		_	
Electives				Elective group				-	
Form of in	octruction	Cod	Semester	Hours	E	CTS	Woight	Realization	Credit
							Weight		
lecture		W	1	15		,0	1,00	K	credits
Leading te				(psa_czech@wp	-				
Other tea	chers	Czec	ch Zbigniew	(psa_czech@wp	p.pl)				
Prerequisi	ites								
W-1	none								
Module/co	ourse unit objective	es							
C-1	The aim of the cour	rse is	to get knowle	dge in the field of	intelle	tual pro	perty law and El	J/ISO standardiza	ation.
Course co	ntent divided into	vario	us forms of	instruction					Number of hours
T-W-1	Introduction to the						property, non-m	naterial goods,	2
T-W-2	standards and stan Preliminary charact						perty rights, indu	strial models,	
	trade-marks, comp	uter s	oftware etc.						2
T-W-3	Protecting intellect	-		-	1				1
T-W-4	The protection of Ir								1
T-W-5	Entities involved in	-			-				1
T-W-6	Negotiation and ex The right balance b	•					r privacy and		1
T-W-7	prorection of intele	ctual	property						1
T-W-8	Significance of inte innovation growth a				gns, pa	tents, co	pyrights for		1
T-W-9	Standardization and	d stan	dards from th	ne engineer's poin	t of vie	Ν.			1
T-W-10	ISO and CEN, interr	nation	al standardiza	ation system, ESS	, nation	al standa	ards, industrial s	tandards etc.	1
T-W-11	European Standard								1
T-W-12	Standards as a valu production. Example					prove pe	rformance and s	afety of the	2
Student w	orkload - forms of	activ	ity						Number of hours
A-W-1	Participation in lect	ures							15
A-W-2	Self-study of the lite	eratur	e						10
A-W-3	Consultations								5
Teaching	methods / tools								
M-1	Lecture								
Evaluation	n methods (F - prog	gress	ive, P - final)					
S-1	P Written test	-							
L									

							.9			
Desig	ned lear	ning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes f or qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course	e content	Teaching methods	Evaluatior methods
Knowledge					1					
MSE_1A_A03_W01 The student has a bas law and about standa	sic knowle rds and st	dge about intellectual property andardization.	MSE_1A_W08	P6S_WG		C-1		T-W-7 T-W-8 T-W-9 T-W-10 T-W-11 T-W-12	M-1	S-1
Skills										
projects in terms of ir	ntellectual	aluate creative works and property law. He can also ormation from standards	MSE_1A_U12	P6S_UO		C-1			M-1	S-1
Social competen	ces									
MSE_1A_A03_K01 The student understa property law and star the future engineer.	nds the im ndardizatio	nportant role of intellectual on system from the point of view	MSE_1A_K02	P65_KK	P6S_WK	C-1	T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6	T-W-7 T-W-8 T-W-9 T-W-10 T-W-11 T-W-12	M-1	S-1
Outcomes	Grade		E	Evaluation cr	iterion					
Knowledge										
MSE_1A_A03_W01	2,0 3,0 3,5 4,0 4,5 5,0	Student describes selected issue	es at a basic level (score => 50%)						
Skills										
MSE_1A_A03_U01	2,0 3,0 3,5 4,0 4,5 5,0									
Other social com		es								
MSE_1A_A03_K01	2,0 3,0 3,5 4,0 4,5 5,0	Student describes selected issue	es at a basic level (score => 50%)						
Required reading	 g	•								
1. Norman Helen,	ntellectu	al Property Law Directions, C	OUP, Oxford, 201	4						
2. www.cencenele										
		wth/single-market/european-	standards_en							
4. https://www.iso.	org/stan	dards.html								

			<u> </u>							<u> </u>			
Field of s	study	Mate	erials Science	e and	Engineering								
Mode of	study	stati	onary		Level		first cyo	cle		/	~ 1		
Graduate	e's qualification	inżyr	nier						- W	/Til	Lh)	
Fields of	science	engi	neering and	techn	nology								
Discipline	es of science	-	erials engine						1 🔽			Τ.,	
	nal profile		eral academi	-	<u> </u>								
Module		gene		C									
Course u	nit		and Ergon	omic	6								
Code			1A_S_A04	onne	3								
			_1A_5_A04										
	specialisation								- '				
	ering faculty	-		-	ic and Sorbe			ngineering	_				
ECTS		1,0			(forms)		1,0		_				
Form of a	course credit	cred	its	Lang	uage		polish						
Electives	5			Elect	ive group								
Form of i	instruction	Cod	Semester	H	lours	EC	TS	Weight	Rea	alization		Crea	lit
lecture		w	1		15	1,	0	1,00		К		cred	its
Leading	teacher	Mich	alkiewicz Be	ata (E	Beata.Michalk	iewi	cz@zut.e	edu.pl)					
Other tea					Beata.Michalk			-					
Prerequis								1. 7					
W-1	none												
Module/C C-1	Course unit objectiv		the problems	s of oc	cupational hoa	lth a	nd cafoty	and organom	icc				
			-		-						1		<u> </u>
	ontent divided into					otvir	a tha law (of the Europe	an Unio	n and	Nur	nber of	hours
T-W-1	Poland	i the i	ielu ol occupa	lionai	nealth and sar	ety ii		or the Europed		ii anu			3
T-W-2	Ergonomics												2
T-W-3	Interaction betwee												1
T-W-4	Work with dangero		emicals or proc	cesses									2
T-W-5	Workplace diagnos												2
T-W-6	Certification of pro	ducts,	machines and	devic	ces to meet saf	ety r	equiremen	nts					1
T-W-7 T-W-8	Accidents at work Occupational disea	<u> </u>	cupational ricl								-		1
T-W-8	Safety Managemer			ĸ									1
			·										
	workload - forms of		ity								Nur	nber of	
A-W-1 A-W-2	Participation in lect Preparation for tes												15 13
A-W-2 A-W-3	Individual consulta										-		2
													£
Teaching M-1	g methods / tools												
	on methods (F - pro	gress	ive, P - final)										
5-1	P Test								1			1	1
	Designed learnin	g outo	comes	0	Reference to the learning outcomes designed for the fields o study	Learn of for q	deference to ning Outcomes Jualifications at QF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course co	ntent	Teaching methods	Evaluation methods
Knowled	ge												
MSE_1A_A0	4_W01 ows the problems of occu			6.1.	MSE_1A_W09		P6S_WK		C-1		-W-6 -W-7	M-1	S-1

Faculty of Chemical Technology and Engineering

Skills		
Social compete	nces	
Outcomes	Grade	Evaluation criterion
Knowledge		·
MSE_1A_A04_W01	2,0	
	3,0	Student knows the problems of occupational health and safety (test score $=> 50\%$)
	3,5	
	4,0	
	4,5	
	5,0	
Skills		
Other social cor	mpetenc	es
Required readir	ng	
1 Poniamin O Al	li Eundon	agental Drinciples of Occupational Health and Safety, International Labour Office, Conous, 2009

1. Benjamin O. Alli, Fundamental Principles of Occupational Health and Safety, International Labour Office, Geneva, 2008

Field of stu	udy	Mate	erials Science	e and En	ngineering						
Mode of st	tudy	stati	onary	Le	vel	first cy	·cle	1.4	/T:1/	• I	
Graduate's	s qualification	inży	nier					V\	/Til(-n	
Fields of s	cience	engi	neering and	technolo	ogy						
Disciplines	s of science	mat	erials engine	ering (1	00%)					<u> </u>	
Education	al profile	gene	eral academi	с							
Module											
Course un	it	Libr	ary Orienta	ation/Lil	brary Skill	s Training					
Code		MSE	_1A_S_A05							0	
Field of sp	ecialisation										
Administe	ring faculty	Bibli	oteka Główn	а							
ECTS		0,0		ECTS (fo	orms)	0,0					
Form of co	ourse credit	cred	its	Langua	ige	english					
Electives				Elective	e group						
Form of in	struction	Cod	Semester	Ηοι	ırs	ECTS	Weight	Rea	alization	Crec	lit
lecturing c	course	А	1	5	;	0,0	1,00		К	cred	its
Leading te	eacher	Arat	czyk-Mosiev	vicz Anna	a (Anna.Ara	abczyk@zut.	edu.pl)	1		1	
Other tead	chers	Jank	owska Elżbie	eta (Elzb	ieta.Jankow	/ska@zut.ed	u.pl)				
Prerequisi	tes	-					<u> </u>				
W-1	Knows the basics of	f usin	g computer ar	nd www n	etwork						
Module/co	urse unit objective	25									
C-1	To acquaint users v		ne organizatio	n, functio	ning and pri	nciples of usir	ng the library,	its colle	ctions and	services	
Course co	ntent divided into	vario	us forms of i	instructio	on					Number of	f hours
T-A-1	The Main Library im organization, opera The training can be Under E-services / I General courses, ar Training program: 1. general informat hours Rules of using the I collections available 3. basic sources of Using the Aleph onl in to the system: pl loan period, checking	tion, foun E-edu nd in t ion al ibrary e: use scient ine ca acing	and use of the d on the unive cation in the c them the court pout the librar d's collections er registration, tific information atalog: simple orders for the	e library, i ersity web ourse cat se ZUT M y: library and servi using the on, databa and com e lending	its collection: osite www.zu tegories plea lain Library - collection, o ces, with par e reading roo ases plex searchin library and r	s and services t.edu.pl se indicate Library traini rganizational ticular empho om, borrowing ng, indexes, f	s. ng structure and asis on the rule g, interlibrary l unctions availa	locatior es of ma oans able afte	aking er logging		5
Student w	orkload - forms of		-							Number of	f hours
A-A-1	To become familiar the collections and Szczecin" - Annex t	servi	ces of the Mai	n Library	of the West	Pomeranian L	Iniversity of Te				2
A-A-2	written test	0 1.10									1
Teaching r	methods / tools										
M-1	online training										
Evaluation	methods (F - prog	gress	ive, P - final)	1							
5-1	F Test passed	on tł	ne basis of 70%	% correct	answers						
	Designed learning	g out	comes	le	Reference to the earning outcomes gned for the fields o study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course conte	ent Teaching methods	Evaluation methods
Knowledge	9			ı							
	W01 nows the regulations in of using library service		in the Main Libr	ary M	4SE_1A_W08	P6S_WG		C-1	T-A-1	M-1	S-1

Faculty of Chemical Technology and Engineering

Skills									
Aleph system (searcl borrowing or as part	ning, order of present	the library's collections and the ing, reserving books for ing books - on the spot in the asic scientific databases.	MSE_1A_U10 MSE_1A_U11	P6S_UK P6S_UO P6S_UW		C-1	T-A-1	M-1	S-1
Social competer	nces								
MSE_1A_A14_K01 He knows the inform how to use it	ation and I	library system of ZUT and knows	MSE_1A_K01	P65_KK	P6S_WK	C-1	T-A-1	M-1	S-1
Outcomes	Grade		E	valuation cr	iterion				
Knowledge	1	1							
MSE_1A_A14_W01	2,0								
	3,0	Correct answers to 70% of the tes	st questions						
	3,5								
	4,0								
	4,5								
	5,0								
Skills									
MSE_1A_A14_U01	2,0								
	3,0	70% correct answers to test ques	tions						
	3,5								
	4,0								
	4,5								
	5,0								
Other social con	npetence	es							
MSE_1A_A14_K01	2,0								
	3,0	Passing the test on the basis of 70	0% correct answer	ſS					
	3,5								
	4,0								
	4,5								
	5,0								

Required reading

 "Regulamin korzystania ze zbiorów i usług Biblioteki Głównej Zachodniopomorskiego Uniwersytetu Technologicznego w Szczecinie" załącznik do zarządzenia nr 58 Rektora ZUT z dnia 25 września 2019 r., 2019

E 1.1.1. C													
Field of s	tudy		Mate	erials Science	and Engineerin	g							
Mode of s	study	:	stati	onary	Level		first cy	cle	3.4	/ T :			
Graduate	e's qualif	fication	inży	nier	I					/Til	Ch		
Fields of :	science		engi	neering and t	technology								
Discipline	es of scie	ence	mate	erials enginee	ering (100%)					_		<u> </u>	
Educatior	nal profi	le	gene	eral academic	2					- 1			
Module										- 1			
Course ui	nit		онз	Training						- 1			
Code			MSE	_1A_S_A06						- 1			
Field of s	pecialisa	ation											
Administe	ering fac	culty	Depa	artment of Ca	atalytic and Sort	ent l	Materials E	Engineering					
ECTS			0,0		ECTS (forms)		0,0		-			_	
Form of c	course ci	redit	cred	its	Language		english		-				
Electives					Elective group		_		-				
Form of i	nstructio	on (Cod	Semester	Hours	E	CTS	Weight	Rea	alizatio	1	Cred	lit
lecture			W	1	5),0	1,00		K		credi	
Leading t	toachor		Mich		ata (Beata.Micha								
Other tea					ata (Beata.Micha		-	•					
			Mici				VICZ@ZUL.	200.01)					
Prerequis W-1	none												
		- '4 - 4 ' 4 '											
Moaule/c		nit objective	S										
		upint student	c wit	h tha knowladd	no of OSH logiclati	on							
					ge of OSH legislati		ts						
C-1 C-2 C-3	To acq	uaint student	s wit	h the knowledg	ge of dealing with		ts						
C-2 C-3	To acq To acq	uaint student uaint student	s wit s wit	h the knowledg h the knowledg	ge of dealing with ge of first aid		ts				Nun	nber of	hours
C-2 C-3 Course co	To acq To acq ontent d	uaint students uaint students livided into v	s wit s wit <i>/ario</i>	h the knowledg	ge of dealing with ge of first aid		ts				Nun	nber of	hours
C-2 C-3	To acq To acq ontent d Selecte	uaint student uaint student	s wit s wit <i>ario</i> s	h the knowledg h the knowledg us forms of in	ge of dealing with ge of first aid		ts				Nun	nber of	
C-2 C-3 Course co T-W-1	To acq To acq ontent d Selecte Threat	uaint student uaint student <i>livided into v</i> ed legal issues	s wit s wit <i>ario</i> s ealth	h the knowledg h the knowledg us forms of in	ge of dealing with ge of first aid		ts				Nun	nber of	1
C-2 C-3 Course co T-W-1 T-W-2	To acq To acq ontent d Selecte Threat Protect	uaint student: uaint student: <i>livided into v</i> ed legal issues s to life and h	s wit s wit <i>ario</i> s hreat	h the knowledg h the knowledg us forms of in	ge of dealing with ge of first aid		ts				Nun	nber of	1
C-2 C-3 Course co T-W-1 T-W-2 T-W-3	To acq To acq ontent d Selecte Threat Protect	uaint student: uaint student: <i>livided into v</i> ed legal issues s to life and h tion against th g with threats	s wit s wit <i>ario</i> s hreat	h the knowledg h the knowledg us forms of in	ge of dealing with ge of first aid		ts				Nun	nber of	1 1 1
C-2 C-3 Course co T-W-1 T-W-2 T-W-3 T-W-4 T-W-5	To acq To acq ontent d Selecte Threat Protect Dealing First ai	uaint student: uaint student: <i>livided into v</i> ed legal issues s to life and h tion against th g with threats	s wit s wit / <i>ario</i> s hrealth	h the knowledg h the knowledg us forms of in s	ge of dealing with ge of first aid		ts					nber of	1 1 1 1
C-2 C-3 Course co T-W-1 T-W-2 T-W-3 T-W-4 T-W-5	To acq To acq Ontent d Selecte Threat Protect Dealing First ai	uaint student: uaint student: <i>livided into v</i> ed legal issues s to life and h tion against th g with threats d	s wit s wit vario s hreat hreat s	h the knowledg h the knowledg us forms of in s	ge of dealing with ge of first aid		ts						1 1 1 1
C-2 C-3 Course co T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 Student v	To acq To acq Ontent d Selecte Protect Dealing First ai workloac Partici	uaint student: uaint student: <i>livided into v</i> ed legal issues s to life and h tion against th g with threats d d <i>- forms of a</i> pation in lectu	s wit s wit vario s hreat hreat s	h the knowledg h the knowledg us forms of in s	ge of dealing with ge of first aid		ts						1 1 1 1 1
C-2 C-3 Course co T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 Student v A-W-1	To acq To acq Ontent d Selecte Protect Dealing First ai workloac Partici	uaint student: uaint student: <i>livided into v</i> ed legal issues s to life and h tion against th g with threats d d - forms of a pation in lectu	s wit s wit vario s hreat hreat s	h the knowledg h the knowledg us forms of in s	ge of dealing with ge of first aid		ts						1 1 1 1 1
C-2 C-3 Course co T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 Student v A-W-1 Teaching M-1	To acq To acq Ontent d Selecte Protect Dealing First ai workload Particip I method Lecture	uaint student: uaint student: <i>livided into v</i> ed legal issues s to life and h tion against th g with threats d d - forms of a pation in lectu ds / tools e	s wit s wit vario s ealth hreat s activ ures	h the knowledg h the knowledg us forms of in s	ge of dealing with ge of first aid		ts						1 1 1 1 1
C-2 C-3 Course co T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 Student v A-W-1 Teaching M-1 Evaluatio S-1	To acq To acq Ontent d Selecte Protect Dealing First ai workload Particip I method Lecture	uaint student: uaint student: <i>livided into v</i> ed legal issues s to life and h tion against th g with threats d d - forms of a pation in lectu ds / tools e	s wit s wit vario s ealth hreat s activ ures	h the knowledg h the knowledg us forms of in s	ge of dealing with ge of first aid		ts						1 1 1 1 1
C-2 C-3 Course co T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 Student v A-W-1 Teaching M-1 Evaluatio	To acq To acq I To acq Selecte Threat Protect Dealing First ai workload Particip I method Lecture	uaint student: uaint student: <i>livided into v</i> ed legal issues s to life and h tion against th g with threats d d - forms of a pation in lectu ds / tools e pds (F - prog	s wit s wit /ario s ealth hreat activ ures	h the knowledg h the knowledg us forms of in s ity ive, P - final)	ge of dealing with ge of first aid		ts						1 1 1 1 1
C-2 C-3 Course co T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 Student v A-W-1 Teaching M-1 Evaluatio S-1	To acq To acq Ontent d Selecte Protect Dealing First ai workload Particip Lecture on method P F	uaint student: uaint student: livided into v ed legal issues s to life and h tion against th g with threats d d - forms of a pation in lectu ds / tools e pods (F - prog Test	s wit s wit vario s ealth hreat activ ures in le	h the knowledg h the knowledg us forms of in s ive, P - final) ctures	ge of dealing with ge of first aid		ts Reference to arning Outcomes r qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course	Course	Nun		1 1 1 1 1
C-2 C-3 Course co T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 Student v A-W-1 Teaching M-1 Evaluatio S-1	To acq To acq Ontent d Selecte Protect Dealing First ai workload Particip Lecture on method P F Design	uaint student: uaint student: livided into v ed legal issues s to life and h tion against th g with threats d d - forms of a pation in lectu ds / tools e ods (F - prog Test Participation	s wit s wit vario s ealth hreat activ ures in le	h the knowledg h the knowledg us forms of in s ive, P - final) ctures	ge of dealing with ge of first aid nstruction		Reference to arning Outcomes	learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering		Course	Nun	nber of	1 1 1 1 5 5
C-2 C-3 Course co T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 Student v A-W-1 Teaching M-1 Evaluatio S-1 S-2 Knowledg MSE 1A A00	To acq To acq Intent d Selecte Threat Protect Dealing First ai workloac Particip Destigr P F Desigr ge 6 W01	uaint student: uaint student: <i>livided into v</i> ed legal issues s to life and h tion against th g with threats d d - forms of a pation in lectu ds / tools e ods (F - prog Test Participation	s wit s wit vario s ealth hreat activ ures in le	h the knowledg h the knowledg us forms of in s ive, P - final) ctures	ge of dealing with ge of first aid nstruction Reference to th learning outcom designed for the fiel study	threa	Reference to arning Outcomes	learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering		Course	Nun	nber of	1 1 1 1 5 5
C-2 C-3 Course co T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 Student v A-W-1 Teaching M-1 Evaluatio S-1 S-2 Knowledg MSE 1A A06	To acq To acq Intent d Selecte Threat Protect Dealing First ai workloac Particip Destigr P F Desigr ge 6 W01	uaint student: uaint student: <i>livided into v</i> ed legal issues s to life and h tion against th g with threats d d - forms of a pation in lectu ds / tools e ods (F - prog Test Participation	s wit s wit vario s ealth hreat activ ures in le	h the knowledg h the knowledg us forms of in s ity ive, P - final) ctures	ge of dealing with ge of first aid nstruction Reference to th learning outcom designed for the fiel study	threa	Reference to arning Outcomes r qualifications at PQF 6, 7 or 8	learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering	C-1 C-2	T-W-1 T-W-2	Content	nber of Teaching methods	1 1 1 1 5 5 Evaluation methods

Outcomes	Grade	Evaluation criterion
Knowledge	- I	
MSE_1A_A06_W01	2,0	
	3,0	Student knows basic problems of occupational health and safety (test score => 50%). Participation in lectures: 100%
	3,5	
	4,0	
	4,5	
	5,0	
Skills		
Other social con	npetenc	es
Required readin	g	
1, selfmade mat	erials, 20	011

			-						
Field of s	tudy	Mate	erials Scienc	e and Engineeri	ng				
Mode of s	study	stati	onary	Level		first o	cycle	14/701/	~1
Graduate	's qualification	inżyı	nier	I				WTil(Lh
Fields of .	science	engi	neering and	technology					
Discipline	es of science	mate	erials engine	eering (100%)					
Educatio	nal profile	gene	eral academ	ic					
Module									
Course u	nit	Mat	hematics 1						C
Code		-	1A_S_B01a						
	pecialisation								
	ering faculty	Stud	lium Matema	atyki					
ECTS		6,0		ECTS (forms)		6,0			
	course credit		nination	Language		english			
Electives		Exai	mation			english	1		
				Elective group					
	nstruction	Cod	Semester	Hours	_	TS	Weight	Realization	Credit
lecturing	course	A	1	30		,0	0,41	К	credits
lecture		W	1	30	4	,0	0,59	К	examination
Leading t	teacher	Iglev	vska-Nowak	llona (llona.lgle	wska-N	lowak@	zut.edu.pl)		
Other tea	achers	Iglev	vska-Nowak	llona (llona.lgle	wska-N	lowak@	zut.edu.pl)		
Prerequis	sites								
W-1	Knowledge of math	emati	ics at A level.						
Module/c	ourse unit objective	es							
C-1	The target is that t	he stu							physical and
C-2	chemical processes Awareness of the n			-	thema	ical tool	s necessary for f	urther studies.	
			-						N
Course co T-A-1	ontent divided into Exercise solving an				c from	ho loctu	r		Number of hours
T-A-1 T-A-2	Tests.				5 110111		ie.		26
T-W-1	Algebraic calculation	on pro	grams: introd	uction to Mathema	atica.				2
T-W-2	Elementary functio					exponer	tial functions, lo	garithms.	8
T-W-3	Differential calculu	s: defi	nition of a de	rivative and differe	entiatio	n metho	ds.		4
T-W-4	Application of diffe	rential	l calculus to f	unctions: approxim	nate ca	culation	s, maxima/minin	na, monotonicity	4
T 14/ F	of a function. Integral calculus: d	efinite	and indefinit	e integrals, relatio	n with	different	iation,		0
T-W-5	tables of integrals,	integr	ration method	ls.					8
T-W-6	Ordinary differentia			first order: separat	DIE ODE	, linear (DDE.		4
	workload - forms of		ity						Number of hours
A-A-1	Training participati								30
A-A-2	Individual work: ex	ercise	solving and t	est preparation.					24
A-A-3 A-A-4	Consultation. Final test.								4
A-A-4 A-W-1	Participation in the	lectur	<u>م</u>						30
A-W-2	Individual study of			iven literature.					52
A-W-3	Consultations.								10
A-W-4	Preparation for the	exam	1						25
A-W-5	The exam.								2
Teaching	methods / tools								·
M-1	Lecture. Presentati	on of t	theory and sa	mple exercises.					
М-2	Training. Exercise	solving	g, problem dis	scussion.					
Evaluatio	n methods (F - pro	gress	ive, P - final.)					
			_,						

Faculty of Chemical Technology and Engineering

Evaluation	metho	ods (F -	progressive, P - final)								
S-1	Р	Written	n exam.								
S-2	Р	Exercis	e tests.								
S-3	F	Lecture	e: based on discussions. Traini	ing: based on so	lved exercises	5.					
	Desigr	ned lear	rning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course	e content	Teaching methods	Evaluation methods
Knowledge	,										
MSE_1A_B01_V Knows the bas		itions, the	eorem and calculation methods.	MSE_1A_W01	P6S_WG P6S_WK	P6S_WG	C-1	T-W-2 T-W-3	T-W-4 T-W-5	M-1	S-1 S-3
Skills											
MSE_1A_B01_ Is able to appl the litarature t	y the m		ught in the course and found in ms.	MSE_1A_U02	P6S_UW		C-1	T-A-1 T-W-2 T-W-3	T-W-4 T-W-5	M-1 M-2	S-1 S-2 S-3
Social com	peten	ces									
MSE_1A_B01_l Is aware of the		f further	study and systematic work.	MSE_1A_K02	P6S_KK	P6S_WK	C-2	T-A-1 T-W-2 T-W-3	T-W-4 T-W-5	M-1 M-2	S-1 S-2 S-3
Outcom	nes	Grade		E	valuation cr	iterion					
Knowledge	,		1								
MSE_1A_B01_V	W01	2,0									
		3,0	Student demonstrates basic know	wledge of mathema	atics						
		3,5									
		4,0									
		4,5									
CL:II-		5,0									
Skills			1								
MSE_1A_B01_	001	2,0					- 1				
		3,0 3,5	Student is able to use the acquire	ed knowledge at a	basic level to so	live mathematic	al proble	ems.			
		4,0									
		4,5									
		5,0									
Other socia	al com	petence	es								
MSE_1A_B01_I		2,0									
		3,0	The student understands the nee	ed for continuous e	ducation and tra	aining at a basic	level.				
		3,5									
		4,0									
		4,5									
		5,0									
Required re	eading	1									
1. Tom M. A	postol,	Calculus	s Vol. I, Juohn Wiley & Sons, h	ttps://www.dorad	ci.com.br/dow	nloads/matem	atica/A	postol_	Calculus	_vol-1.p	odf
2. Paul Daw	kins, Ca	alculus I,	, https://notendur.hi.is/adl2/Ca	alcl_Complete.pd	lf						
3. Michael T	rott, Th	e Mathe	ematica GuideBook for Symbo	lics, https://link.s	springer.com/l	book/10.1007,	/0-387-2	28815-5	5		
Supplemer	ntary r	eading									

1. Jeffrey Lockshin, Calculus: theory, examples, exercises, https://pokrovka11.files.wordpress.com/2012/10/calculus.pdf

Field of									
	study	Mate	rials Scienc	e and Engineeri	ng				
Mode of	f study	stati	onary	Level		first c	zycle	\./TT:L	
Graduat	te's qualification	inżyr	nier	I				WTil	Ch
Fields o	f science	engi	neering and	technology					_
Disciplir	nes of science	mate	erials engine	ering (100%)					
-	onal profile		ral academ						
Module	,								
Course	unit	Mat	hematics 2	•					
Code			1A_S_B01b						
	specialisation								C
	stering faculty	Stud	ium Matema	atyki					
ECTS		4,0		ECTS (forms)		4,0			
	f course credit		nination	Language		english			
Elective		exai				english		4	
				Elective group					
Form of	finstruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
lecturin	g course	A	2	30	2	0	0,41	К	credits
lecture		W	2	30	2	0	0,59	К	examination
Leading	teacher	Iglev	vska-Nowak	llona (llona.lgle	wska-N	owak@	zut.edu.pl)		
Other te	eachers	Iglev	vska-Nowak	llona (llona.lgle	wska-N	owak@	zut.edu.pl)		
Prerequ	iisites								
W-1	Mathematics I.								
Module	/course unit objective	es							
C-1	The target is that t	he stu	dents have k	nowledge and abil	ities to	use mati	nematical metho	ods to describing	physical and
C-2	chemical processes			-	athemat	ical tools	s necessary for	further studies.	
C-2	Awareness of the n	eeu o	Tall and syst	ematic work.					
1									
	content divided into								
T-A-1	Exercise solving an				s from t	he lectu	re.		26
Т-А-1 Т-А-2	Exercise solving an Tests.	d prot	olem discussio	on regarding topic				ODE with	26 4
T-A-1 T-A-2 T-W-1	Exercise solving an Tests. Ordinary differentia constant coefficien	d prot al equa ts.	olem discussion	on regarding topic				ODE with	26 4 4
T-A-1 T-A-2 T-W-1 T-W-2	Exercise solving an Tests. Ordinary differentia constant coefficien Differentiation of fu	d prot al equa ts. unctior	blem discussion ations of the f hs of many va	on regarding topic first order: Bernou nriables.	lli equat	ion. Sec	ond order linear	ODE with	26 4 4 2
T-A-1 T-A-2 T-W-1 T-W-2 T-W-3	Exercise solving an Tests. Ordinary differentia constant coefficien Differentiation of fu Partial differential e	d prot al equa ts. unctior equation	ations of the f ns of many va ons of the firs	on regarding topic first order: Bernou ariables. st and second orde	lli equat er with c	ion. Sec onstant	ond order linear	ODE with	26 4 4 2 6
T-A-1 T-A-2 T-W-1 T-W-2 T-W-3 T-W-4	Exercise solving an Tests. Ordinary differentia constant coefficien Differentiation of fu Partial differential e Linear algebra: ope	al equa ts. unctior equation	ations of the f ns of many va ons of the firs	on regarding topic first order: Bernou ariables. st and second orde	lli equat er with c	ion. Sec onstant	ond order linear	ODE with	26 4 4 2 6 8
T-A-1 T-A-2 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5	Exercise solving an Tests. Ordinary differentia constant coefficien Differentiation of fu Partial differential e Linear algebra: ope Dimensional analys	al equa ts. unctior equation	ations of the f ns of many va ons of the firs	on regarding topic first order: Bernou ariables. st and second orde	lli equat er with c	ion. Sec onstant	ond order linear	ODE with	26 4 4 2 6 8 8 2
T-A-1 T-A-2 T-W-1 T-W-2 T-W-3 T-W-4	Exercise solving an Tests. Ordinary differentia constant coefficien Differentiation of fu Partial differential of Linear algebra: ope Dimensional analys Error function.	d prok al equa ts. unctior equation sis.	ations of the f ations of the f as of many va ons of the firs s on vectors	on regarding topic first order: Bernou ariables. and second orde and matrices, solv	lli equat er with c ring line	ion. Sec onstant ar equat	ond order linear coefficients. ion systems.		26 4 4 2 6 8
T-A-1 T-A-2 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7	Exercise solving an Tests. Ordinary differentia constant coefficien Differentiation of fu Partial differential e Linear algebra: ope Dimensional analys Error function. Probability, standar	d prob al equa ts. unctior equation sis. rd dist	ations of the f ns of many va ons of the firs s on vectors ributions, var	on regarding topic first order: Bernou ariables. and second orde and matrices, solv	lli equat er with c ring line	ion. Sec onstant ar equat	ond order linear coefficients. ion systems.		4 4 2 6 8 2 2 2 6
T-A-1 T-A-2 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 Student	Exercise solving an Tests. Ordinary differentia constant coefficien Differentiation of fu Partial differential of Linear algebra: ope Dimensional analys Error function. Probability, standar	d prob al equa ts. unction equation sis. rd dist	ations of the f ations of the f as of many va ons of the firs s on vectors ributions, var	on regarding topic first order: Bernou ariables. and second orde and matrices, solv	lli equat er with c ring line	ion. Sec onstant ar equat	ond order linear coefficients. ion systems.		26 4 4 2 6 8 2 2 2 6 <i>Number of hours</i>
T-A-1 T-A-2 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 Student A-A-1	Exercise solving an Tests. Ordinary differentia constant coefficien Differentiation of fu Partial differential of Linear algebra: ope Dimensional analys Error function. Probability, standar tworkload - forms of Participation in rect	d prob al equa ts. inctior equation sis. rd dist	ations of the f ns of many va ons of the firs s on vectors ributions, var <i>ity</i>	on regarding topic first order: Bernou ariables. and second orde and matrices, solv iance, standard de	lli equat er with c ring line	ion. Sec onstant ar equat	ond order linear coefficients. ion systems.		26 4 4 2 2 6 8 8 2 2 2 2 6 <i>Number of hours</i> 30
T-A-1 T-A-2 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 Student	Exercise solving an Tests. Ordinary differential constant coefficien Differentiation of fu Partial differential e Linear algebra: ope Dimensional analys Error function. Probability, standar tworkload - forms of Participation in rect Individual work: ex	d prob al equa ts. inctior equation sis. rd dist	ations of the f ns of many va ons of the firs s on vectors ributions, var <i>ity</i>	on regarding topic first order: Bernou ariables. and second orde and matrices, solv iance, standard de	lli equat er with c ring line	ion. Sec onstant ar equat	ond order linear coefficients. ion systems.		26 4 4 2 6 8 2 2 2 6 <i>Number of hours</i>
T-A-1 T-A-2 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-5 T-W-6 T-W-7 Student A-A-1 A-A-2	Exercise solving an Tests. Ordinary differentia constant coefficien Differentiation of fu Partial differential of Linear algebra: ope Dimensional analys Error function. Probability, standar tworkload - forms of Participation in rec	d prob al equa ts. inctior equation sis. rd dist	ations of the f ns of many va ons of the firs s on vectors ributions, var <i>ity</i>	on regarding topic first order: Bernou ariables. and second orde and matrices, solv iance, standard de	lli equat er with c ring line	ion. Sec onstant ar equat	ond order linear coefficients. ion systems.		26 4 4 2 2 6 8 2 2 2 2 6 <i>Number of hours</i> 30 24
T-A-1 T-A-2 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 Student A-A-1 A-A-2 A-A-3	Exercise solving an Tests. Ordinary differentia constant coefficien Differentiation of fu Partial differential of Linear algebra: ope Dimensional analys Error function. Probability, standar t workload - forms of Participation in rect Individual work: ex Consultation.	d prob al equa ts. unction equation sis. rd dist <i>activ</i> itation ercise	ations of the f ns of many va ons of the firs s on vectors ributions, var <i>ity</i>	on regarding topic first order: Bernou ariables. and second orde and matrices, solv iance, standard de	lli equat er with c ring line	ion. Sec onstant ar equat	ond order linear coefficients. ion systems.		26 4 4 2 2 6 8 2 2 2 6 <i>Number of hours</i> 30 24 4
T-A-1 T-A-2 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-5 T-W-6 T-W-7 Student A-A-1 A-A-1 A-A-2 A-A-3 A-A-4	Exercise solving an Tests. Ordinary differentia constant coefficien Differentiation of fu Partial differential e Linear algebra: ope Dimensional analys Error function. Probability, standar tworkload - forms of Participation in rect Individual work: ex Consultation. Final test.	d prot al equa ts. unction equation sis. rd dist <i>activ</i> itation ercise	ations of the f ations of the f ns of many va ons of the firs s on vectors ributions, var <i>ity</i> s solving and t	irst order: Bernou iriables. and second orde and matrices, solv iance, standard de est preparation.	lli equat er with c ring line	ion. Sec onstant ar equat	ond order linear coefficients. ion systems.		26 4 4 2 2 6 8 8 2 2 2 6 8 7 2 6 8 8 2 2 2 6 8 7 2 4 4 2 2 4 4 2 2
T-A-1 T-A-2 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-6 T-W-5 T-W-6 T-W-7 Student A-A-1 A-A-2 A-A-3 A-A-4 A-W-1	Exercise solving an Tests. Ordinary differentia constant coefficien Differentiation of fu Partial differential of Linear algebra: ope Dimensional analys Error function. Probability, standar tworkload - forms of Participation in rect Individual work: ex Consultation. Final test. Lecture participatio	d prot al equa ts. unction equation sis. rd dist <i>activ</i> itation ercise	ations of the f ations of the f ns of many va ons of the firs s on vectors ributions, var <i>ity</i> s solving and t	irst order: Bernou iriables. and second orde and matrices, solv iance, standard de est preparation.	lli equat er with c ring line	ion. Sec onstant ar equat	ond order linear coefficients. ion systems.		26 4 4 2 2 6 8 2 2 2 2 6 8 2 2 6 8 2 2 30 24 4 2 30
T-A-1 T-A-2 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-5 T-W-6 T-W-7 Student A-A-1 A-A-2 A-A-3 A-A-4 A-W-1 A-W-2 A-W-3 A-W-3	Exercise solving an Tests. Ordinary differential constant coefficien Differentiation of fu Partial differential of Linear algebra: ope Dimensional analys Error function. Probability, standard tworkload - forms of Participation in rect Individual work: ex Consultation. Final test. Lecture participation Individual study of	d prob al equa ts. unction equation sis. rd dist ration ercise	ations of the f ations of the f ns of many va ons of the firs s on vectors ributions, var <i>ity</i> s solving and t	irst order: Bernou iriables. and second orde and matrices, solv iance, standard de est preparation.	lli equat er with c ring line	ion. Sec onstant ar equat	ond order linear coefficients. ion systems.		26 4 4 2 2 6 8 2 2 2 2 30 6 <i>Number of hours</i> 30 24 4 2 2 30 24 4 2 30 24 30 24 8 30 24 8 30 24 30 24 30 30 24 8 30 30 24 8 30 8 30 8 30 8 30 8 30 8 30 8 8 8 8 8
T-A-1 T-A-2 T-W-1 T-W-2 T-W-3 T-W-3 T-W-3 T-W-5 T-W-5 T-W-5 T-W-5 T-W-7 Student A-A-1 A-A-2 A-A-3 A-A-4 A-W-1 A-W-2 A-W-3	Exercise solving an Tests. Ordinary differentia constant coefficien Differentiation of fu Partial differential e Linear algebra: ope Dimensional analys Error function. Probability, standar tworkload - forms of Participation in rect Individual work: ex Consultation. Final test. Lecture participatio Individual study of Consultations.	d prob al equa ts. unction equation sis. rd dist ration ercise	ations of the f ations of the f ns of many va ons of the firs s on vectors ributions, var <i>ity</i> s solving and t	irst order: Bernou iriables. and second orde and matrices, solv iance, standard de est preparation.	lli equat er with c ring line	ion. Sec onstant ar equat	ond order linear coefficients. ion systems.		26 4 4 2 2 6 8 2 2 2 6 7 2 6 8 7 2 4 2 6 8 7 2 4 2 2 30 24 4 2 30 14 7
T-A-1 T-A-2 T-W-1 T-W-3 T-W-3 T-W-5 T-W-6 T-W-7 Student A-A-1 A-A-2 A-A-3 A-A-4 A-W-1 A-W-2 A-W-3 A-W-5	Exercise solving an Tests. Ordinary differentia constant coefficien Differentiation of fu Partial differential of Linear algebra: ope Dimensional analys Error function. Probability, standar tworkload - forms of Participation in reci Individual work: ex Consultation. Final test. Lecture participatio Individual study of Consultations. Preparation for the	d prob al equa ts. unction equation sis. rd dist ration ercise	ations of the f ations of the f ns of many va ons of the firs s on vectors ributions, var <i>ity</i> s solving and t	irst order: Bernou iriables. and second orde and matrices, solv iance, standard de est preparation.	lli equat er with c ring line	ion. Sec onstant ar equat	ond order linear coefficients. ion systems.		26 4 4 2 2 6 8 2 2 2 2 30 6 <i>Number of hours</i> 30 24 4 2 2 30 24 4 2 30 24 30 24 8 30 24 8 30 24 30 24 30 30 24 8 30 30 24 8 30 8 30 8 30 8 30 8 30 8 8 8 8 8 8 8
T-A-1 T-A-2 T-W-1 T-W-3 T-W-3 T-W-5 T-W-6 T-W-7 Student A-A-1 A-A-2 A-A-3 A-A-4 A-W-1 A-W-2 A-W-3 A-W-5	Exercise solving an Tests. Ordinary differentia constant coefficien Differentiation of fu Partial differential e Linear algebra: ope Dimensional analys Error function. Probability, standar tworkload - forms of Participation in rect Individual work: ex Consultation. Final test. Lecture participatio Individual study of Consultations. Preparation for the The exam.	d prob al equa ts. unction equation sis. rd dist <i>activ</i> itation ercise	ations of the f ations of the f as of many va ons of the firs s on vectors ributions, var <i>ity</i> s solving and t e notes and g cheory and sa	irst order: Bernou irist order: Bernou ariables. it and second orde and matrices, solv iance, standard de est preparation. iven literature.	lli equat er with c ring line	ion. Sec onstant ar equat	ond order linear coefficients. ion systems.		26 4 4 2 2 6 8 2 2 2 2 30 6 <i>Number of hours</i> 30 24 4 2 2 30 24 4 2 30 24 30 24 8 30 24 30 24 30 30 24 30 30 24 30 30 30 30 30 30 30 30 30 30 30 30 30

Faculty of Chemical Technology and Engineering

Evaluation	metho	ods (F -	progressive, P - final)							
S-1	Р	Written	i exam.							
5-2	Р	Exercis	e tests.							
S-3	F	Lecture	e: based on discussions. Traini	ing: based on so	lved exercises					
	Desigr	ned lear	rning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course content	Teaching methods	Evaluation methods
Knowledge	1			1				1		
MSE_1A_B01b	W01	itions the	eorem and calculation methods.	MSE_1A_W01	P6S_WG P6S_WK	P65_WG	C-1	T-W-4	M-1	S-1 S-3
Skills	ac denni	itions, the			P05_WK	_				5-5
MSE_1A_B01b	y the me		ught in the course and found in ns.	MSE_1A_U02	P6S_UW		C-1	T-A-1 T-W-4	M-1 M-2	S-1 S-2 S-3
Social com	peteno	ces								
MSE_1A_B01b Is aware of the		of further	study and systematic work.	MSE_1A_K02	P6S_KK	P6S_WK	C-2	T-A-1 T-W-4	M-1 M-2	S-1 S-2 S-3
Outcom	nes	Grade		E	valuation cr	iterion				
Knowledge			•							
MSE_1A_B01b	W01	2,0								
		3,0	Student demonstrates basic know	wledge of mathema	atics.					
		3,5								
		4,0 4,5								
		<i>4,5</i> <i>5,0</i>								
Skills		0,0								
MSE_1A_B01b	U01	2,0								
	-	3,0	Student is able to use the acquire	ed knowledge at a	basic level to so	lve mathematic	al proble	ems.		
		3,5								
		4,0								
		4,5								
<u></u>		5,0								
Other socia			es							
MSE_1A_B01b	_K01	2,0								
		3,0	The student understands the nee	ed for continuous e	ducation and tra	aining at a basic	level.			
		3,5 4,0								
		4,5								
		5,0								
Required re	eadino		1							
	-		s Vol. I, Juohn Wiley & Sons, h	ttps://www.dorad	ci.com.br/dowi	nloads/matem	atica/A	postol Calculus	vol-1.r	odf
			rential Equations for Engineer	•				-		
3. Volker Sir	non, Be	ernhard	Weigand, and Hassan Gomaa ds/2017_Book_DimensionalAr	, Dimensional An	alysis for Eng					
			George C. Runger, Applied St			gineers,				

http://www.um.edu.ar/math/montgomery.pdf

Field of s								7	
	tudy	Mate	erials Scienc	e and Engineeri	ng				
Mode of s	study	stati	ionary	Level		first c	ycle		~ 1
Graduate	's qualification	inży	nier					WTil(Ch
Fields of :	science	engi	neering and	technology					
Discipline	es of science	-	-	ering (100%)					
-	nal profile		eral academ						
Module		gen							
Course u	nit	Phy	sics of Mat	orials					
Code		-	1A_S_B02						
	nacialization	INSE.	_IA_3_B02						C
	pecialisation	Dam							
	ering faculty	-		lanomaterials Pl	nysicoo		-y		
ECTS		12,0		ECTS (forms)		12,0		-	
	ourse credit	exar	nination	Language		english		_	
Electives				Elective group					
Form of i	nstruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
lecturing	course	Α	1	45	4	,0	0,30	К	credits
laborator	y course	L	1	30	3	,0	0,30	К	credits
lecture		w	1	45	5	,0	0,40	К	examination
Leading t	eacher	Mijo	wska Ewa (E	wa.Borowiak-Pa	len@z	ut.edu.p	bl)	•	
Other tea		Pale		ztof (Krzysztof.L bl), Szymczyk Ar zut.edu.pl)					
Prerequis W-1	Knowledge of the b	asic c	ourse in math	ematics and phys	ics at t		ntary level		
						le eleme			
	OURSE UNIT OBJECTIVE		owlodgo in th	o area of fundam	ontal nh	iscics an	d skills to ovalo	ro fundamental n	roportios of
C-1	materials		lowledge in th						Toperties of
Course co	ontent divided into	vario	ous forms of	instruction					Number of hours
T-A-1	Heat (determinatio determination of he radiation)	n of D eat co	ebye tempera nduction; use	ature and specific of Stefan's law ar	heat ca nd Wien	pacity; a 's law in	pplication of Fo	urier's law in	
T-A-2	Thermodynamics (calcul					the calculation	of heat	5
							s; efficiency of	of heat	5
Т-А-З	Temperature (expr	peffici	ents of perfor	mance for heat pu	imps an	d refrige	s; efficiency of a rators)	of heat an engine;	
Т-А-3 Т-А-4		oeffici essing	ents of perfor g temperature	mance for heat pu	imps an	d refrige	s; efficiency of a rators)	of heat an engine;	4
	Temperature (expr liquids)	pefficio essing tructu	ents of perfor g temperature re factor	mance for heat pu	ımps ar s, calcu	d refrige lation of	s; efficiency of a rators)	of heat an engine;	4
T-A-4	Temperature (expr liquids) Determination of st	efficie essing tructu g of x	ents of perfor y temperature re factor -ray diffractio	mance for heat pu in different scale n patter in Powde	imps an s, calcu rcell sof	d refrige lation of tware	s; efficiency of a rators)	of heat an engine;	4
Т-А-4 Т-А-5	Temperature (expr liquids) Determination of st Computer modellin	tructu g of x g ap l	ents of perfor g temperature re factor -ray diffractio basing on exp	mance for heat pu in different scale n patter in Powde erimental data, di	imps ar s, calcu rcell sof scussio	d refrige lation of tware	s; efficiency of rators) thermal expans	of heat an engine; ion of solids and	4 5 2 2
Т-А-4 Т-А-5 Т-А-6	Temperature (expr liquids) Determination of st Computer modellin Calculation of band	efficie essing tructu g of x l gap l terials	ents of perfor y temperature re factor -ray diffractio basing on exp s - case stydy	mance for heat pu in different scale n patter in Powde erimental data, di based on carbon	imps ar s, calcu rcell sof scussio	d refrige lation of tware	s; efficiency of rators) thermal expans	of heat an engine; ion of solids and	4 5 2 2 4
Т-А-4 Т-А-5 Т-А-6 Т-А-7	Temperature (expr liquids) Determination of st Computer modellin Calculation of band Defects in solid ma	essing tructu g of x I gap I terials	ents of perfor g temperature -ray diffractio basing on exp s - case stydy ntum number	mance for heat pu in different scale n patter in Powde erimental data, di based on carbon s - analysis	imps ar s, calcu rcell sof scussio materia	d refrige lation of tware	s; efficiency of rators) thermal expans	of heat an engine; ion of solids and	4 5 2 2 4 4 5
T-A-4 T-A-5 T-A-6 T-A-7 T-A-8 T-A-9 T-A-10	Temperature (expr liquids) Determination of st Computer modellin Calculation of band Defects in solid ma Physical meaning o	efficience essing tructu g of x l gap l terials of quan specti	ents of perfor g temperature -ray diffractio basing on exp s - case stydy ntum number rum and role of	mance for heat pu in different scale n patter in Powde erimental data, di based on carbon s - analysis	imps ar s, calcu rcell sof scussio materia	d refrige lation of tware	s; efficiency of rators) thermal expans	of heat an engine; ion of solids and	4 5 2 2 4 5 5 5
T-A-4 T-A-5 T-A-6 T-A-7 T-A-7 T-A-8 T-A-9 T-A-10 T-A-11	Temperature (expr liquids) Determination of st Computer modellin Calculation of band Defects in solid ma Physical meaning o Analysis of atomic summary and test	befficionessing tructuring of x I gap I terials of quan spectricals	ents of perfor g temperature -ray diffractio basing on exp s – case stydy ntum number rum and role o ecrum	mance for heat pu in different scale n patter in Powde erimental data, di based on carbon s - analysis of X-ray diffractior	imps ar s, calcu rcell sof scussio materia	d refrige lation of tware	s; efficiency of rators) thermal expans	of heat an engine; ion of solids and	4 5 2 2 4 4 5 5 5 5 5 5 3
T-A-4 T-A-5 T-A-6 T-A-7 T-A-8 T-A-9 T-A-10 T-A-11 T-A-11 T-L-1	Temperature (exprliquids)Determination of stComputer modellinCalculation of bandDefects in solid maPhysical meaning ofAnalysis of atomic stAnalysis of moleculsummary and testX-rays diffraction in	efficionessing tructuring of x I gap I terials of qual specturing lar spector	ents of perfor y temperature -ray diffractio basing on exp s - case stydy ntum number rum and role o ecrum	mance for heat pure in different scale in different scale n patter in Powde erimental data, di based on carbon s - analysis of X-ray diffraction f materials	imps ar s, calcu rcell sof scussio materia	d refrige lation of tware	s; efficiency of rators) thermal expans	of heat an engine; ion of solids and	4 5 2 2 2 4 4 5 5 5 5 5 5 3 3 5
T-A-4 T-A-5 T-A-6 T-A-7 T-A-7 T-A-7 T-A-9 T-A-10 T-A-10 T-A-11 T-L-1 T-L-2	Temperature (exprliquids)Determination of stComputer modellinCalculation of bandDefects in solid maPhysical meaning ofAnalysis of atomic stAnalysis of moleculsummary and testX-rays diffraction inDetermination of M	esfficionessing tructu g of x I gap I terials of qual spectri lar spe n char liller in	ents of perfor g temperature re factor -ray diffractio basing on exp s - case stydy ntum number rum and role of ecrum acterization of ndices of refle	mance for heat pure in different scale n patter in Powde erimental data, di based on carbon s - analysis of X-ray diffraction f materials xions of copper an	imps ar s, calcu rcell sof scussio materia	d refrige lation of tware n .ls - Ram	es; efficiency of erators) thermal expans	of heat an engine; ion of solids and s	4 5 2 2 2 4 4 5 5 5 5 5 5 3 3 5 5 5 5 5 5 5 5 5 5
T-A-4 T-A-5 T-A-6 T-A-7 T-A-8 T-A-9 T-A-10 T-A-11 T-L-1 T-L-1 T-L-2 T-L-3	Temperature (exprliquids)Determination of stComputer modellinCalculation of bandDefects in solid maPhysical meaning ofAnalysis of atomic stAnalysis of moleculsummary and testX-rays diffraction inDetermination of MDetermination of cur	esting essing tructu g of x I gap I terials of qual specti lar spe n char liller in rystall	ents of perfor g temperature -ray diffractio basing on exp s - case stydy ntum number rum and role o ecrum acterization o ndices of refle ographic stru	mance for heat pure in different scale n patter in Powde erimental data, di based on carbon s - analysis of X-ray diffraction f materials xions of copper an	imps ar s, calcu rcell sof scussio materia	d refrige lation of tware n .ls - Ram	es; efficiency of erators) thermal expans	of heat an engine; ion of solids and s	4 5 2 2 4 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5
T-A-4 T-A-5 T-A-6 T-A-7 T-A-8 T-A-9 T-A-10 T-A-11 T-L-1 T-L-2 T-L-3 T-L-4	Temperature (exprliquids)Determination of stComputer modellinCalculation of bandDefects in solid maPhysical meaning ofAnalysis of atomic stAnalysis of moleculsummary and testX-rays diffraction inDetermination of completermination of com	esficionessing tructu g of x g ap l terials of qual spectri lar spe n char liller in rystall charao	ents of perfor g temperature re factor -ray diffractio basing on exp s - case stydy ntum number rum and role of ecrum acterization of ndices of refle ographic stru cteristics	mance for heat pure in different scale in different scale n patter in Powde erimental data, di based on carbon s - analysis of X-ray diffraction f materials xions of copper and tat	imps ar s, calcu rcell sof scussio materia	d refrige lation of tware n .ls - Ram	es; efficiency of erators) thermal expans	of heat an engine; ion of solids and s	4 5 2 2 4 4 5 5 5 5 5 5 5 5 5 5 5 3
T-A-4 T-A-5 T-A-6 T-A-7 T-A-8 T-A-9 T-A-10 T-A-11 T-L-1 T-L-1 T-L-2 T-L-2 T-L-3 T-L-4 T-L-5	Temperature (exprliquids)Determination of stComputer modellinCalculation of bandDefects in solid maPhysical meaning ofAnalysis of atomic stAnalysis of moleculsummary and testX-rays diffraction inDetermination of crStudy of hallotron ofDetermination of th	esting tructu g of x I gap I terials of qua spectu lar spe n char liller in rystall charac	ents of perfor g temperature re factor -ray diffractio basing on exp s - case stydy ntum number rum and role of ecrum acterization of ndices of refle ographic stru cteristics th's magnetic	mance for heat pure in different scale in different scale n patter in Powde erimental data, di based on carbon s - analysis of X-ray diffraction f materials xions of copper and tate type and late field	Imps ar s, calcu rcell sof scussio materia	d refrige lation of tware n ils - Ram stant by	s; efficiency of a prators) thermal expans an data analysi X-ray diffractio	of heat an engine; ion of solids and s s n	4 5 2 2 4 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5
T-A-4 T-A-5 T-A-6 T-A-7 T-A-8 T-A-9 T-A-10 T-A-10 T-A-11 T-L-1 T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6	Temperature (exprliquids)Determination of stComputer modellinCalculation of bandDefects in solid maPhysical meaning ofAnalysis of atomic stAnalysis of moleculsummary and testX-rays diffraction inDetermination of MDetermination of thDetermination of thMeasurements of th	esting essing tructu g of x I gap I terials of qual spectronic lar spectronic lar	ents of perfor g temperature re factor -ray diffractio basing on exp s - case stydy ntum number rum and role of acterization of ndices of refle ographic stru cteristics th's magnetic pendence of r	mance for heat pure in different scale in different scale n patter in Powde erimental data, di based on carbon s - analysis of X-ray diffraction f materials xions of copper and take to the type and lat is field magnetic permeak	Imps ar s, calcu rcell sof scussio materia	d refrige lation of tware n ils - Ram stant by	s; efficiency of a prators) thermal expans an data analysi X-ray diffractio	of heat an engine; ion of solids and s s n	4 5 2 2 4 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5
T-A-4 T-A-5 T-A-6 T-A-7 T-A-8 T-A-9 T-A-10 T-A-11 T-L-1 T-L-1 T-L-2 T-L-2 T-L-3 T-L-4 T-L-5	Temperature (exprliquids)Determination of stComputer modellinCalculation of bandDefects in solid maPhysical meaning ofAnalysis of atomic stAnalysis of moleculsummary and testX-rays diffraction inDetermination of crStudy of hallotron ofDetermination of th	esfficionessing essing tructung of x I gap I terials of qual spectric lar spectric lar spectric	ents of perfor g temperature re factor -ray diffractio basing on exp s - case stydy ntum number rum and role of ecrum acterization of ndices of refle ographic stru cteristics th's magnetic pendence of r aboratory wo	mance for heat pure in different scale in different scale n patter in Powde erimental data, di based on carbon s - analysis of X-ray diffraction f materials xions of copper an cture type and lat field nagnetic permeabre rk	Imps ar s, calcu rcell sof scussio materia n nd iron tice cor	d refrige lation of tware n ils – Ram stant by	s; efficiency of a rators) thermal expans an data analysi X-ray diffraction nets on temper	of heat an engine; ion of solids and s s n n ature	4 5 2 2 4 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5

		Faculty of chem		ology all		eenn	iy			
Course co	ontent a	ivided into various forms of inst	ruction					Nun	nber o	f hours
T-W-2	conve	nternal energy, heat capacity and s tion, thermal radiation, phonos, hea	it transport in met	als and isolat	ors, calorimet	ry)				5
T-W-3	Therm heat p	odynamics (laws of thermodynamics umps)	s, thermodynamic	s functions, he	eat engines, re	efrigera	tors and			4
T-W-4		nce between amorphous, semi-crys	-	•						3
T-W-5	electro	ort properties: microscopic model o ns, Semiconductors								4
T-W-6		nic structure, fluorescence: atom m n transitions, fluorescence and spec		ire semicondu	ictors, electro	n orbita	lls,			3
T-W-7	Optica	l band gap, electron doping, spectro	photometry							4
T-W-8	Conde	nsed matter structure: Symmetry; c	rystallographic str	ucture types;	Bragg's equa	tion; dif	fraction			2
T-W-9		adiation; Powder X-ray diffractomet								2
T-W-10	Electri			2						
T-W-11	depen	e and its		1						
T-W-12	Hall ef effect,	a, Hall			2					
T-W-13	preces	nucleus, isotopes; - The phenomen sion; - Quantum and classical descri nd relaxation times; - Characteristic	ption of nuclear m	nagnetic resor	nance; - Chem	ical shit				2
T-W-14	Magne	tic susceptibility: Magnetic quantitie	s and units, Curie	-Weiss law, Fe	erro- and antif	erro-ma	agnetism			2
T-W-15	Partici	pation in the zero-term exam								4
Student w	vorkload	l - forms of activity						Nun	nber o	f hours
A-A-1		pation in recitations								45
A-A-2	-	ing for tests								45
A-A-3		ation for recitations								30
A-L-1	partici				30					
A-L-2	-	ation for laboratory exercises						1		
A-L-3		ation of reports								
A-L-4	· ·	ing for tests								
A-W-1		pation in lectures						4		
A-W-2		ual literature studies						4		
A-W-3	prepar	ing for the exam								60
A-W-4	Final e	xam								1
Teaching	method	ls / tools								
M-1	lecture	s with presentation								
M-2	subjec	t discussion during lectures, auditor	um excercises an	d laboratories						
M-3	self stu	ıdies								
Evaluatio	n metho	ods (F - progressive, P - final)								
S-1	Р	written exam								
5-2	F	written completion of exercises and	l laboratories							
S-3	F	laboratory reports								
5-4	F	student activity during auditory exe	ercise and labora	tories						
	Desigi	ned learning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course cor	e content Tea me		Evaluation methods
Knowledg	e									
engineer		ge useful to a materials science and	MSE_1A_W02	P6S_WG	P6S_WG	C-1	T-W-2 T- T-W-3 T- T-W-4 T- T-W-5 T- T-W-6 T-	-W-8 -W-9 -W-10 -W-11 -W-12 -W-13 -W-14	M-1	S-1
Skills							T-W-7 T	-W-14		<u> </u>

		Faculty of Chem	ical Techno	ology an	d Engin	eerii			1
MSE_1A_B02_U01 skills to explore the f	undamenta	al properties of materials	MSE_1A_U03	P6S_UW	P6S_UW	C-1	T-A-1 T-A-10 T-A-2 T-L-1 T-A-3 T-L-2 T-A-4 T-L-3 T-A-5 T-L-3 T-A-6 T-L-4 T-A-7 T-L-6 T-A-8 T-L-7 T-A-9 T-L-7	M-2 M-3	S-2 S-3 S-4
Social competer	nces								
MSE_1A_B02_K01 Is aware of the need	of further s	study and systematic work.	MSE_1A_K02	P65_KK	P6S_WK	C-1	$\begin{array}{ccccc} T-A-1 & T-L-7 \\ T-A-2 & T-W-1 \\ T-A-3 & T-W-2 \\ T-A-4 & T-W-3 \\ T-A-5 & T-W-3 \\ T-A-5 & T-W-4 \\ T-A-6 & T-W-5 \\ T-A-7 & T-W-6 \\ T-A-8 & T-W-7 \\ T-A-9 & T-W-7 \\ T-A-9 & T-W-7 \\ T-A-9 & T-W-7 \\ T-A-10 & T-W-8 \\ T-A-10 & T-W-8 \\ T-A-10 & T-W-9 \\ T-A-11 & T-W-10 \\ T-L-1 & T-W-11 \\ T-L-2 & T-W-12 \\ T-L-3 & T-W-13 \\ T-L-4 & T-W-14 \\ T-L-5 & T-W-15 \\ T-L-6 \\ \end{array}$	M-1 M-2	S-1 S-3
Outcomes	Grade		E	valuation cr	iterion				
Knowledge									
MSE_1A_B02_W01	2,0 3,0 3,5 4,0 4,5 5,0	from 50 to 55% of percentage p	oints						
Skills									
MSE_1A_B02_U01	2,0 3,0 3,5 4,0 4,5 5,0	from 50 to 55% of percentage p	oints						
Other social con		25							
4SE_1A_B02_K01	2,0	from 50 to 55% of percentage p	oints						

3. Yves Quere, Physics of Materials, CRC PRESS, 1998, ISBN 9789056991197

			<u> </u>													
Field of s	study	Mate	rials Scienc	e and Engineeri	ng											
Mode of	study	statio	onary	Level		first o	cycle	A/T:10	· I_							
Graduate	e's qualification	inżyr	nier					WTil	_n							
Fields of	science	engir	neering and	technology					_							
Disciplin	es of science	mate	erials engine	ering (100%)												
Educatio	onal profile	gene	ral academ													
Module	,															
Course u	ınit	Chemistry														
Code		-	1A_S_B03													
	specialisation								C							
	tering faculty	Dena	artment of l	norganic and Ar	alvtica	l Chemi	strv									
ECTS		11,0		ECTS (forms)	arytica	11,0	Joci y									
	course credit	-	nination													
		exan	lination	Language		english										
Electives	-	<u> </u>		Elective group					1							
Form of	instruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit							
lecturing	g course	A	2	30	2	,0	0,25	К	credits							
laborato	ry course	L	2	75	7	,0	0,50	К	credits							
lecture		W	2	30	2	,0	0,25	К	examination							
Leading	teacher	Toma	aszewicz Elź	zbieta (Elzbieta.	Tomas	zewicz@) 2ut.edu.pl)									
		Mate (Zbig	usz (Mateus niew.Rozwa	al.Pelka@zut.ed sz.Piz@zut.edu. adowski@zut.ed Struk@zut.edu.p	ol), Roz u.pl), S	wadow ośnicki	ski Zbigniew Jacek (Jacek.S	osnicki@zut.edu	pl), Struk							
Prerequi																
W-1	The basic knowled	ge of fi	undamental a	and inorganic chei	nistry a	s wel as	basic safety rule	:S								
Module/c	course unit objectiv															
C-1	Knowledge and un chemical reactions	derstar . classi	nding the bas ifications and	ic concepts and la characterisation	aws of in of inora	norganic anic and	and organic che	mistry: type of ch inds as well as the	emical bonds, Pir structure							
C-2	Knowledge of relat	-			5		3 1									
Course c	content divided into	vario	us forms of	instruction					Number of hours							
T-A-1	Equilibria in hetero								2							
T-A-2	Buffers: the contro	l of pH							2							
Т-А-З	Acid-base equilibria	a in sal	t solutions						2							
T-A-4	Equilibria in aqueo		•	•					2							
T-A-5	Coordination comp complexes.	ounds	and their nor	menclature. Equili	brium c	onstant	in aqueous solut	ions of	2							
T-A-6	Exercises in recogr formulas	nizing f	unctional gro	oups, naming orga	nic com	pounds	and writing their	structural	5							
T-A-7	Solving simple pro	blems	in organic ch	emistry			Solving simple problems in organic chemistry									
T-A-8	-	-	Average molecular weight of polymers - definition, basic equation													
T-A-9	Degree of polymer					3										
				-					2							
T-A-10		•	rium, catalys	is, reaction mech	anisms	tor Do		uisment								
	Chemical kinetics, Occupational healt Regulation and saf laboratory report p	h and s ety rul	rium, catalys safety in an i es in organic	is, reaction mech norganic chemistr	anisms y labora				2							
T-A-10 T-L-1 T-L-2	Occupational healt Regulation and saf laboratory report p Acid-base titrimetr	h and s ety rul repara y. Titra	rium, catalys safety in an i es in organic tion tion of HCI se	is, reaction mech norganic chemistr chemistry laborat	anisms y labora cory. Ba	sic labor	atory equipment		2 5 5 5							
T-A-10 T-L-1 T-L-2 T-L-3	Occupational healt Regulation and saf laboratory report p Acid-base titrimetr Qualitative analysi	h and s ety rul repara y. Titra s of ca	rium, catalys safety in an i es in organic tion ition of HCI so tions of I, II a	is, reaction mech norganic chemistr chemistry laborat plution. Determina nd III groups	anisms y labora cory. Ba	sic labor	atory equipment		2 5 5 5 10							
T-A-10 T-L-1 T-L-2	Occupational healt Regulation and saf laboratory report p Acid-base titrimetr	h and s ety rul repara y. Titra s of cat s of cat	rium, catalys safety in an i es in organic tion ition of HCI so tions of I, II a tions of IV an	is, reaction mech norganic chemistr chemistry laborat plution. Determina nd III groups	anisms y labora cory. Ba	sic labor	atory equipment		2 5 5 5							

		Faculty of chemi		ology all		cern	ig				
Course co	ontent a	livided into various forms of instru	uction					Nun	nber of	f hours	
T-L-6	Qualita	ative analysis of salts								5	
T-L-7	Detern	nination of melting and boiling points	. Simple and frac	tional distillat	ions					5	
T-L-8	Prepar	ation and purification of n-butyl aceta	ate by distillation	l						5	
T-L-9	Prepar	ation and purification of aspirin								5	
T-L-10	Prepar	ation and purification of p-bromoacet	anilide							5	
T-L-11	Prepar	ation and purification of dibenzyliden	eacetone							5	
T-L-12	Intrins	ic viscosity as a measure of average	molecular weigth	1					5		
T-L-13	Rheolo	gical behavior of polymers in melt							5		
T-L-14	Measu	rement of the rate of selected chemic	cal reactions							5	
T-W-1	Orbita	hybridization and molecular structur	е							4	
T-W-2	States	of matter - gases, liquids, plasma an	d solids							2	
T-W-3	Physic	al properties of solutions (Henry's law	ı, colligative prop	perties)						2	
T-W-4	Coordi	nation compounds and their nomencl	ature. Equilibria	in solutions of	f coordination	compo	unds			2	
T-W-5	Organi	c chemistry in life and science (an in	troduction)							1	
T-W-6	Basic r	ules of organic chemistry								2	
T-W-7	Overvi	ew of the structures and properties o	f basic functiona	l groups						7	
T-W-8	Intridu			2							
T-W-9	Mecha	nisms of polymerization reactions and	d polymers class	ification						3	
T-W-10	Inorga			3							
T-W-11	Chemi	cal kinetics								2	
Student v	workload	d - forms of activity						Nun	nber of	f hours	
A-A-1		pation in recitations								30	
A-A-2	study of literature										
A-A-3	consul		1								
A-L-1	partici		7								
A-L-2	study	of literature							5		
A-L-3	prepar	ation of written reports							5		
A-L-4	consul	tations							3		
A-W-1	partici	pation in lectures							30		
A-W-2	study	of literature								20	
A-W-3	consul	tations								10	
A-W-4	The ex	am								1	
Teaching	, method	ls / tools						-			
M-1	Lectur										
M-2	Discus										
M-3	Labs	3011									
		ods (F - progressive, P - final)									
S-1	P	Written exam (lecture)									
5-2	P	Continupus assessment: lab reports	and activity (lab	s)							
	Designed learning outcomes Reference to the learning outcomes designed for the fields of study PQF 6, 7 or 8 PQF 6, 7 or 8 PQF 6, 7 or 8 References Course objectives Course o										
Knowledg	ge										
MSE_1A_B03 Students ha and laws of	3_W01 as knowled chemistry inorganic	ge and understanding of basic concepts : type of reactions, characterisation of compounds, kinetics, chemical methods	MSE_1A_W02	P65_WG	P65_WG	C-1 C-2	T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6 T-A-7 T-A-8 T-A-9 T-A-10 T-W-1	T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 T-W-8 T-W-9 T-W-10 T-W-11	M-1 M-2 M-3	S-1	

Skills											
MSE_1A_B03_U01 Students are able to p measurements or com the obtained results a	nputer sin	nulations, as well as to interpret	MSE_1A_U03	P6S_UW	P6S_UW	C-2	T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7	T-L-8 T-L-9 T-L-10 T-L-11 T-L-12 T-L-13 T-L-14	M-1 M-2 M-3	S-2	
Social competent	ces										
		and work in a group also as a nding the need of learning	MSE_1A_K01 MSE_1A_K02	P6S_KK	P6S_WK	C-1	T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7	T-L-8 T-L-9 T-L-10 T-L-11 T-L-12 T-L-13 T-L-14	M-2 M-3	5-2	
Outcomes	Grade		E	valuation cri	iterion						
Knowledge	1	I									
MSE_1A_B03_W01	2,0 3,0 3,5 4,0 4,5 5,0	Min. 60% of scoring									
Skills	3,0										
MSE_1A_B03_U01	3,0 Positive grades of lab reports 3,5 4,0 4,5 5,0										
MSE_1A_B03_K01	2,0 3,0 3,5 4,0 4,5 5,0	Positive grades of lab reports									
Required reading	<i>y</i>										
1. Andrew F. Parson	ns, Keyn	otes in Organic Chemistry, Bla	ackwell Science,	2003							
2. John McMurry, O	rganic C	hemistry, Brooks/Cole, 2012,	8 ed								
3. John McMurry, O	rganic C	hemistry Solutions, Brook/Col	e, 2012, 8 ed								
4. James W. Zubric	k, The O	rganic Chemistry Survival Mar	nual, John Wiley	& Sons, 1988,	, 2 ed						
		G. Sharpe, Inorganic Chemistry on, M. J. Frazer, R. A. Y. Jones,			-		Group L	JK Limite	d, New	York,	
		nistry. Principles and Structure	<u> </u>								
		nic Chemistry. An Unified App				93					
9. G. L. Miessler, D.	. A. Tarr,	Inorganic Chemistry, Pearson	Education Inc.,	New Jersey, 2	2004						
Supplementary re	eading										
	-	Chemistry as a Second Langua			<u> </u>	-	ons, 20)08, 2 ed			
2. G. C. Hill, J. S. Ho	olman, C	hemistry in Context, Thomas	Nelson and Sons	Ltd., Wdinbu	rgh, UK, 19 <mark>8</mark> 9						

Field of st	udy		Mate	rials Scienc	e and Engineerii	ng				
Mode of s	tudy		statio	onary	Level		first c	ycle	VA/T:L	C h
Graduate'	s qualif	ïcation	inżyr	nier					WTil	Ch
Fields of s	cience		engir	neering and	technology				_	_
Discipline	s of scie	ence	mate	erials engine	ering (100%)					<u> </u>
Education	al profi	le	gene	ral academ	ic					
Module										
Course un	nit		Foreign Language 1							
Code			MSE_	_1A_S_B04a			C			
Field of sp	pecialisa	ation								
Administe	ering fac	culty	Stud	ium Językóv	v Obcych					
ECTS			6,0		ECTS (forms)		6,0			
Form of co	ourse ci	redit	exan	nination	Language		english			
Electives					Elective group					
Form of in	structio	on	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
foreign lar	nguage	course	LK	1	75	6	,0	1,00	К	examination
Leading te	eacher		Obst	awski Andrz	ej (Andrzej.Obst	awski	@zut.ed	u.pl)		
Other tead	chers		Dwoi	nik@zut.ed	ota.Koc@zut.edu u.pl), Stelmaszc rzyna.Waligorska	zyk Ma	arek (Ma			
Prerequisi	ites									
W-1	Baccal	aureate in a	langua	age at the ele	mentary or exten	ded lev	el.			
Module/cc		nit objective								
C-1				anguage in a Juage proficie	variety of everyd ency level.	ay situa	ations by	skillfully applyir	ng the rules of gr	ammar and
C-2		-	-		vocabulary consis	tent wit	h the fie	ld of study.		
С-3	Develo	p an awaren	ess of	the need for	continuous and a	utonom	ous learr	ning.		
Course co				us forms of						Number of hours
T-LK-1		t Simple, Pre do/ be/ have		Continuous, P	resent Perfect Sim	iple, Pa	st Simple	e. (Phrasal verb	s). Auxiliary	20
T-LK-2		Past/ Past C		ous						20
T-LK-3	Selecte	ed specialize	d voca	bulary in an	area consistent wi	th the s	student's	major.		35
Student w	orkload	l - forms of	activi	ity						Number of hours
A-LK-1	particip	pating in clas	sses							75
A-LK-2		ation for clas	ses							75
A-LK-3	consult									30
A-LK-4	The ex									1
Teaching	-									
M-1	•	al classes								
M-2	group									
INA J	nrocon	tation								
M-3 M-4	presen									
M-4	discuss	sion								
M-4 M-5	discuss work w	sion vith text	nsion							
M-4	discuss work w listenir	sion								
M-4 M-5 M-6 M-7	discuss work w listenir writing	sion rith text Ig comprehe formal lette	rs	ve. P - final)					
M-4 M-5 M-6 M-7	discuss work w listenir writing	sion rith text Ig comprehe formal lette	rs gressi	ve, P - final))					
M-4 M-5 M-6 M-7 Evaluatior	discuss work w listenir writing	sion ith text ig comprehe formal lette pds (F - prog	rs g <i>ressi</i> est (F))					
M-4 M-5 M-6 M-7 Evaluation S-1	discuss work w listenir writing	sion ith text og comprehe formal lette ods (F - prog diagnostic t	rs g <i>ressi</i> est (F))					

		,		55 -	5		<u> </u>			
Desigr	ned lear	ning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course co	ontent	Teaching methods	Evaluation methods
Knowledge			I							
Skills										
subjects in verbal and	written fo	at level B2 with a variety of orm and reads with orts concerning the contemporary	MSE_1A_U13	P6S_UU		C-1	T-LK-1	Г-LK-2	M-1 M-2 M-3 M-5 M-6 M-7	S-2
MSE_1A_A06-1a_U02 has the ability to unde vocabulary of his/her f	rstand te ield	xts and use the basic specialized	MSE_1A_U13	P6S_UU		C-2	T-LK-3		M-1 M-3 M-5	S-2 S-3 S-4
Social competend	ces									
MSE_1A_A06-1a_K01 understands the impor professional activities	tance of	language competence in future	MSE_1A_K01	P6S_KK	P6S_WK	C-3	T-LK-1 T-LK-2	Г-LK-З	M-1 M-2 M-4	S-2 S-3 S-4
Outcomes	Grade		E	Evaluation cri	iterion					
Knowledge	1									
Skills										
MSE_1A_A06-1a_U01	2,0									
	3,0	The student is able to communica	ate at a basic level	with various su	bjects in verbal	and writ	ten form.			
	3,5									
	4,0									
	4,5									
	5,0									
MSE_1A_A06-1a_U02	2,0									
	3,0	The student understands the bas	ic specialist vocab	ulary in their fiel	d and uses the	n to a lir	nited exte	nt.		
	3,5									
	4,0 4,5									
	4,5 5,0									
Other social com	-									
MSE_1A_A06-1a_K01	2,0	-5								
	3,0	The student recognizes the impo	rtanco of languago	competences in	futuro profoss	ional wo	rk			
	3,5			eompetences n						
	4,0									
	4,5									
	5,0									
Required reading	•									
-		ENGLISH, Pearson Longman	n, 2006							
	-	NEW CUTTING EDGE, Pearson	·	7						
Supplementary re			-							
		JSE OF ENGLISH, Macmillan, 2	2003							
		LISTENING AND SPEAKING, Ma								
		READING, Macmillan, 2003	2005							
		WRITING, Macmillan, 2003								
		aukowe z dziedziny studiowar	nego kierunku ?	011						
J. ATZ, TEKSLY POPL		autowe z uzieuziny studiowal								

T-LK-1Lifestyle depending on where you live. Forms of the future tense (going to; will; Present Continuous to express the future; modal verbs expressing the future). Grading of adjectives .10T-LK-2The role of the individual in economic processes. The first conditional period and time sentences. Modal verbs (must; have to; mustn't; should; shouldn't). Structure - question tags.10T-LK-3Self-realization and creativity. Passions, leisure time. The Present Perfect Simple and Continuous. Verb forms - infinitive / gerund. Countable / uncountable nouns.10T-LK-4Learning about foreign countries, their cultures, geographical phenomena during holiday travel. Past Perfect Simple in contrast to Past Simple. Different structures using the verb 'like'. Prepositions.10T-LK-5Education. The need for lifelong learning. Modal verbs indicating possibility (can; could; to be able; to manage). Past tense structures- used to/ would.10T-LK-6Selected specialized vocabulary in an area consistent with the student's major.10Student workload - forms of activityNumber of hour A-LK-210A-LK-2consultations10				- j			- 55 -		J	
Graduate's qualification inżynier Field of science engineering and technology Disciplines of science materials engineering (100%) Educational profile general academic Madule	Field of st	tudy	Mate	erials Scienc	e and Engineeri	ng				
Fields of science engineering and technology Disciplines of science materials engineering (100%) Educational profile general academic Module	Mode of s	tudy	stati	onary	Level		first o	cycle		C 1
Fields of science engineering and technology Disciplines of science materials engineering (100%) Educational profile general academic Module	Graduate	's qualification	inżyr	nier	I			-	WIII	Ch
Educational profile general academic Module		•			technology					
Module Foreign Language 2 Code MSE_1A_5_B04b Field of specialisation Administering faculty Studium Jezyków Obcych Administering faculty Studium Jezyków Obcych 4.0 FORM of course credit Credits Language english Electives Elective group Form of instruction Cod Semester Hours ECTS Weight Realization Credits Leading teacher Obstawski Andrzej (Andrzej) Obstawski Quzt.edu.pl) K Credits Credits Other teachers Dworik(&Qutt.edu.pl) Sewinska-Dwornik (Danna (Goanna Sowinska-Dwornik (Danna (Goanna (Goanna Sowinska-Dwornik (Danna (Goanna (Goanna (Goanna (Goann	Discipline	s of science	mate	erials engine	eering (100%)					
Administering faculty Studium Języków Obcych 4,0 ECTS (forms) 4,0 Form of course credit credits Language english Electives Elective group Form of instruction Cod Semester Hours ECTS Weight Realization Credits Leading teacher Obstawski Andrzej (Andrzej, Obstawski@zut.edu.pl) Koc Dorota (CorQuet.edu.pl) Waligorska@zut.edu.pl) Verequisites W-1 passes exam on Foreign language 1 Module/course unit objectives Number of hours Colourse (CorQuet.edu.pl) Kora Corota (CorQuet.edu.pl) Kora Corota (Corota (CorQuet.edu.pl) Colourse (Corota (Corot	Education	nal profile	gene	eral academ	ic					
Administering faculty Studium Języków Obcych 4,0 ECTS 4,0 ECTS (forms) 4,0 Form of course credit credits Language english Electives Elective group Encine Credits Form of instruction Cod Semester Hours ECTS Weight Realization Credit torigin language course LK 2 75 4.0 1.00 K credits Leading teacher Obstawski Andrzej (Andrzej).Obstawski@zut.edu.pl) Kor Dorota (Dorota, Sco@winkiska-Dwornik Joanna (Joanna Sowinska-Dwornik@zut.edu.pl), Svelimaszczyk Marek (Marek. Stelmaszczyk@zut.edu.pl), Waligórska Katarzyna (Katarzyna, Waligorska@zut.edu.pl) Katarzyna (Katarzyna, Waligorska@zut.edu.pl) Module/course unit objectives W-1 passes exam on Foreign language 1 Module/course unit objectives Module/course unit objectives Realization Number of hou C-2 Understand and use basic specialized vocabulary consistent with the field of study. C-3 Develop an awareness of the need for continuous and autonomous learning. Number of hou TLK-2 Understand and use to synessing the future -question tags. Number of hou 10 TLK-2 Unether t	Module									
Administering faculty Studium Języków Obcych 4,0 ECTS (forms) 4,0 Form of course credit credits Language english Electives Elective group Form of instruction Cod Semester Hours ECTS Weight Realization Credits Leading teacher Obstawski Andrzej (Andrzej, Obstawski@zut.edu.pl) Koc Dorota (CorQuet.edu.pl) Waligorska@zut.edu.pl) Verequisites W-1 passes exam on Foreign language 1 Module/course unit objectives Number of hours Colourse (CorQuet.edu.pl) Kora Corota (CorQuet.edu.pl) Kora Corota (Corota (CorQuet.edu.pl) Colourse (Corota (Corot	Course ur	nit	Fore	eign Langu	age 2					
Administering faculty Studium Języków Obcych 4,0 ECTS 4,0 ECTS (forms) 4,0 Form of course credit credits Language english Electives Elective group Encine Credits Form of instruction Cod Semester Hours ECTS Weight Realization Credit torigin language course LK 2 75 4.0 1.00 K credits Leading teacher Obstawski Andrzej (Andrzej).Obstawski@zut.edu.pl) Kor Dorota (Dorota, Sco@winkiska-Dwornik Joanna (Joanna Sowinska-Dwornik@zut.edu.pl), Svelimaszczyk Marek (Marek. Stelmaszczyk@zut.edu.pl), Waligórska Katarzyna (Katarzyna, Waligorska@zut.edu.pl) Katarzyna (Katarzyna, Waligorska@zut.edu.pl) Module/course unit objectives W-1 passes exam on Foreign language 1 Module/course unit objectives Module/course unit objectives Realization Number of hou C-2 Understand and use basic specialized vocabulary consistent with the field of study. C-3 Develop an awareness of the need for continuous and autonomous learning. Number of hou TLK-2 Understand and use to synessing the future -question tags. Number of hou 10 TLK-2 Unether t	Code		MSE	1A_S_B04b	-					
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A-LK-1 participation in class 75 A-LK-2 consultations 10 A-LK-3 study of literature and vocabulary 35 Teaching methods / tools 35 M-1 practical classes 75 M-2 group work 75 M-3 presentation 76 M-4 discussion 76 M-5 work with text 76 M-6 listening comprehension 77 M-7 writing formal letters 76	T-LK-6	Selected specialize	ed voca	abulary in an	area consistent w	ith the s	student's	s major.		25
A-LK-2 consultations 10 A-LK-3 study of literature and vocabulary 35 Teaching wethods / tools 35 M-1 practical classes 7 M-2 group work 7 M-3 presentation 7 M-4 discussion 7 M-5 writing formal letters 7	Student w	vorkload - forms o	factiv	ity						Number of hours
A-LK-3 study of literature and vocabulary 35 Teaching wethods / tools 1 M-1 practical classes 1 M-2 group work 1 M-3 presentation 1 M-4 discussion 1 M-5 work with text 1 M-6 listening comprehension 1 M-7 writing formal letters 1	A-LK-1	participation in cla	SS							75
Teaching methods / tools M-1 practical classes M-2 group work M-3 presentation M-4 discussion M-5 work with text M-6 listening comprehension M-7 writing formal letters										10
M-1 practical classes M-2 group work M-3 presentation M-4 discussion M-5 work with text M-6 listening comprehension M-7 writing formal letters	A-LK-3	study of literature	and vo	cabulary						35
M-2 group work M-3 presentation M-4 discussion M-5 work with text M-6 listening comprehension M-7 writing formal letters	Teaching	methods / tools								
M-3 presentation M-4 discussion M-5 work with text M-6 listening comprehension M-7 writing formal letters	M-1	practical classes								
M-4 discussion M-5 work with text M-6 listening comprehension M-7 writing formal letters										
M-5 work with text M-6 listening comprehension M-7 writing formal letters	-									
M-6 listening comprehension M-7 writing formal letters										
M-7 writing formal letters			ncion							
ראועמנוסח methods (F - progressive, P - final)		_			N					
	Evaluation	n metnods (F - pro	gressi	ive, P - final,)					

L			-					_			
	netho		progressive, P - final)								
S-1	F	-	stic test (F)								
5-2	F		test / colloquium (F)								
S-3	F	quiz (F									
S-4	F	present	tation (F)								
D	esigr	ned lear	rning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course	content	Teaching methods	Evaluation methods
Knowledge				1							
Skills											
MSE_1A_A06-2a has the ability t subjects in verb understanding a	o comr al and	written fo	at level B2 with a variety of orm and reads with or	MSE_1A_U13	P6S_UU		C-1	T-LK-1 T-LK-2 T-LK-3	T-LK-4 T-LK-5	M-1 M-2 M-3 M-5 M-6 M-7	5-2
MSE_1A_A06-2a has the ability t vocabulary of h	o unde	rstand te ield	xts and use the basic specialized	MSE_1A_U13	P6S_UU		C-2	T-LK-6		M-1 M-3 M-5	S-2 S-3 S-4
Social comp	etend	ces									
MSE_1A_A06-2a understands the professional act	e impo	rtance of	language competence in future	MSE_1A_K01	P6S_KK	P6S_WK	C-3	T-LK-1 T-LK-2 T-LK-3		M-1 M-2 M-4	S-2 S-3 S-4
Outcome	es	Grade		E	valuation cr	iterion					
Knowledge											
Skills											
MSE_1A_A06-2a	_U01	2,0									
		3,0	The student is able to communic	ate at a basic level	with various su	bjects in verbal	and writ	ten form			
		3,5									
		4,0 4,5									
		5,0									
MSE_1A_A06-2a	_U02	2,0									
		3,0	The student understands the bas	ic specialist vocab	ulary in their fie	ld and uses ther	m to a lir	nited ex	tent.		
		3,5									
		4,0									
		4,5 5,0									
Other social	com		<u>ا</u> مح								
MSE_1A_A06-2a		2,0									
		3,0	The student recognizes the impo	rtance of language	competences i	n future professi	ional wo	ſk.			
		3,5									
		4,0									
		4,5									
		5,0									
Required rea											
			_ ENGLISH, Pearson Longmar								
2. SCunning	ham,	P. Moor,	NEW CUTTING EDGE, Pearson	n Longman, 200	7						
Supplement	ary re	eading									
1. S. T. Knowl	es, M.	Mann, l	JSE OF ENGLISH, Macmillan, 2	2003							
			LISTENING AND SPEAKING, Ma	acmillan, 2003							
			READING, Macmillan, 2003								
			WRITING, Macmillan, 2003								
5. XYZ, Tekst	у рорі	ularno-n	aukowe z dziedziny studiowar	nego kierunku., 2	2011						

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Field of st	udy	Mate	erials Scienc	e and	Engineering							
Mode of s	tudy	stat	ionary		Level	first cy	cle	1.4	/T:I/	~ L		
Graduate	s qualification	inży	nier					V)	/Til(LN		
Fields of s	science	engi	ineering and	techn	ology							
Discipline	s of science	mat	erials engine	eering	(100%)						<u> </u>	
Education	al profile	gen	eral academ	ic								
Module												
Course ur	nit	Bas	ics of Scier	ntific I	nformation)	
Code		MSE	_1A_S_B05									
Field of sp	pecialisation										_	
Administe	ering faculty	Bibli	ioteka Główr	na								
ECTS		0,0		ECTS	(forms)	0,0						
Form of c	ourse credit	cred	lits	Lang	uage	english						
Electives				Electi	ive group							
Form of ir	struction	Cod	Semester	Н	lours	ECTS	Weight	Rea	alization		Crea	lit
lecture		W	2		2	0,0	1,00		К		credi	its
Leading to	eacher	Gryt	a Anna (Ann	a.Gryt	a@zut.edu.pl)				•		
Other tea	chers	Gryt	a Anna (Ann	a.Gryt	ta@zut.edu.pl), Jankowska	a Elżbieta (E	zbieta.	Jankowsk	a@z	ut.edu	.pl)
Prerequis	ites											
W-1	knowledge of comp	outer	and www serv	rices								
Module/co	burse unit objectiv	es										
C-1	learn that they can make a list of used of scientific work a entent divided into	litera nd the	ture independ e basics of cop	dently c byright	or with the use of law.					he et		spects
T-W-1	1. The information 2. Sources of scien - bibliogra - full-text - patent in 3. Access to license - passwor	and li tific ir aphic servic nform ed dat ds an rtual p s czecin graphy eating ng of base o	brary system formation and abstract of ces for books a ation abases outsid d access code private networ libraries, ZBC , bibliographi appendix bibli information in of ZUT researc	of ZUT databas and jou le ZUT s k c - West c footno liograph databa	ses Irnals - Polish ar network: t Pomeranian D otes hies ases 9.			multidis	ciplinary			2
Student w	vorkload - forms of	activ	vity							Num	nber of	f hours
A-W-1	participation in clas	sses										2
Teaching	methods / tools									•		
M-1	lecture											
Evaluatio	n methods (F - pro	gress	sive, P - final,)								
S-1	P Credit base	-										
	Designed learnin	g out	comes	c	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course con	tent	Teaching methods	Evaluation methods
Knowledg	е											

Z	acho	dniopomorski Uı	niwersvt	et Tech	nologia	znv	w Szc	zecini	e
		Faculty of Chemi	cal Techn	ology ar	nd Engin	eeriı	ng		
catalogs in which he/ or she knows techniq searching database r electronic journals ca licensed resources of use licensed databas network via VPN. He	she can so ues and w esources. In be avail ZUT. The es also fro or she kno are of the	rmation services and library earch materials for the thesis. He ways of formulating inquiries and He/she knows that full texts of lable within Open Access or in student knows that he/she can om computers outside the ZUT ows the rules of preparing lists of ethical aspects of scientific work	MSE_1A_W10	P65_WK	P6S_WG	C-1	T-W-1	M-1	S-1
Skills									
services and library of the thesis. He/she kn formulating queries a He/she knows how to may be available witi ZUT. He/she is able t from computers outs	catalogs in ows to ap and search access fu hin Open / o access li ide the ZL terature in	ppropriate databases, information which to search for materials for ply techniques and methods of ning resources of databases. Ill texts of electronic journals that Access or in licensed resources of icensed databases via VPN also JT network. He/she is able to ndependently or with the use of	MSE_1A_U13	P65_UU		C-1	T-W-1	M-1	S-1
Social competer	nces								
databases. Develops	skills of s	on environment of scientific cientific communication. Is aware ific work - knows the basics of	MSE_1A_K01	P65_KK	P65_WK	C-1	T-W-1	M-1	S-1
Outcomes	Grade		E	valuation cr	riterion				
Knowledge									
MSE_1A_A13_W01	2,0								
	3,0	not applicable							
	3,5								
	4,0								
1	4,5								
	5,0								
Skills									
MSE_1A_A13_U01	2,0								
	3,0	not applicable							
	3,5								
	4,0								
	4,5								
	5,0								
Other social con	-	es							
MSE_1A_A13_K01	2,0								
	3,0	not applicable							
	3,5								
	4,0 4,5								
	4,5								
Required readin		<u> </u>							

Required reading

1. PN-ISO 690 : 2012. Informacja i dokumentacja – Wytyczne opracowania przypisów bibliograficznych i powołań na zasoby informacji, 2012

2. Mazur-Kulesza K., Wierzbicka-Próchniak D., ABC tworzenia przypisów i bibliografii załącznikowej, SBP Zarząd Okręgu w Opolu, Opole, 2012, http://libra.ibuk.pl/book/42212

Field of s		Mahariata Caisa	and the state of t	na						
	tudy	Materials Scier	nce and Engineerir	.9						
Mode of s	study	stationary	Level	firs	t cycle		14/		~1	
Graduate	e's qualification	inżynier		I			W	Til	_h	
Fields of .	science	engineering ar	nd technology							
Discipline	es of science	materials engi	neering (100%)							_
Educatio	nal profile	general acade	mic							
Module										
Course u	nit	Ethics for En	gineers							
Code		MSE_1A_S_BO	-						C	
Field of s	pecialisation									
	ering faculty	Department of	f Chemical and Pro	cess Engine	ering				_	
ECTS		1,0	ECTS (forms)	1,0	0		-			
Form of c	course credit	credits	Language	engli	sh		-			
Electives			Elective group	- 5			-			
	Instruction	Cod Semeste		ECTS	1//	ight	Roal	ization	Cri	edit
lecture		W 2	15	1,0		.00	near	K		dits
	tooohor				I			1		0115
Leading t		-	nna.Story@zut.edu	-						
Other tea		Story Anna (Ar	nna.Story@zut.edu	.pr)						
Prerequis										
W-1	No prerequisites									
Module/c	ourse unit objecti		erstanding of the me	aning of ethi	cs in the e	naineer	ina profe	ssion. Stu	ident will b	pecome
Module/c C-1	The course is aim familiar with relev	ed at increase und ant moral theories s which engineers	erstanding of the me s, categories of ethica may encounter in th	al decision-m	aking, pro	fessiona	l codes o	of ethics a	nd various	s case
C-1	The course is aim familiar with relev studies - situation	ed at increase und 'ant moral theories s which engineers g.	s, categories of ethica may encounter in th	al decision-m	aking, pro	fessiona	l codes o	of ethics a e to maki	nd various	s case decision
C-1 Course co T-W-1	The course is aim familiar with relev studies - situation within engineerin ontent divided int	ed at increase und vant moral theories s which engineers g. o various forms o hics and Engineeri	s, categories of ethica may encounter in th	al decision-m eir professior	aking, pro nal life. Str	fessiona idents w	l codes o vill be abl	of ethics a e to maki	ind various ing ethical	decision
C-1 Course co	The course is aim familiar with relev studies - situation within engineerin ontent divided inte Introduction to Et Code of Ethics for	ed at increase und vant moral theories s which engineers g. o various forms of hics and Engineerin Engineers	s, categories of ethica may encounter in th of instruction ng Ethics - basic con	al decision-m eir professior cepts, ethical	aking, pro nal life. Str theories,	fessiona udents w moral d	il codes c vill be abl	of ethics a le to maki	ind various ing ethical	s case decision of hours
C-1 Course co T-W-1	The course is aim familiar with relev- studies - situation within engineerin ontent divided inte Introduction to Et Code of Ethics for Research Ethics a unethical treatme authorship	ed at increase und vant moral theories s which engineers g. o various forms of hics and Engineerin Engineers nd Integrity for En- nt of human-anima	s, categories of ethica may encounter in th of instruction ng Ethics – basic con gineers – falsification al research subjects,	al decision-m eir professior cepts, ethical of data, fabr hiding conflic	aking, pro hal life. Stu theories, ication of cts of inter	fessiona udents w moral d data, pla est, gho	I codes c vill be abl ilemmas agiarism, ostwriting	f ethics a e to maki	ind various ing ethical	decision of hours
C-1 Course co T-W-1 T-W-2	The course is aim familiar with relev- studies - situation within engineerin ontent divided inte Introduction to Et Code of Ethics for Research Ethics a unethical treatme authorship Professional Ethic	ed at increase und vant moral theories s which engineers g. o various forms of hics and Engineerin Engineers nd Integrity for En- nt of human-anima s and Integrity for	s, categories of ethica may encounter in th of instruction ng Ethics - basic con gineers - falsification	al decision-m eir professior cepts, ethical of data, fabr hiding conflic	aking, pro hal life. Stu theories, ication of cts of inter	fessiona udents w moral d data, pla est, gho	I codes c vill be abl ilemmas agiarism, ostwriting	f ethics a e to maki	ind various ing ethical	of hours
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C-1 Course co T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6	The course is aim familiar with relev- studies - situation within engineerin ontent divided inter- Code of Ethics for Research Ethics a unethical treatme authorship Professional Ethic design, deliberate Engineering Ethic including adaptiv Facing the potent encounter in their	ed at increase und vant moral theories s which engineers g. o various forms of hics and Engineerin Engineers nd Integrity for En- int of human-anima s and Integrity for e design faults s and Sustainabilit e design, green teo	s, categories of ethica may encounter in th of instruction ng Ethics – basic con gineers – falsification al research subjects, Engineers – fraud, co y – selected topics in choologies, economic	al decision-me eir profession cepts, ethical of data, fabr hiding conflic prruption, mis engineering issues, care	aking, pro hal life. Stu theories, ication of tts of inter managen ethics rel- for the er	fessiona udents w moral d data, pla est, gho nent, poo ated to s vironme	I codes c vill be abl ilemmas agiarism, ostwriting or produc sustainab	f ethics a e to maki	ind various ing ethical	of hours a of hours a 1 2 1 2 1 5
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C-1 Course co T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 Student v A-W-1 A-W-2	The course is aim familiar with relevent studies - situation studies - situation within engineerin ontent divided internation Introduction to Et Code of Ethics for Research Ethics au unethical treatment authorship Professional Ethic design, deliberate Engineering Ethic including adaptive Facing the potent encounter in their Written test workload - forms com Participation in cl Individual literatu	ed at increase und vant moral theories s which engineers g. o various forms of hics and Engineerin Engineers nd Integrity for Environ nt of human-anima s and Integrity for Environ s and Integrity for Environ a design faults s and Sustainability e design, green teo- ial ethical dilemma future profession of activity ass re studies and pres	s, categories of ethica may encounter in th of instruction ng Ethics – basic con gineers – falsification al research subjects, Engineers – fraud, co y – selected topics in choologies, economic	al decision-meir profession eir profession cepts, ethical of data, fabr hiding conflic prruption, mis engineering issues, care ferent situatio	aking, pro hal life. Stu theories, ication of tts of inter managen ethics rel- for the er	fessiona udents w moral d data, pla est, gho nent, poo ated to s vironme	I codes c vill be abl ilemmas agiarism, ostwriting or produc sustainab	f ethics a e to maki	nd various ing ethical Number	s case decision of hours 3 2 1 2 1 2 1 5 1 5 1 0f hours 15 8
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C-1 Course co T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 Student v A-W-1 A-W-2 A-W-3 A-W-4	The course is aim familiar with relev studies - situatior within engineerin ontent divided inter Introduction to Et Code of Ethics for Research Ethics a unethical treatme authorship Professional Ethic design, deliberate Engineering Ethic including adaptive Facing the potent encounter in their Written test workload - forms of Participation in cl Individual literatu Preparing for test	ed at increase und vant moral theories s which engineers g. o various forms of hics and Engineerin Engineers nd Integrity for En- int of human-anima s and Integrity for e design faults s and Sustainabilit e design, green teo ial ethical dilemma future profession of activity ass re studies and pres	s, categories of ethica may encounter in th of instruction ng Ethics – basic con gineers – falsification al research subjects, Engineers – fraud, co y – selected topics in chologies, economic as – case study of diff	al decision-meir profession eir profession cepts, ethical of data, fabr hiding conflic prruption, mis engineering issues, care ferent situatio	aking, pro hal life. Stu theories, ication of tts of inter managen ethics rel- for the er	fessiona udents w moral d data, pla est, gho nent, poo ated to s vironme	I codes c vill be abl ilemmas agiarism, ostwriting or produc sustainab	f ethics a e to maki	nd various ing ethical Number	s case decision of hours 3 2 1 2 1 2 1 5 1 5 1 0f hours 15 8
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Faculty of Chemical Technology and Engineering

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Knowledge										
MSE_1A_B06_W01 Student possesses a professional ethics ar		nowledge of the research and y for engineers.	MSE_1A_W10	P6S_WK	P6S_WG	C-1	T-W-1 T-W-2 T-W-3 T-W-4	T-W-5 T-W-6 T-W-7	M-1	S-1
Skills										
when confronted with work. Student is able	n engineer to assess ompliance	make informed ethical decisions ing problems in different types of the consequences and threats with the rules of professional	MSE_1A_U06	P65_UW	P6S_UW	C-1	T-W-2 T-W-3 T-W-4	T-W-5 T-W-6	M-1	5-2
Social competen	ices									
professionals. Studen	it has an ir	ities and responsibilities as nproved awareness and ability of Jes within an engineering	MSE_1A_K04	P65_KR		C-1	T-W-2 T-W-3 T-W-4	T-W-5 T-W-6	M-1	S-1 S-2
Outcomes	Grade		E	valuation cr	iterion					
Knowledge										
MSE_1A_B06_W01	2,0	Unacceptable understanding of co	ourse material							
	3,0	Serious deficiencies in understand	ding the core subj	ect material						
	3,5	Some deficiencies in understandi	ng the subject ma	terial						
	4,0	Some deficiencies in understandi	ng the core subjec	t material						
	4,5	Some mild deficiencies in Mastery	of subject mater	ial						
	5,0	Complete Mastery of subject mate	erial							
Skills										
MSE_1A_B06_U01	2,0	Unacceptable understanding of co	ourse material							
	3,0	Serious deficiencies in understand	ding the core subj	ect material						
	3,5	Some deficiencies in understandi	ng the subject ma	terial						
	, -	Some deficiencies in understandi								
	, -	Some mild deficiencies in Mastery		ial						
	5,0	Complete Mastery of subject mate	erial							
Other social com	petence	e <i>s</i>								
MSE_1A_B06_K01	2,0	Unacceptable understanding of co	ourse material							
	3,0	Serious deficiencies in understand								
	3,5	Some deficiencies in understandi								
	4,0	Some deficiencies in understandi								
	4,5	Some mild deficiencies in Mastery		ial						
	5,0	Complete Mastery of subject mate	eriai							
Required reading										
		tbook on professional ethics a								
2. C.E. Harris Jr., M ISBN: 978-0-495-5		hard, M.J. Rabins, Engineering	Ethics: Concept	s and Cases, 4	1th Edition, Ce	engage	Learnin	ıg, Wads	worth, 2	2009,
		eering Ethics, 4th Edition, Pre	ntice Hall, Uppe	r Saddle Rive	r, New Jersey,	2012, I	SBN: 97	78-0-13-2	214521	-3
Supplementary i	reading									
		. Bertha, Engineering Ethics: I	Real World Case	Studies, Ame	erican Society	of Civil	Engine	ers, 201	7, ISBN:	978-

0-7844-1467-5

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Field of st	tudy	Mate	erials Scienc	e and Engineeri	ng			
Mode of s	study	stati	onary	Level	first	cycle	\A/T:1/	~ L
Graduate	's qualification	inży	nier				WTil	LN
Fields of s	science	engi	neering and	l technology				
Discipline	es of science	mate	erials engine	eering (100%)			I _	_
Educatior	nal profile	gene	eral academ	ic				
Module								C
Course ui	nit	Tecl	hnology, La	aw and the Wo	rking Enviro	onment		
Code		MSE	1A_S_B07					
Field of s	pecialisation							
	ering faculty	Department of Catalytic and Sorbent Materials Engineering						
ECTS		1,0		ECTS (forms)	1,0			
	course credit	cred	its	Language	englis	h		
Electives				Elective group	chights		_	
	nstruction	Cod	Semester	Hours	ECTS	Waight	Realization	Credit
	IISUUCION				ECTS	Weight		
lecture		W	2	15	1,0	1,00	Z	credits
Leading t		-		ata.Tryba@zut.e	-			
Other tea	achers	Tryb	a Beata (Be	ata.Tryba@zut.e	edu.pl)			
Prerequis	sites							
W-1	The basic knowled	lge on i	the chemical	technology				
L								
Module/c	<i>ourse unit objectiv</i> The aim of this co	urse is		ne general oriental				
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C-1 Course cc T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 T-W-6 T-W-7 T-W-8 T-W-9 T-W-10 T-W-10 T-W-11 T-W-12 Student v A-W-1 A-W-2 A-W-3 A-W-4	ourse unit objectiv The aim of this contract of the technology, sate case of incompating the different work substances. ontent divided into Impact of the Envi Vienna Convention Geneva Convention Risks and mechan European Union di The Occupational Occupational Heal Employment law in The Toxic Substan Nuclear safety REACH regulation Nanotechnology in workload - forms o Participation in the Studies of the liter preparation for ex	urse is afety ar polity of ing env polity of ronme on and isms of irective Safety th and n a wor ices Co n law re f activ e lectur ature of am	nd man; the s f the work in t vironment and mus forms of ntal Law and protocols f accidents in es on industria and Health A Safety Manag rking environ introl Act egulations rity res connected wit	ne general oriental itudent will be awa the industrial syste d will know how to <i>instruction</i> EU Regulations on the industrial inst al safety .ct gement Systems ment	re responsibilit ems; students v asses the risk the developm	y for the work an vill be aware of th during working w	d some legal con le possible occur ith the toxic or da	Number of hours
C-1 Course cc T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 T-W-6 T-W-7 T-W-8 T-W-9 T-W-10 T-W-10 T-W-11 T-W-12 Student v A-W-1 A-W-2 A-W-3 A-W-4	ourse unit objectiv Ourse unit objectiv The aim of this contract of the technology, sate case of incompatilithe different work substances. Ontent divided into Impact of the Envi Vienna Convention Geneva Convention Risks and mechan European Union di The Toxic Substant Nuclear safety REACH regulation Nanotechnology in workload - forms o Participation in the Studies of the liter preparation for ex Concultations with	urse is afety ar polity of ing env polity of ronme n on and isms of irective Safety th and n a wor ces Co n law re f activ e lectur ature of am n the le	nd man; the s f the work in t vironment and mus forms of ntal Law and protocols f accidents in es on industria and Health A Safety Manag rking environ introl Act egulations rity res connected wit	ne general oriental itudent will be awa the industrial syste d will know how to instruction EU Regulations on the industrial inst al safety ct gement Systems ment th the classes	re responsibilit ems; students v asses the risk the developm	y for the work an vill be aware of th during working w	d some legal con le possible occur ith the toxic or da	Number of hours
C-1 Course cc T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 T-W-6 T-W-7 T-W-8 T-W-9 T-W-10 T-W-10 T-W-11 T-W-12 Student v A-W-1 A-W-2 A-W-3 A-W-4 Teaching M-1	ourse unit objectiv The aim of this con the technology, sa case of incompatil the different worki substances. ontent divided into Impact of the Envi Vienna Conventior Geneva Conventior Risks and mechan European Union di The Occupational Occupational Heal Employment law in The Toxic Substan Nuclear safety REACH regulation Nanotechnology in workload - forms o Participation in the Studies of the liter preparation for ex Concultations with methods / tools	urse is afety ar polity of ing envi- polity of ronme on and isms of irective Safety th and n a wor ices Co n law re f activ e lectur rature of am n the le medial	nd man; the s f the work in t vironment and ous forms of ntal Law and protocols f accidents in es on industria and Health A Safety Manag rking environ introl Act egulations rity res connected wit cturer	the general oriental student will be awa the industrial syste d will know how to instruction EU Regulations on the industrial inst al safety ct gement Systems ment th the classes	re responsibilit ems; students v asses the risk the developm	y for the work an vill be aware of th during working w	d some legal con le possible occur ith the toxic or da	Number of hours

Faculty of Chemical Technology and Engineering

						1	- <u> </u>		
Desig	gned lear	rning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes f or qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course content	Teaching methods	Evaluati method
Knowledge			•	•					<u> </u>
MSE_1A_B07_W01 has knowledge abou environment	t law and r	egulations at the working	MSE_1A_W09 MSE_1A_W10	P6S_WK	P65_WG	C-1	T-W-1 T-W-2 T-W-2 T-W-3 T-W-4 T-W-9 T-W-4 T-W-10	M-1	S-1
Skills							1	<u>I</u>	
		ons and OHS rules applicable in predict and asses the danger in	MSE_1A_U06	P6S_UW	P6S_UW	C-1	T-W-4 T-W-7 T-W-5 T-W-8 T-W-6 T-W-10	M-1	S-1
Social competer	nces								
MSE_1A_B07_K01 Is aware of responsit and their effect on th	oility for the	e taken decisions during work ded environment	MSE_1A_K05	P65_KR	P6S_WK	C-1	T-W-1 T-W-4 T-W-5 T-W-5 T-W-5 T-W-11 T-W-6 T-W-12	M-1	S-1
Outcomes	Grade		E	- Evaluation cr	iterion	1	<u></u>	L	<u></u>
Knowledge									
	3,0 3,5 4,0 4,5 5,0	Min 50% of score from a final tes	st						
Skills									
MSE_1A_B07_U01	2,0 3,0 3,5 4,0 4,5 5,0	Min 50% of score from a final tes	st						
Other social cor	npetence	es							
MSE_1A_B07_K01	2,0 3,0 3,5 4,0 4,5 5,0	Min 50% of score from a final tes	st						
Required readin	Ig								
2013		k) Pring, International Enviro						shers, E	3oston
		rles C. Caldart, Technology, L							
-		emicals Regulation, New Gove	ernance, Hybridit	y and REACH,	University Co	niege Lo	ondon, UK, 2015) 	
Supplementary									
1. J. C. Miller, R. S	errato, J.	M. Represas-Cardenas, G. Ku	ndahl, The Handl	book of Nanot	echnology. Bu	isiness,	Policy, and Inte	ellectua	1

1. J. C. Miller, R. Serrato, J. M. Represas-Cardenas, G. Kundahl, The Handbook of Nanotechnology. Business, Policy, and Intellectual Property Law, John Wiley & Sons, Inc., USA, 2005

2. G. Hunt, M. Mehta, Nanotechnology. Risk, Ethics and Law, 2000

Field of st	udy	Mate	erials Science	e and Engineerin	g							
Mode of st	tudy	stati	onary	Level		first cy	cle	3.4				
Graduate'	s qualification	inży	nier					N	/Til	Lr)	
Fields of s	cience	engi	neering and	technology								
Discipline	s of science	mat	erials engine	ering (100%)					_		_	
Education	al profile	gene	eral academi	с								
Module												
Course un	nit	Qua	lity Manag	ement and Bus	iness	Econom	ics					
Code		MSE	_1A_S_B08									
Field of sp	ecialisation											
Administe	ring faculty	Dep	artment of P	olymer and Biom	nateria	als Scienc	e					
ECTS		1,0		ECTS (forms)		1,0						
Form of co	ourse credit	cred	lits	Language		english						
Electives				Elective group								
Form of in	struction	Cod	Semester	Hours	EC	TS	Weight	Rea	alization		Crea	lit
lecture		W	2	15		,0	1,00		K	+	cred	
Leading te	eacher	FI Fr	av Mirosława	a (Miroslawa.ElFr				1				
Other tead			-	a (Miroslawa.ElFr		-						
					<u>عبى ر</u> د							
Prerequisi W-1	none											
	ourse unit obje											
C-1	The aim of the	e course is naking, and	to develop in s I the ability to	students a systema recognise, use and	atic ap d inter	proach to o pret econo	quality manag mic informatio	jement : on from	systems i both the	n proo organ	ducts de lisation	esign and
Course co	ntent divided	into vario	ous forms of i	instruction						Nur	nber o	f hours
T-W-1				n developemnt of	produc	cts (as exa	mple, ISO 134	85:201	6)			3
T-W-2	5		Validation of P			-1>						2
T-W-3 T-W-4				forecast, market la arations of conform								2
T-W-4	Risk Analysis				nty, ct	,						2
T-W-6	Business econ		•									4
Student w	⊥ vorkload - forn	ns of activ	vitv							Nur	nber o	fhours
A-W-1	participation i		,							l		15
A-W-2	individual stud		ure									10
A-W-3	consultations											5
Teaching	methods / too	ls										
M-1	Lecture with c											
Evaluatior	n methods (F ·	progress	ive, P - final)									
	P Final to											
S-1					1		Reference to					1
5-1	Designed lea	rning out	comes	Reference to the learning outcome designed for the fiel study	es Lea ds of for	Reference to irning Outcomes qualifications at PQF 6, 7 or 8	learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course co	ntent	Teaching methods	
	-	rning out	comes	learning outcome designed for the fiel	es Lea ds of for	rning Outcomes qualifications at	learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering		Course co	ntent		Evaluation methods
Knowledge MSE_1A_B08 knows the pri and business and the wide	e	t design ma ation from b	nagement syste	learning outcome designed for the fiel study	es Lea ds of for	rning Outcomes qualifications at	learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering		Course co	ntent		
Knowledge MSE_1A_B08 knows the pri and business and the wide Skills MSE_1A_B08	e W01 inciples of produc economic inform r environment pe	t design ma ation from b rspective	nagement syste oth the organisa	ms tion	es Lea ds of for 8	rning Outcomes qualifications at PQF 6, 7 or 8	learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering	objectives	T-W-1 T	-W-4 -W-5	methods	methods

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Social competer	ices									
MSE_1A_B08_K01 is ready to undertake organization	economic	driven decissions in	MSE_1A_K03	P6S_KO	P6S_WK	C-1	T-W-1 T-W-2 T-W-3	T-W-4 T-W-5 T-W-6	M-1	S-1
Outcomes	Grade		E	valuation cr	iterion					
Knowledge										
MSE_1A_B08_W01	2,0									
		Min 50% of score from a final t	test							
	3,5									
	4,0									
	4,5									
	5,0									
Skills										
MSE_1A_B08_U01	2,0									
	3,0	Positive grade of the final test	(more than 55% corr	ect answers)						
	3,5									
	4,0 4,5									
	5,0									
Other social com		25								
MSE_1A_B08_K01	2,0									
	3,0	positive grade of the final test	and exam (more than	n 55% correct a	nswers)					
	3,5									
	4,0									
	4,5									
	5,0									
Required reading	g					_				
1. Adam Smith, Th	e Wealth	of Nations, 2010								
1. selfmade mater	ials, 2020)								
2. Charles Kinderb	erger, Ma	anias, Panics, and Crashes,	2014							

							0		
Field of s	study	Mate	erials Scienc	e and Engineeri	ng				
Mode of	study	stati	onary	Level		first o	ycle	3 4 7	
Graduate	e's qualification	inży	nier					WTil	Ch
Fields of	science	engi	neering and	technology					
Discipline	es of science			eering (100%)					
•	nal profile	_	eral academ	-					
Module		gene							
		D:-1	f F						
Course u	Init	-	ogy for Eng	gineers					C
Code		MSE.	_1A_S_B09						
	specialisation								
Administ	ering faculty	Depa	artment of C	Chemical and Pro	ocess E	-	ring		
ECTS		3,0		ECTS (forms)		3,0			
Form of o	course credit	exar	nination	Language		english			
Electives	5			Elective group					
Form of i	instruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
lecturing	course	Α	2	30	1	,0	0,30	к	credits
	ry course	L	2	30		,0	0,30	ĸ	credits
lecture		W	2	30		,0 ,0	0,30	К	examination
								I. I	CXdIIIIIddioII
Leading	teacher			upak Agata (Aga			· · · ·	Coholowaki Dia	+
Other tea	achers		bolewski@z	upak Agata (Aga ut.edu.pl)	ага.ма	rowska	i@zut.edu.pi),	SODOIEWSKI PIO	
Prerequis	sites								
W-1	Finished course of	Intrdu	ction to Biolo	ду					
Module/c	course unit objectiv	es							
C-1	To introduce stude them aware of app examples.	nts to	modem biolo n of engineer	gy with an empha ing principles in bi	sis on e iology, a	volution and engi	of biology as a r neering robust s	nulti-disciplinary olutions inspired	field, to make by biological
Course c	ontent divided into	vario	us forms of	instruction					Number of hours
T-A-1	Mendel' Law testin								10
T-A-2	Hardy-Weinberg La	-	ting						6
Т-А-3	Chromosome Mapp	bing	-						4
T-A-4	Case studies from	literat	ure						10
T-L-1	Function of protein	s and	eznymes						4
T-L-2	Function of carboh	ydrate	S						4
T-L-3	Function o lipids.								4
T-L-4	DNA isolation from	plant	cells. DNA ele	ectrophoresis					4
T-L-5	Introduction to Mic								4
T-L-6	Introduction to Mic				· ·		5		4
T-L-7	Introduction to Mic								6
T-W-1	Engineering aspect					dicine &	Chemistry.		1
T-W-2	Molecules of Life (p			oohydrates, nucleid	c acids)				8
T-W-3	Catabolic metaboli								3
T-W-4	Anabolic metabolic	•	-						3
T-W-5 T-W-6	Photorespiration, p Cell cycle, aging, a				5).				2
T-W-7	Gene Structure and				roquia	tion			4
T-W-8	Cancer biology - Co				regula				2
T-W-8	Physiology of nervo								2
T-W-10	Engineering design	-		-					3
	workload - forms of		-						Number of hours
Juuent	workidau - IOIIIIS OT	activ	цу						wumber of nours

Faculty of Chemical Technology and Engineering

			raculty of chemi		ology all			ig			
Student wo	rkload	d - form	s of activity						Nur	nber o	f hours
A-A-1	Partici	pation in	recitations								30
	Partici	pation in	laboratory classes								30
A-W-1	partici	pation in	lectures								30
Teaching m	nethoc	ls / tool	S								
M-1	lecture	es with p	resentation								
M-2 0	disscu	ssion dui	ring lectures and seminar								
		tory clas									
		ion class									
M-5 I	Private	e study ,	tutorial, learning materials								
Evaluation I	metho	ods (F -	progressive, P - final)								
S-1	F	multiple	e choice test								
5-2	F	evaluat	ion of reports (labortory and	recitation)							
[Desigr	ned lear	ning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Cours	se content	Teaching methods	Evaluatior methods
Knowledge											
the biosphere, understand the evolution for th become more of	lerstand know a import ne organ complex ortant fo	daptive fe tance of d nisms, une x as they	ortance of biochemical cycling in aatures, adaptation and ifferent types of selection and derstand that organisms grow, nderstand that cell elopment of organisms and the	MSE_1A_W02	P65_WG	P65_WG	C-1	T-A-1 T-A-2 T-A-3 T-A-4 T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6	T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 T-W-8 T-W-9 T-W-10	M-1 M-2 M-3 M-5	S-1 S-2
Skills											
present it in a o that may involv number of sour	ate info clear, lo ve a wio rces to i rate a h	ogical forn de range o identify pa	rom a number of sources and n; solve problems in situations of variables; process data from a atterns or trends in modern to explain facts, or find facts to	MSE_1A_U10 MSE_1A_U11	P6S_UK P6S_UO P6S_UW		C-1	T-A-1 T-A-2 T-A-3 T-A-4 T-L-1	T-L-2 T-L-3 T-L-4 T-L-5 T-L-6	M-1 M-2 M-3 M-4 M-5	S-1 S-2
Social comp		ces									
MSE_1A_B09_K Students is able work in group.	(01 e to pei	rform all t	ask on time and cooperate and	MSE_1A_K03	P65_KO	P6S_WK	C-1	T-A-1 T-A-2 T-A-3 T-A-4 T-L-1	T-L-2 T-L-3 T-L-4 T-L-5 T-L-6	M-2 M-3 M-4	S-2
Outcom	es	Grade		· F	valuation cr	iterion		1		<u></u>	
Knowledge											
MSE_1A_B09_V	V01	2,0									
			use appropriate scientific and tec concepts to give basic explanatic (erned of 51% points on a test)								
		3,5 4,0									
		4,5									
Chille		5,0									
<i>Skills</i> MSE 1A B09 U	101	20									
<u>9</u> 1V_009_0		2,0 3,0	Student is able to prepare writter identify a pattern or trend, selec laboratory procedure								to
		3,5									
		4,0									
		4,5 5,0									
		5,0									

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Other social con	npetenc	es
MSE_1A_B09_K01	2,0	
	3,0	Student is able to worksconstructively as a team member and finsish all task during the course with the help of the colleagues and teacher.
	3,5	
	4,0	
	4,5	
	5,0	
Required readin		

Required reading

1. Michael T. Madigan,, Kelly S. Bender Daniel H. Buckley,, W. Matthew Sattley, & 1 more, Brock Biology of Microorganisms, Pearson, 2018, 15

2. Matt Ridley, Genome: The Autobiography of a Species in 23 Chapters Hardcover, HarperCollins, 1999

3. Robert A. Weinberg, Robert A Weinberg, The Biology of Cancer, W. W. Norton & Company, 2013, 2

4. Murray P. Pendarvis, John L. Crawley, Exploring Biology in the Laboratory V, Morton Publishing Company, 2018

5. Chandel Navdeep, Navigating Metabolism, Cold Spring Harbor Laboratory, 2016

Supplementary reading

1. Joey Hajda, Lisa B. Hajda, Friendly Biology Student Workbook, CreateSpace Independent Publishing Platform, 2017

2. Richard Dawkins, The Extended Phenotype: The Long Reach of the Gene, Oxford University Press, 2016, 2

3. Biology and Genetic Journal, 2011, International Journal of Biometeorology, Disease Models & Mechanisms, Annual Review of Physiology, Biology of Reproduction, The Journal of Experimental Biology

Field of s	study	Mate	erials Scienc	e and Engineeri	ng]	
Mode of	study	stati	onary	Level		first c	cycle	14/771	C 1
Graduat	e's qualification	inży	nier	I		-		WTil	Ch
Fields of	fscience	engi	neering and	technology					
Disciplin	es of science	mate	erials engine	eering (100%)					_
Educatio	onal profile	gene	eral academ	ic					
Module									
Course ι	unit	Gra	phical Engi	neering					\mathbf{O}
Code		MSE	1A_S_C01						
Field of s	specialisation								
Adminis	tering faculty		artment of li ronment En	norganic Chemic	al Tech	nnology	/ and		
ECTS		3,0		ECTS (forms)		3,0		-	
	course credit	cred	its	Language		english	1	-	
Electives				Elective group		<u>j</u>		-	
	instruction	Cod	Semester	Hours	EC	τς	Weight	Realization	Credit
		L	2	45	2,		0,50	Keanzacion	credits
	ry course	W	2					K K	
lecture				15		0	0,50	N N	credits
Leading	teacher			al.Pelka@zut.edu	-	. .			
Other te	achers			a (Karolina.Kielb acek.Zaplata@zu			рі), Реіка Ката	і (Катаі.Реіка@	zut.edu.pl),
Prerequi	isites					•			
W-1	Basics of mathema	atics ar	nd drawing at	the high school le	evel				
W-2	Basic computer ski	ills, ba	sics of IT						
Module/	course unit objectiv	es							
C-1	Familiarize student		the principle	s of technical drav	ving.				
C-2	Familiarize student	ts with	the AutoCAD	program.					
С-3	Forming students'	skills i	n reading tec	hnical drawings, m	nachine	diagram	ns, installations,	devices.	
C-4	Forming students'	skills i	n making tec	nnical drawings.					
C-5	Shaping the stude	nts' ab	ility to use Au	itoCAD to perform	technic	al drawi	ings.		
Course o	content divided into	vario	us forms of	instruction					Number of hours
T-L-1	Rectangular projec		European or A	merican method)					3
T-L-2	Axonometric proje	ction							3
T-L-3	Cross sections								3
T-L-4 T-L-5	Dimensioning of si Drawing objects	mple c	letalis						3
	Drawing objects	oCAD	program (28h	n);					
T-L-6	Test: preparation of	of a teo	hnical drawir	ng using the AutoC					30
T-W-1	Basics of technical								2
T-W-2	Rectangular and a			on (European and	America	n metho	oa), cross sectio	ns	2
T-W-3 T-W-4	Dimensioning, drav	-		vical systems mar	hiner a	nd devic	200		2
T-W-4	AutoCAD: basics, c			-			.65		6
									0
T-W-6	Written test								1
		activ	ity						
Student	workload - forms of		-						Number of hours
		ry clas	ses	ed within course					
Student A-L-1	workload - forms of Attending laborato	ry clas n the t	ses	ed within course					Number of hours 45
Student A-L-1 A-L-2	workload - forms of Attending laborato Lilterature study o	ry clas n the t	ses	ed within course					Number of hours 45 5

			Faculty of Chem	ical lecnn	ology an	a Engin	eerin	g			
Student wo	orkload	l - form	s of activity						Nur	nber o	f hours
A-W-2	Literat	ure stud	y on the topics discussed wit	hin the frame of	the lectures						8
A-W-3	Prepar	ing for t	ests								5
A-W-4	Consul	tations									2
Teaching m	nethod	ls / tool	S								
			ted by Power Point presenta	tion							
			ises: manual drawing								
M-3	Progra	mmed n	nethods: drawing with the us	e of a computer							
Evaluation	meth	nds (F .	progressive, P - final)								
S-1	P		e: written test								
<i>S</i> -2	F		al exercises: positive grade fi	rom each drawin	a made						
S-3	F		nmed methods: positive grade		-	mnuter					
5-5 5-4	 Р	-	es: average grade resulting f			-	ethods				
5-4	-	LACICIS				<u> </u>		1			
l	Desigr	ned lear	rning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes f or qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course	e content	Teaching methods	Evaluatior methods
Knowledge											
MSE_1A_B07_V Student knows used to design field of engine	s the app n, model	and simu	methods, techniques and tools llate and perform tasks in the	MSE_1A_W05	P65_WG P65_WK		C-1 C-2	T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-5	T-W-1 T-W-2 T-W-3 T-W-4 T-W-5	M-1 M-2 M-3	S-1 S-2 S-3 S-4
Skills											-
MSE_1A_B07_L Student has at drawings both	oility and	d skills to ly and us	read and perform technical ing AutoCAD program	MSE_1A_U04 MSE_1A_U05 MSE_1A_U11 MSE_1A_U13	P6S_UK P6S_UU P6S_UW	P6S_UW	C-3 C-4 C-5	T-L-1 T-L-2 T-L-3 T-L-4 T-L-5	T-W-1 T-W-2 T-W-3 T-W-4 T-W-5	M-1 M-2	S-1 S-2 S-3 S-4
Social com	peten	ces			1	1					4
	stands t		for continuous vocational eld of graphical engineering	MSE_1A_K01 MSE_1A_K02 MSE_1A_K03 MSE_1A_K04 MSE_1A_K05	P65_KK P65_KO P6S_KR	P6S_WK	C-1 C-2	T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-5	T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6	M-1 M-2	S-4
Outcom	nes	Grade		E	Evaluation cr	iterion					<u>.</u>
Knowledge											
MSE_1A_B07_\	W01	2,0 3,0 3,5 4,0 4,5 5,0	Student has basic knowledge ab engineering graphics	oout the appropriate	e methods, techr	niques and tools	s used to	perform	n task in t	he field	of
Skills											
MSE_1A_B07_U	J02	2,0 3,0 3,5 4,0 4,5 5,0	Student performs a simple techr	nical drawing using	the Autocad pro	gram					
Other socia	al com		۱ ۵۲								
MSE_1A_B07_K	3,0 Student understands at the basic level the need for continuous education and training in the field 3,5 4,0 4,5 5,0									al engine	≥ering
Required re	eading										

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Required reading

1. CADFolks, AutoCAD 2017 For Beginners, 2016

2. Cheryl R. Shrock, Steve Heather, Beginning AutoCAD 2017: Exercise Workbook, 2016

3. George Omura, Brian C. Benton, Mastering AutoCAD 2018 and AutoCAD LT 2018, 2017

4. W. Abbott, Technical drawing, Blackie & Son Limited, London, 1976, Fourth edition

5. R.S.RHODES, L.B.COOK, Basic Engineering Drawing, Pitman Publishing, London, 1978

Field of st	udy	Mate	erials Scienc	e and Engineeri	ng				
Mode of st	tudy	stati	onary	Level		first o	cycle	\ A / T : L /	
Graduate'	s qualification	inżyı	nier	I				WTil	LN
Fields of s	cience	engi	neering and	technology					
Disciplines	s of science	mate	erials engine	ering (100%)					_
Education	al profile	gene	eral academ	ic					
Module									
Course un	it	Intro	o to MatSc	I					
Code		MSE.	_1A_S_C01a						
Field of sp	ecialisation								C
Administe	ring faculty	Depa	artment of N	Ianomaterials Pl	nysicod	hemist	ry		
ECTS		2,0		ECTS (forms)		2,0			
Form of co	ourse credit	exar	nination	Language		english	l		
Electives		2		Elective group					
Form of in	struction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
lecture		w	2	30	2	,0	1,00	К	examination
Leading te	eacher	Miio	wska Ewa (F	wa.Borowiak-Pa	len@z	ut.edu.r	ـــــــــــــــــــــــــــــــــــــ		
Other tead		El Fr	ay Mirosław	a (Miroslawa.ElF manska@zut.ec	ray@z	ut.edu.p	ol), Kochmańsk		zut.edu.pl)
Prerequisi	tes	10.3.							
W-1	Knowledge of the b	asic c	ourse in math	nematics, physics	and che	emistry a	t the elementary	r level	
Module/co	urse unit objective	25							
C-1	The purpose of the		e is to enriche	e the students' kn	owledge	e in mair	n principle of mat	erials science ar	nd engineering.
Course co	ntent divided into	vario	us forms of	instruction					Number of hours
T-W-1	Historical Perspecti	ve, Ma	aterials Scien		g, Class	ification	of Materials, Adv	vanced	2
T-W-2	Materials, Modern I Atomic Structure a			dina					2
T-W-3	The Structure of Cr								2
T-W-4	Imperfections in So	-							2
T-W-5	Diffusion in solids								2
T-W-6	Metallic crystal stru materials; Anisotro		s: Close-pack	ed crystal structur	es; Poly	morphis	m and allotropy;	Polycrystalline	3
T-W-7	Imperfections in so		acancies and	self-interstitials; I	Dislocat	ions—lin	ear defects; Inte	rfacial defects	2
T-W-8	Interpretation of ph microstructure in is diagrams having in phase transformati	omor _l terme	phous alloys;	Development of n	nicrostr	ucture in	eutectic alloys;	Equilibrium	3
T-W-9	Properties and app	licatio	ns of metals						2
T-W-10	Introduction to poly				•	-			2
T-W-11	Structure-property polymer structure	relatio	onships in pol	ymeric materials:	overvie	w of cha	racterization me	thods of	2
T-W-12	Introduction to poly	/mer p	processing						2
T-W-13	Introduction to poly								2
T-W-14	Selected examples	of cor	mmodity poly	mers, engineering	and hi	gh-pefor	mance		2
	orkload - forms of	activ	ity						Number of hours
A-W-1	participation in lect								30
A-W-2	self-study of literat	ure							20
A-W-3 A-W-4	Consultations preparation for exa	m							8
A-W-4 A-W-5	Final exam								1
	methods / tools								1 1
M-1	lectures with prese	ntatio	n						

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Evaluation r	metho	ds (F -	progressive, P - final)								
S-1	Р	written	exam								
S-2	F	student	activity during lectures								
E	Design	ed lear	rning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course	e content	Teaching methods	Evaluation methods
Knowledge											
MSE 1A CO1a	W01 n princi	ples of m	naterials science and engineering.	MSE_1A_W03	P65_WG P65_WK	P6S_WG	C-1	T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-6	T-W-8 T-W-9 T-W-10 T-W-11 T-W-12 T-W-13 T-W-14	M-1	S-1 S-2
Skills											
	ate infoi clear, lo	gical forn	rom a number of sources and n; solve problems in situations of variables	MSE_1A_U10 MSE_1A_U11	P6S_UK P6S_UO P6S_UW		C-1	T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7	T-W-8 T-W-9 T-W-10 T-W-11 T-W-12 T-W-13 T-W-14	M-1	5-2
Social comp	oetenc	es			1						
MSE_1A_C01a_ Is aware of the		f further s	study and systematic work.	MSE_1A_K02	P6S_KK	P65_WK	C-1	T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-6	T-W-8 T-W-9 T-W-10 T-W-11 T-W-12 T-W-13 T-W-14	M-1	S-1 S-2
Outcome	es	Grade		E	valuation cri	iterion					
Knowledge											
MSE_1A_C01a_	W01	2,0									
			positive grade of the final test (m	ore than 55% corr	ect answers)						
		3,5									
		4,0 4,5									
		5,0									
Skills											
MSE_1A_C01a_	U01	2,0									
		3,0	positive grade of the final test (m	ore than 55% corr	ect answers)						
		3,5									
		4,0									
		4,5									
Other social	Leom	5,0									
MSE_1A_C01a_	•	2,0									
			positive grade of the final test (m	ore than 55% corr	ect answers)						
		3,5									
		4,0									
		4,5									
		5,0									
Required re											
0495244462			leep P. Fulay , Essentials of M							ISBN-13	3: 978-
2. William D.	Callist	er Jr., M	aterials Science and Engineer	ing: An Introduc	tion, Wiley, 19	99, ISBN-13:	978-047	713201	35		

3. Tariq A. Khraishi, Marwan S. Al-Haik, Experiments in Materials Science and Engineering, Cognella, 2010, ISBN-13: 978-1609278687

Field of s	tudy	Materials Sci	ence a	nd Engineeri	ing				
Mode of s	-	stationary		Level		first c	cycle		~ 1
	's qualification	inżynier					<u>,</u>	WTil(Ch
Fields of s	•	engineering	and teo	chnology					
	es of science	materials en		5,					
•	nal profile	general acad	-						
Module		J							
Course ui	nit	Intro to Ma	Ena						
Code		MSE_1A_S_C	-						
Field of s	pecialisation				CI				
	ering faculty	Department	of Mate	erials Techno	ology				
ECTS	<u> </u>	2,0		TS (forms)		2,0			
	course credit	examination		inguage		english		-	
Electives	,	2		ective group				-	
Form of i	nstruction	Cod Semest		Hours		CTS	Weight	Realization	Credit
lecture		W 2		30		,0	1,00	K	examination
								K	examination
Leading t	teacher	Paszkiewicz S				-		kowska Magdale	
<i>Other tea</i>	achers	(Magdalena.	Kwiatko	owska@zut.e	edu.pl),	Mijowsl	ka Ewa (Ewa.B edu.pl), Piegat	orowiak-Palen@)zut.edu.pl),
Prerequis	sites	•					<u> </u>		
W-1	The subject "Introd	luction to Mater	ials Scie	ence and Engi	neering'	' aims to	introduce the st	tudent to the basi	c knowledge on
								ne student with th	e basic infomation
	on the structure ar	nd properties of						ne student with th	e basic infomation
Module/co		nd properties of es n acquanting the	differen	it types of eng	gineering	g materia	als.		
Module/co C-1	on the structure ar ourse unit objective The subject aims ir	nd properties of es n acquanting the tic scope.	differen e studer	nt types of eng nt with the kno	gineering	g materia	als.		l background,
Module/co C-1 Course co	on the structure ar ourse unit objective The subject aims ir vocabulary, thema	nd properties of es n acquanting the tic scope. various forms rical Perspective	differen e studer <i>of inst</i> e, Mater	nt types of engineering int with the know truction ials Science a	gineering owledge	g materia e on engir	als. neering materia	ls: term, historica	l background,
Module/co C-1 Course co T-W-1	on the structure ar ourse unit objective The subject aims ir vocabulary, thema ontent divided into Introduction: Histor	nd properties of es n acquanting the tic scope. <i>various forms</i> rical Perspective s, Modern Mate	differen e studer <i>of inst</i> e, Mater rials' Ne	nt with the known truction ials Science a reds	gineering owledge	g materia e on engir	als. neering materia	ls: term, historica	l background, Number of hours
Module/co C-1 Course co T-W-1 T-W-2	on the structure ar ourse unit objective The subject aims ir vocabulary, thema ontent divided into Introduction: Histor Advanced Material	nd properties of es n acquanting the tic scope. various forms rical Perspective s, Modern Mater nd Interatomic	differen e studer <i>of inst</i> e, Mater rials' Ne	nt with the known truction ials Science a reds	gineering owledge	g materia e on engir	als. neering materia	ls: term, historica	Number of hours
Module/co C-1 Course co T-W-1 T-W-2 T-W-3 T-W-4	on the structure ar ourse unit objective The subject aims in vocabulary, thema ontent divided into Introduction: Histor Advanced Material Atomic Structure a The Structure of Cr Imperfections in Sc	nd properties of es n acquanting the tic scope. <i>various forms</i> rical Perspective s, Modern Mater nd Interatomic I rystalline Solids	differen e studer <i>of inst</i> e, Mater rials' Ne	nt with the known truction ials Science a reds	gineering owledge	g materia e on engir	als. neering materia	ls: term, historica	background, Number of hours 2 2 2 2 2
Module/co C-1 Course co T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5	on the structure ar ourse unit objective The subject aims in vocabulary, thema ontent divided into Introduction: Histor Advanced Materials Atomic Structure a The Structure of Cr Imperfections in Sc Diffusion in solids	nd properties of es n acquanting that tic scope. <i>various forms</i> rical Perspective s, Modern Mater nd Interatomic rystalline Solids plids	differen e studer of inst e, Mater rials' Ne Bonding	nt with the known truction ials Science a reds	gineering owledge	g materia e on engir	als. neering materia	ls: term, historica	background, Number of hours 2 2 2 2 2 2 2 2 2
Module/co C-1 Course co T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-6	on the structure ar ourse unit objective The subject aims in vocabulary, thema ontent divided into Introduction: Histor Advanced Material Atomic Structure a The Structure of Cr Imperfections in So Diffusion in solids Properties and app	nd properties of es n acquanting the tic scope. <i>Various forms</i> rical Perspective s, Modern Mater nd Interatomic rystalline Solids olids	differen e studer e, Mater rials' Ne Bonding	nt with the known truction ials Science a reds	owledge nd Engin	g materia	als. neering material Classification of	ls: term, historica	background, Number of hours 2 2 2 2 2 2 2 2 2 2 2 2
Module/co C-1 Course co T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7	on the structure ar ourse unit objective The subject aims in vocabulary, thema ontent divided into Introduction: Histor Advanced Material Atomic Structure a The Structure of Cr Imperfections in Sc Diffusion in solids Properties and app Introduction to met Structures of polyn	nd properties of es n acquanting the tic scope. <i>Various forms</i> rical Perspective s, Modern Mater nd Interatomic rystalline Solids plids lication of cerar tal materials; ph ners - classificat	differen e studer e, Mater rials' Ne Bonding nics nase dia ion, che	nt with the known truction ials Science a reds grams, proper	owledge nd Engin	on engir neering,	als. neering material Classification of tion of metals	ls: term, historica Materials,	background, Number of hours 2 2 2 2 2 2 2 2 2 2 3
Module/cd C-1 Course cd T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-6 T-W-6 T-W-7 T-W-8	on the structure ar ourse unit objective The subject aims in vocabulary, thema ontent divided into Introduction: Histor Advanced Material Atomic Structure a The Structure of Cr Imperfections in So Diffusion in solids Properties and app Introduction to met Structures of polyn materials (injectior	nd properties of es n acquanting the tic scope. <i>Various forms</i> rical Perspective s, Modern Mater nd Interatomic rystalline Solids plids lication of cerar tal materials; ph ners - classificat n moulding, extr	differen e studer e, Mater rials' Ne Bonding nics nase dia ion, che usion, p	nt with the kno truction ials Science a reds grams, proper emical structu pressing, etc)	owledge nd Engin rties and re, fabri	on engin neering, d applica cation ar	als. neering material Classification of tion of metals nd processing of	ls: term, historica Materials, engineering	background, Number of hours 2 2 2 2 2 2 2 2 2 3 3 5
Module/cd C-1 Course cd T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 T-W-8 T-W-8 T-W-9	on the structure ar ourse unit objective The subject aims in vocabulary, thema ontent divided into Introduction: Histor Advanced Material Atomic Structure a The Structure of Cr Imperfections in Soc Diffusion in solids Properties and app Introduction to men Structures of polyn materials (injectior Introduction to con matrix and reinforce Types of bonding a	nd properties of es n acquanting the tic scope. various forms rical Perspective s, Modern Mater nd Interatomic rystalline Solids blids lication of cerar tal materials; ph ners - classificat n moulding, extr nposite material	differen e studer of inst a, Mater ials' Ne Bonding nics nase dia ion, che usion, p s: defin osites	at types of eng at with the known truction ials Science a eds grams, prope emical structu pressing, etc) ition of compo	nd Engin rties and re, fabri	g materia on engin neering, d applica cation ar pes of co	als. neering material Classification of tion of metals nd processing of mposite materia	ls: term, historica Materials, engineering	background, Number of hours 2 2 2 2 2 2 2 2 2 2 3 5 5 2
Module/cd C-1 Course cd T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-6 T-W-5 T-W-6 T-W-7 T-W-8 T-W-9 T-W-9	on the structure ar ourse unit objective The subject aims in vocabulary, thema ontent divided into Introduction: Histon Advanced Material Atomic Structure a The Structure of Cr Imperfections in Soc Diffusion in solids Properties and app Introduction to mer Structures of polyn materials (injectior Introduction to con matrix and reinforce Types of bonding a strength Reinforcements - g	nd properties of es n acquanting the tic scope. various forms rical Perspective s, Modern Mater nd Interatomic I rystalline Solids blids lication of cerar tal materials; ph ners - classificat n moulding, extr nposite material cement in comp t the interface -	differen e studer of inst a of inst of inst a of inst a of inst a of inst a	at types of eng twith the known truction ials Science a eds grams, prope emical structu pressing, etc) ition of compo mical, physica	nd Engin rties and re, fabri osite, ty	g materia on engir neering, d applica cation ar pes of co nemical b	als. neering material Classification of tion of metals nd processing of mposite materia	ls: term, historica Materials, engineering als. Role of m interface bond	background, Number of hours 2 2 2 2 2 2 2 2 2 3 3 5
Module/co C-1 Course co T-W-1 T-W-2 T-W-3 T-W-3 T-W-3 T-W-4 T-W-5 T-W-5 T-W-6 T-W-7 T-W-8 T-W-9 T-W-9 T-W-10 T-W-11	on the structure ar ourse unit objective The subject aims in vocabulary, thema ontent divided into Introduction: Histor Advanced Materials Atomic Structure a The Structure of Cr Imperfections in So Diffusion in solids Properties and app Introduction to mere Structures of polyn materials (injection Introduction to con matrix and reinforce Types of bonding a strength Reinforcements - g carbide fibers.	nd properties of es n acquanting the tic scope. <i>Various forms</i> rical Perspective s, Modern Mater nd Interatomic rystalline Solids blids lication of cerar tal materials; pl ners - classificat n moulding, extr nposite material cement in comp it the interface - glass fibers, cark	differen e studer of inst e, Mater rials' Ne Bonding nics asse dia ion, che usion, p s: defin osites - mecha	at types of engine with the known of engine truction in the second struction is a second struct of the second stru	nd Engin rties and re, fabri osite, ty	g materia on engir neering, d applica cation ar pes of co nemical b	als. neering material Classification of tion of metals nd processing of mposite materia	ls: term, historica Materials, engineering als. Role of m interface bond	background, Number of hours 2 2 2 2 2 2 2 2 2 2 2 3 3 5 2 2 2 3 3 3 3
Module/cd C-1 Course cd T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-3 T-W-6 T-W-5 T-W-6 T-W-7 T-W-8 T-W-7 T-W-8 T-W-9 T-W-10 T-W-11 T-W-12	on the structure ar ourse unit objective The subject aims in vocabulary, thema ontent divided into Introduction: Histor Advanced Material Atomic Structure a The Structure of Cr Imperfections in So Diffusion in solids Properties and app Introduction to med Structures of polyn materials (injectior Introduction to con matrix and reinforc Types of bonding a strength Reinforcements - g carbide fibers. Matrix materials -	nd properties of es n acquanting the tic scope. various forms rical Perspective s, Modern Mater nd Interatomic I rystalline Solids plids lication of cerar tal materials; ph ners - classificat n moulding, extr nposite material ement in comp it the interface - glass fibers, cart polymers, meta	differen e studer of inst e, Mater rials' Ne Bonding nics asse dia ion, che usion, p s: defin osites - mecha	at types of engine with the known of engine truction in the second struction is a second struct of the second stru	nd Engin rties and re, fabri osite, ty	g materia on engir neering, d applica cation ar pes of co nemical b	als. neering material Classification of tion of metals nd processing of mposite materia	ls: term, historica Materials, engineering als. Role of m interface bond	background, Number of hours 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
Module/co C-1 Course co T-W-1 T-W-2 T-W-3 T-W-3 T-W-3 T-W-4 T-W-5 T-W-5 T-W-5 T-W-6 T-W-7 T-W-6 T-W-7 T-W-8 T-W-9 T-W-10 T-W-10 T-W-11 T-W-11 T-W-12 Student v	on the structure ar ourse unit objective The subject aims in vocabulary, thema ontent divided into Introduction: Histor Advanced Materials Atomic Structure a The Structure of Cr Imperfections in So Diffusion in solids Properties and app Introduction to men Structures of polyn materials (injection Introduction to con matrix and reinforce Types of bonding a strength Reinforcements - g carbide fibers. Matrix materials - in workload - forms of	ad properties of es acquanting the tic scope. <i>various forms</i> rical Perspective s, Modern Mater nd Interatomic rystalline Solids olids lication of cerar tal materials; ph ners - classificat n moulding, extr nposite material ement in comp it the interface - glass fibers, cart polymers, meta	differen e studer of inst e, Mater rials' Ne Bonding nics asse dia ion, che usion, p s: defin osites - mecha	at types of engine with the known of engine truction in the second struction is a second struct of the second stru	nd Engin rties and re, fabri osite, ty	g materia on engir neering, d applica cation ar pes of co nemical b	als. neering material Classification of tion of metals nd processing of mposite materia	ls: term, historica Materials, engineering als. Role of m interface bond	background, Number of hours 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
Module/cd C-1 Course cd T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-6 T-W-5 T-W-6 T-W-7 T-W-7 T-W-8 T-W-9 T-W-9 T-W-10 T-W-11 T-W-12 Student v A-W-1	on the structure ar ourse unit objective The subject aims in vocabulary, thema ontent divided into Introduction: Histor Advanced Materials Atomic Structure a The Structure of Cr Imperfections in Soc Diffusion in solids Properties and app Introduction to merilist (injection Structures of polyn materials (injection Introduction to con matrix and reinforce Types of bonding a strength Reinforcements - g carbide fibers. Matrix materials - I workload - forms of Participation in lect	ad properties of es acquanting the tic scope. various forms rical Perspective s, Modern Mater nd Interatomic I systalline Solids lids lication of cerar tal materials; ph ners - classificat noulding, extr posite materials ement in comp it the interface - glass fibers, cark polymers, meta <i>activity</i> tures.	differen e studer of inst e, Mater rials' Ne Bonding nics nase dia ion, che usion, p s: defin osites • mecha pon/grap	at types of engineric types of e	nd Engin rties and re, fabri osite, ty il and ch	g materia on engir neering, d applica cation ar pes of co nemical b	als. neering material Classification of tion of metals nd processing of mposite materia	ls: term, historica Materials, engineering als. Role of m interface bond	l background, Number of hours 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3 3 5 2 2 3 3 3 3
Module/cd C-1 Course cd T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-4 T-W-4 T-W-5 T-W-6 T-W-7 T-W-6 T-W-7 T-W-7 T-W-7 T-W-7 T-W-10 T-W-10 T-W-11 T-W-12 Student v A-W-1 A-W-2	on the structure ar ourse unit objective The subject aims in vocabulary, thema ontent divided into Introduction: Histor Advanced Material Atomic Structure a The Structure of Cr Imperfections in Soc Diffusion in solids Properties and app Introduction to med Structures of polyn materials (injection) Introduction to com matrix and reinforce Types of bonding a strength Reinforcements - g carbide fibers. Matrix materials - workload - forms of Participation in lect Getting acquaintec	ad properties of es acquanting the tic scope. various forms rical Perspective s, Modern Mater nd Interatomic I systalline Solids lids lication of cerar tal materials; ph ners - classificat noulding, extr posite materials ement in comp it the interface - glass fibers, cark polymers, meta <i>activity</i> tures.	differen e studer of inst e, Mater rials' Ne Bonding nics nase dia ion, che usion, p s: defin osites • mecha pon/grap	at types of engineric types of e	nd Engin rties and re, fabri osite, ty il and ch	g materia on engir neering, d applica cation ar pes of co nemical b	als. neering material Classification of tion of metals nd processing of mposite materia	ls: term, historica Materials, engineering als. Role of m interface bond	background, Number of hours 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3 3 3 3 3 <i>Number of hours</i> 30 20
Module/co C-1 Course co T-W-1 T-W-2 T-W-3 T-W-3 T-W-5 T-W-5 T-W-5 T-W-5 T-W-6 T-W-7 T-W-7 T-W-7 T-W-7 T-W-7 T-W-10 T-W-10 T-W-11 T-W-12 Student v A-W-1 A-W-2 A-W-3	on the structure ar ourse unit objective The subject aims in vocabulary, thema ontent divided into Introduction: Histor Advanced Materials Atomic Structure a The Structure of Cr Imperfections in Soc Diffusion in solids Properties and app Introduction to merilist (injection Structures of polyn materials (injection Introduction to con matrix and reinforce Types of bonding a strength Reinforcements - g carbide fibers. Matrix materials - I workload - forms of Participation in lect	ad properties of es acquanting the tic scope. various forms rical Perspective s, Modern Mater nd Interatomic I systalline Solids lids lication of cerar tal materials; ph ners - classificat noulding, extr posite materials ement in comp it the interface - glass fibers, cark polymers, meta <i>activity</i> tures.	differen e studer of inst e, Mater rials' Ne Bonding nics nase dia ion, che usion, p s: defin osites • mecha pon/grap	at types of engineric types of e	nd Engin rties and re, fabri osite, ty il and ch	g materia on engir neering, d applica cation ar pes of co nemical b	als. neering material Classification of tion of metals nd processing of mposite materia	ls: term, historica Materials, engineering als. Role of m interface bond	l background, Number of hours 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3 3 5 2 2 3 3 3 3
Module/cd C-1 Course cd T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-5 T-W-5 T-W-5 T-W-5 T-W-5 T-W-7 T-W-10 T-W-10 T-W-10 T-W-11 T-W-12 Student v A-W-1 A-W-2 A-W-3 A-W-4	on the structure ar ourse unit objective The subject aims in vocabulary, thema ontent divided into Introduction: Histon Advanced Material Atomic Structure a The Structure of Cr Imperfections in So Diffusion in solids Properties and app Introduction to med Structures of polyn materials (injectior Introduction to com materials (injectior Types of bonding a strength Reinforcements - c carbide fibers. Matrix materials - workload - forms of Participation in lect Getting acquaintec Consultations Final exam	ad properties of es acquanting the tic scope. various forms rical Perspective s, Modern Mater nd Interatomic I systalline Solids lids lication of cerar tal materials; ph ners - classificat noulding, extr posite materials ement in comp it the interface - glass fibers, cark polymers, meta <i>activity</i> tures.	differen e studer of inst e, Mater rials' Ne Bonding nics nase dia ion, che usion, p s: defin osites • mecha pon/grap	at types of engineric types of e	nd Engin rties and re, fabri osite, ty il and ch	g materia on engir neering, d applica cation ar pes of co nemical b	als. neering material Classification of tion of metals nd processing of mposite materia	ls: term, historica Materials, engineering als. Role of m interface bond	background, Number of hours 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3 3 5 5 2 2 2 3 3 3 3
Module/cd C-1 Course cd T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-5 T-W-5 T-W-5 T-W-5 T-W-5 T-W-7 T-W-10 T-W-10 T-W-10 T-W-11 T-W-12 Student v A-W-1 A-W-2 A-W-3 A-W-4	on the structure ar ourse unit objective The subject aims in vocabulary, thema ontent divided into Introduction: Histor Advanced Materials Atomic Structure a The Structure of Cr Imperfections in So Diffusion in solids Properties and app Introduction to men Structures of polyn materials (injection Introduction to con matrix and reinforc Types of bonding a strength Reinforcements - of carbide fibers. Matrix materials - <i>workload - forms of</i> Participation in lect Getting acquainted Consultations	ad properties of es acquanting the tic scope. various forms rical Perspective s, Modern Mater nd Interatomic I rystalline Solids olids lication of cerar tal materials; ph ners - classificat noulding, extr nposite materials cement in comp it the interface - glass fibers, cart polymers, meta	differen e studer of inst e, Mater rials' Ne Bonding nics nase dia ion, che usion, p s: defin osites • mecha pon/grap	at types of engineric types of e	nd Engin rties and re, fabri osite, ty il and ch	g materia on engir neering, d applica cation ar pes of co nemical b	als. neering material Classification of tion of metals nd processing of mposite materia	ls: term, historica Materials, engineering als. Role of m interface bond	background, Number of hours 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3 3 5 2 2 2 3 3 3 3

Evaluation n	netho	ds (F -	progressive, P - final)								
S-1	Р	Writing	exam								
5-2	F	Questic	ons and Replies (discussion d	uring lectures)							
D	esign	ed leai	rning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course	e content	Teaching methods	Evaluation methods
Knowledge				1		1					
MSE_1A_C01b_V knowledge in m engineering.		nciple of	materials science and	MSE_1A_W03	P65_WG P65_WK	P6S_WG	C-1	T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6	T-W-7 T-W-8 T-W-9 T-W-10 T-W-11 T-W-12	M-1	S-1 S-2
Skills											
	te infor lear, lo	gical forr	rom a number of sources and n; solve problems in situations of variables	MSE_1A_U10 MSE_1A_U11	P6S_UK P6S_UO P6S_UW		C-1	T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6	T-W-7 T-W-8 T-W-9 T-W-10 T-W-11 T-W-12	M-1	S-1 S-2
Social comp	etenc	es									
MSE_1A_C01b_k Is aware of the r		ffurther	study and systematic work.	MSE_1A_K02	P6S_KK	P6S_WK	C-1	T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6	T-W-7 T-W-8 T-W-9 T-W-10 T-W-11 T-W-12	M-1	S-1 S-2
Outcome	es	Grade		E	valuation cri	iterion					
Knowledge	I										
MSE_1A_C01b_V	V01	2,0 3,0 3,5 4,0 4,5 5,0	positive grade of the final test (n	nore than 55% corr	ect answers)						
Skills			I								
MSE_1A_C01b_U	JO1	2,0 3,0 3,5 4,0 4,5 5,0	positive grade of the final test (n	nore than 55% corr	ect answers)						
Other social	com		es								
MSE_1A_C01b_k	-	2,0 3,0 3,5 4,0 4,5 5,0	positive grade of the final test (n	nore than 55% corr	ect answers)						
Required rea	adina	- / -	1								
	-	er, Fund	lamentals of materials scienc	e and engineerin	ig : SI version.	John Wilev &	Sons. F	lobokei	n, NI, US	A, 2013	3
			als science for engineering st		-				-		
_			d G. Rethwisch, Materials Sci								
Supplement	ary re	eading									
	-	-	ao, Introduction to Materials S	Science, Princeto	n University P	ress, USA, 20	04				

								5	
Field of st	tudy	Materials Science and Engineering							
Mode of s	study	stati	onary	Level		first o	cycle	34/771/	~1
Graduate	's qualification	inżyi	nier					WTil(Lh
Fields of s	science	engi	neering and	technology					
Discipline	es of science	mate	erials engine	ering (100%)					
Educatior			eral academ	-					
Module	•								
Course ur	nit	Stru	icture of So		C				
Code		Structure of Solids MSE_1A_S_C02							
	pecialisation		MSE_1A_S_C02						
	ering faculty	Depa	artment of Ir	norganic and An	alvtica	l Chemi	istrv		
ECTS		5,0		ECTS (forms)	,	5,0			
	ourse credit	cred	its	Language		english	1		
Electives				Elective group		cright	•		
Form of i	nstruction	Cod	Semester	Hours	FC	TS	Weight	Realization	Credit
laborator		L	3	45		,0	0,75	K	credits
lecture	,	W	3	15		,0	0,75	K	credits
Leading t	aachar			tr.Tabero@zut.e		,0	0,25		creates
		Bosa	acka Monika	(Monika.Bosack	a@zut				pek@zut.edu.pl),
Other tea	chers		lateusz (Ma r.Tabero@z		du.pl),	Wrobel	Rafał (Rafal.W	robel@zut.edu.	pl), Tabero Piotr
Prerequis	ites								
W-1	Fundamentals of m	athen	natics, physic	s and chemistry					
Module/co	ourse unit objective	es							
C-1	Consolidation of ba								
C-2	Familiarize student			· ·	•				
С-3	Expanding knowled	-			-		•	•	••
C-4	Teaching students literature.	how to	o use stuctura	al data gained fror	n diffra	tion me	asurements, ava	llable structural	databases and
Course co	ontent divided into	vario	us forms of	instruction					Number of hours
T-L-1	Identification of che	emica	l compounds,	metals, alloys and	d their r	nixtures.			5
T-L-2	XRD quantitative p	bhase	analysis of va	rious mixtures.					5
T-L-3	Construction of pha		-						5
T-L-4	X-ray high-tempera of thermal expansion	ature r on. Inv	neasurement /estigations o	s. Determination (f polymorphic pha	of coeffi ase tran	cients of sitions.	f thermal expans	ion. Anisotropy	5
T-L-5	Structure solution f		3						5
T-L-6	Application of XRD		-	•		-			5
T-L-7	Indexation of powd Rentgenographic d			erns. Lattice paran	neter de	etermina	tion. Measureme	ent of density.	5
T-L-8	Determination of g			ress and lattice d	istortior	IS.			5
T-L-9	Aplication of the SA	XS m	ethod.						5
T-W-1	Basic definitions in	crysta	allography. Pl	hysical properties	of solid	s. Struc	ture of "ideal" s	olid.	3
T-W-2	Crystal systems an International Table		vais lattices.	Symmetry in cryst	tals. Poi	nt group	s and space grou	ups.	3
				y.					
T-W-3	Coordination polyh Types of phase dia	edra. grams	Simple struct	y. tures of elements	and cor	npounds			2
T-W-4	Coordination polyh Types of phase dia Defects in crystal s	edra. grams tructu	Simple struct	y. cures of elements tions.			: SC, BCC, FCC a	nd HCP lattices.	2
	Coordination polyh Types of phase dia Defects in crystal s Generation and pro	edra. grams tructu pertie	Simple struct re. Solid solut es of X-rays. Ir	y. ures of elements tions. nteraction of X-ray	/s with I	natter. 2	: SC, BCC, FCC a	nd HCP lattices.	
T-W-4	Coordination polyh Types of phase dia Defects in crystal s	edra. grams tructu opertie tigatio	Simple struct ire. Solid solut es of X-rays. In on of size of cr	y. ures of elements tions. nteraction of X-ray	/s with I	natter. 2	: SC, BCC, FCC a	nd HCP lattices.	2
T-W-4 T-W-5 T-W-6	Coordination polyh Types of phase dia Defects in crystal s Generation and pro Bragg's Law. Invest	edra. grams tructu opertie tigatio amete	Simple struct re. Solid solut s of X-rays. In n of size of cr rs.	y. ures of elements tions. nteraction of X-ray	/s with I	natter. 2	: SC, BCC, FCC a	nd HCP lattices.	2
T-W-4 T-W-5 T-W-6	Coordination polyh Types of phase dia Defects in crystal s Generation and pro Bragg's Law. Invest of the unit cell para	edra. grams tructu opertie tigatio amete	Simple struct ire. Solid solut es of X-rays. In o of size of cr rs.	y. ures of elements tions. nteraction of X-ray	/s with I	natter. 2	: SC, BCC, FCC a	nd HCP lattices.	2 2 3

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Student wo	orkload	- form	s of activity						Nur	nber of	f hours
A-L-3	Prepari	ng for la	aboratory exercises								20
A-L-4	Consult	ations									10
A-W-1	Particip	ation in	lectures								15
A-W-2	Consult	ations									2
A-W-3	Self-stu	dy of th	ne literature								12
A-W-4	Final wi	ritten te	st								2
Teaching r	nethod:	s / tool	s								
M-1	Informa	tive lec	tures with multimedia instrun	nents, explanatio	on						
М-2	Work w	ith com	puters and dedicated softwar	re							
Evaluation	metho	ds (F -	progressive, P - final)								
S-1	Р	Final wi	ritten test.								
S-2	Р	written	reports								
	P written reports Designed learning outcomes Reference to the learning outcomes designed for the fields of study Reference to learning outcomes for qualifications at learning outcomes for qualifications at learning outcomes at learning outcomes for qualifications at learning outcomes for qualifications at learning outcomes for qualifications at learning outcomes at learning outcomes outcomes at learning outcomes outcomes objectives Course objectives objectives Course objectives objectives Course objectives										Evaluation methods
Knowledge	e										
	vs fundan		ncepts in crystallography and sing diffraction phenomenon	MSE_1A_W02 MSE_1A_W03	P6S_WG P6S_WK	P6S_WG	C-1 C-2 C-3	T-W-1 T-W-2 T-W-3	T-W-4 T-W-5 T-W-6	M-1	S-1
Skills		inques u					0.5	1 1 5	1 10 0		
	ble to sele nvestigat	e given p	priate diffraction measuring oroperty of material and interpret 1	MSE_1A_U03	P6S_UW	P6S_UW	C-1 C-2 C-3	T-L-1 T-L-2 T-L-3 T-L-4 T-L-5	T-L-6 T-L-7 T-L-8 T-L-9	M-1	S-1
Social com	petenc	es		•							
	s safety p mportanc	e of perr	es for x-ray equipment and nanent learning to improve	MSE_1A_K04	P6S_KR		C-1 C-2 C-3	T-L-1 T-L-2 T-L-3 T-L-4 T-L-5	T-L-6 T-L-7 T-L-8 T-L-9	M-1	S-1
Outcom	nes	Grade		E	valuation cri	iterion					
Knowledge											
MSE_1A_C02_	W01	2,0									
		3,0	Student will be able to present ba diffraction.	asic concepts of cry	ystallography ar	nd describe basi	c measu	ring met	hods app	lying X-ı	ау
	-	3,5									
	-	4,0									
		4,5									
		5,0									
Skills											
MSE_1A_C02_	U01	2,0									
		3,0	Student will be able to select app crystalline solid	oroprate XRD meas	suring techniqu	e to solve simp	e proble	em conce	erning a	nalysis o	r
		3,5									
		4,0									
	-	4,5									
	,	5,0									
Other socia	-		2S								
MSE_1A_C02_	KUI	2,0 3,0	Student knows and understands s	cafaty procedures	for x roy oquing	ant					
	-	3,0		sarety procedures							
	ŀ	4,0									
	ŀ	4,5									
		5,0									
Required r	eading										
	-	7 Mon	aco D Biterbo E Scordari G	Gilli G Zapott	i M Catti Eu	ndamentals o	f Crysta	llograp	hy ILICE		d

University Press, Oxford, 2000

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Required reading

2. D. B. Williams, C. B. Carter, Transmission Electron Microscopy, Plenum Press, New York and London, 1996

3. O. Engler, V. Randle, Introduction to Texture Analysis. Macrotexture, Microtexture and Orientation Mapping,, CRC Press, Taylor & Francis Group, London, New York, 2010

4. Cullity B.D., Elements of X-ray Diffraction, Addison-Wesley Publishing Company, Inc., London, 1978

5. P. Luger, Modern X-ray Analysis on Single Crystals, Walter de Gruyter and Co., Berlin, 1980

6. Glusker, J. P.; Lewis, M.; Rossi, M., "Crystal Structure Analysis for Chemists and Biologists, VCH, New York, 1994

7. W.I.F. David, K. Shankland, L.B. McCusker and Ch. Baerlocher, Edt., Structure determination form powder diffraction data. IUCr Monographs on crystallography, Oxford Science Publications, Oxford, 2002

8. A. Gaunier, X-ray Diffraction in Crystals, Imperfect Crystals, and Amorphous Bodies, Courier Corporation, New York, 1994 9. A. AUTHIER, G. CHAPUIS, EDS, A LITTLE DICTIONARY OF CRYSTALLOGRAPHY, INTERNATIONAL UNION OF CRYSTALLOGRAPHY, 2017, 2ND EDITION

10. P. P. Ewald, Ed., Fifty Years of X-ray Diffraction, Reprinted in pdf format for the IUCr XVIII Congress, Glasgow, Scotland, Copyright © 1962, 1999 International Union of Crystallography, https://www.iucr.org

Supplementary reading

1. International Union of Crystallography: https://www.iucr.org

2. http://www.xtal.iqfr.csic.es/Cristalografia/parte_01_1-en.html

Field of :								7	
	study	Materials Science and Engineering							
Mode of	f study	stati	onary	Level		first o	cycle	\A/T:1/	
Graduat	te's qualification	inży	nier					WTil	LN
Fields of	f science	engi	neering and	l technology				_	
Disciplin	nes of science	mate	erials engine	eering (100%)					<u> </u>
Educatio	onal profile	gene	eral academ						
Module									
Course ι	unit	Intr	o to Materi	ials Synthesis		\mathbf{O}			
Code		MSE	_1A_S_C03						
Field of :	specialisation								
Adminis	tering faculty	Dep	artment of C	Drganic and Phys	sical Cl	hemistry	/		
ECTS		7,0		ECTS (forms)		7,0		_	
Form of	course credit	exar	nination	Language		english		_	
Electives	S			Elective group					
Form of	instruction	Cod	Semester	Hours	EC	CTS	Weight	Realization	Credit
lecturing	g course	Α	3	30	2	,0	0,25	К	credits
laborato	ory course	L	3	30	3	,0	0,50	К	credits
lecture		W	3	30	2	,0	0,25	К	examination
Leading	teacher	Sośr	nicki Jacek (J	acek.Sosnicki@z	zut.edu	ı.pl)			
								t.edu.pl), Szady	
Prerequi				dy@zut.edu.pl),					
Prerequi W-1	isites Basic knowledge of			dy@zut.edu.pl),					
W-1 Module/	Basic knowledge of	f orgai es	nic chemistry	dy@zut.edu.pl),	Wróble	ewska E	lwira (Elwira.V	Vroblewska@zu	t.edu.pl)
W-1 Module/o C-1	Basic knowledge of Course unit objective The student knows	f orgai es s how t	nic chemistry	dy@zut.edu.pl),	Wróble earch ba	ewska E	lwira (Elwira.V	Vroblewska@zu	t.edu.pl)
W-1 Module/	Basic knowledge of Course unit objective The student knows The student is able their analysis and o	f organ es how t to co can pr	nic chemistry to carry out a nduct the syn epare the rep	dy@zut.edu.pl), basic literature se thesis of the simp ort.	Wróble earch ba	ewska E ased on c nic comp	lwira (Elwira.V latabases and s ound/material a	Vroblewska@zu cientific literature ind knows standa	t.edu.pl) rd methods for
W-1 Module/o C-1	Basic knowledge of Course unit objective The student knows The student is able	f orgai es how t to co can pr re of t	nic chemistry to carry out a nduct the syn epare the rep the importanc	dy@zut.edu.pl), basic literature se thesis of the simp ort.	Wróble earch ba	ewska E ased on c nic comp	lwira (Elwira.V latabases and s ound/material a	Vroblewska@zu cientific literature ind knows standa	t.edu.pl) rd methods for
W-1 Module/o C-1 C-2 C-3	Basic knowledge of <i>course unit objective</i> The student knows The student is able their analysis and o The student is awa improvement of the content divided into	f organ es how t e to co can pr re of t e qual vario	nic chemistry to carry out a nduct the syn epare the rep he importanc ity of life. rus forms of	dy@zut.edu.pl), basic literature se ithesis of the simp ort. e of the knowledg instruction	Wróble earch ba le organ e acqui	ewska E ased on c nic comp red withi	lwira (Elwira.V latabases and s ound/material a n the subject fo	Vroblewska@zu cientific literature ind knows standa r developement c	t.edu.pl) rd methods for
W-1 Module/o C-1 C-2 C-3	Basic knowledge of Course unit objective The student knows The student is able their analysis and o The student is awa improvement of the	f organ es how t to co can pr re of t e qual vario ng syr	nic chemistry co carry out a nduct the syn epare the rep he importanc ity of life. ous forms of thesis of the	dy@zut.edu.pl), basic literature se ithesis of the simp oort. .e of the knowledg <i>instruction</i> simple and compl	Wróble earch ba le organ e acqui	ewska E ased on c nic comp red withi	lwira (Elwira.V latabases and s ound/material a n the subject fo	Vroblewska@zu cientific literature ind knows standa r developement c	t.edu.pl)
W-1 Module/c C-1 C-2 C-3 Course c	Basic knowledge of <i>course unit objective</i> The student knows The student is able their analysis and o The student is awa improvement of the <i>content divided into</i> Exercises in planni	f organ es how t to co can pr re of t e qual vario ng syr th the	nic chemistry to carry out a nduct the syn epare the rep the importanc ity of life. us forms of nthesis of the use of databa	dy@zut.edu.pl), basic literature se thesis of the simp ort. e of the knowledg <i>instruction</i> simple and compl ases.	Wróble earch ba le organ e acqui ex orga	ased on c nic comp red withi nic mole	lwira (Elwira.V latabases and s ound/material a n the subject fo cules through fu	Vroblewska@zu cientific literature ind knows standa r developement c	t.edu.pl) rd methods for of science and for Number of hours
W-1 Module/c C-1 C-2 C-3 Course c T-A-1	Basic knowledge of Course unit objective The student knows The student is able their analysis and o The student is awa improvement of the content divided into Exercises in plannin transformations wi Exercises in detern Regulations and sa	f organ es how t e to co can pr re of t e qual vario ng syr th the nining ifety ru	nic chemistry. co carry out a nduct the syn epare the rep the importanc ity of life. ous forms of thesis of the use of databa the structure ules in the lab	dy@zut.edu.pl), basic literature se thesis of the simp ort. e of the knowledg <i>instruction</i> simple and compl ases. e of organic compo	Wróble earch ba le organ e acqui ex orga punds by c synthe	ased on c nic comp red withi nic mole y IR, NMF esis.	lwira (Elwira.V latabases and s ound/material a n the subject fo cules through fu R, MS methods.	Vroblewska@zu cientific literature ind knows standa r developement c	t.edu.pl) e. rd methods for of science and for <i>Number of hours</i> 15
W-1 Module/c C-1 C-2 C-3 Course c T-A-1 T-A-2	Basic knowledge of Course unit objective The student knows The student is able their analysis and of The student is awa improvement of the content divided into Exercises in planning transformations with Exercises in detern Regulations and sa Practical aspects of (Sample preparation)	f organ es how t e to co can pr re of t e qual vario ng syr th the nining ifety ru f purif on, sel	nic chemistry. co carry out a nduct the syn epare the rep the importanc ity of life. ous forms of thesis of the use of databa the structure ules in the lab ication and st ection of puri	dy@zut.edu.pl), basic literature se thesis of the simp ort. e of the knowledg <i>instruction</i> simple and compl ases. of organic compo poratory of organic ructural analysis (fication method ar	Wróble earch ba le organ e acqui ex orga punds by c synthe by IR, M nd meas	ased on c nic comp red withi nic mole y IR, NMF esis. MS, NMR) surement	lwira (Elwira.V latabases and s ound/material a n the subject fo cules through fo R, MS methods.	Vroblewska@zu cientific literature ind knows standa r developement c unctional group pounds.	t.edu.pl) rd methods for of science and for Number of hours 15 15
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W-1 Module/A C-1 C-2 C-3 Course o T-A-1 T-A-2 T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-6	Basic knowledge of Course unit objective The student knows The student is able their analysis and of The student is awa improvement of the content divided into Exercises in plannin transformations wir Exercises in detern Regulations and sa Practical aspects or (Sample preparation Building a carbon sa Eg. Application of Sa properly selected ra Elemental analysis determination of el Databases and scie Principles of plannin Functional group tr organic materials (reactions) The synthesis of fu Isolation and separ	f organ es how t to co can pr re of t e qual vario ng syr th the nining afety ru f purif on, sel skeletco f purif on, sel skeletco f purif on, sel skeletco f on g anethoo , deter lemen entific e.g. b inction ration	nic chemistry to carry out a nduct the syn epare the rep the importance ity of life. <i>us forms of</i> thesis of the use of databa the structure ules in the lab ication and st ection of purition on by using or ashira reaction d. Structure a rmination of C tal composition journals as a e synthesis of rmations – an ased on couple halized areness halized monom	dy@zut.edu.pl), basic literature set thesis of the simp ort. e of the knowledg <i>instruction</i> simple and compl ases. of organic compo poratory of organic ructural analysis (fication method ar ganometallic component n in the preparation nalysis by spectro C, N and S in orga on by ICP-OES met platform to start of simple and compl introduction to the ling, condensation s, heteroarenes as mers based on org organic compound	Wróble earch ba le organ e acqui e acqui e acqui e acqui e acqui e synthe by IR, M nd meas pounds by IR, M nd meas pounds po	ewska E ased on c nic comp red withi nic mole y IR, NMF esis. AS, NMR) surement (yne. Pur methods erials, m material anic mole esis of co on, subst other ca callic che organic r	lwira (Elwira.V latabases and s ound/material a n the subject fo cules through fu R, MS methods. of organic com t conditions, etc (IR, MS, NMR). icrowave miner (IR, MS, NMR). icrowave miner synthesis. cules. omplex organic itution and elim rbo- and hetero mistry. materials.	Vroblewska@zu cientific literature ind knows standa r developement c unctional group pounds. .) product with a alization and compounds and ination cyclic	t.edu.pl)
W-1 Module/c C-1 C-2 C-3 Course o T-A-1 T-A-2 T-L-1 T-L-2 T-L-3 T-L-4 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5	Basic knowledge of Course unit objective The student knows The student is able their analysis and of The student is awa improvement of the content divided into Exercises in plannin transformations wit Exercises in detern Regulations and sa Practical aspects of (Sample preparation Building a carbon sa Elemental analysis determination of ele Databases and scie Principles of planni Functional group tr organic materials (reactions) The synthesis of fu Compounds.	f organ f organ f organ es how t to co can pr rre of t e qual vario ng syr th the nining fety ru f purif f anston entific e.g. ba unction ration and N	nic chemistry. to carry out a nduct the syn epare the rep the importance ity of life. The structure use of database the structure ules in the lab ication and st ection of purity on by using or ashira reactio d. Structure a rmination of C tal composition journals as a e synthesis of rmations – an ased on coupl halized areness nalized monom techniques of IMR as fundar	dy@zut.edu.pl), basic literature set ithesis of the simp ort. e of the knowledg <i>instruction</i> simple and compl ases. of organic comport ructural analysis (fication method ar ganometallic com n in the preparation n by ICP-OES met platform to start of simple and compl introduction to th ling, condensation s, heteroarenes as mers based on org forganic compount mental methods for	Wróble earch ba le organ e acqui e acqui ex orga punds by c synthe by IR, M nd meas pounds by c synthe by IR, M nd meas pounds of all scopic in nic mat thod. organic lex orga e synth a additio well as anomet ids and or analy	ewska E ased on c nic comp red withi nic mole y IR, NMF esis. AS, NMR) surement (yne. Pur methods erials, m material nic mole esis of co on, subst other ca callic chel organic r sis of org	lwira (Elwira.V latabases and s ound/material a n the subject fo cules through fu a, MS methods. of organic com t conditions, etc ification of the (IR, MS, NMR). icrowave miner synthesis. cules. omplex organic itution and elim rbo- and hetero mistry. materials. ganic compound	vroblewska@zu cientific literature ind knows standa r developement of unctional group pounds. .) product with a alization and compounds and ination cyclic	t.edu.pl)

Faculty of Chemical Technology and Engineering

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Student w	orkload	d - form	s of activity						Nur	nber of	f hours
A-A-1	Partici	pation in	recitations								30
A-A-2	Self-im	provem	ent by solving additional prob	olems.							26
A-A-3	Face to	o face di	scussion.								4
A-L-1	Partici	pation in	the laboratory classes.								30
A-L-2	Self-st	udy of re	comended literature.								26
A-L-3	Face to	o face di	scussion.								4
A-L-4	Theore	tical pre	paration to the laboratory cla	asses.							20
A-L-5	Prepar	ation of	written reports.								10
A-W-1	Partici	pation in	the lectures.								30
A-W-2	Self stu	udy of re	comended literature.								26
A-W-3	Consul	tations.									4
A-W-4	The ex	am									1
Teaching	method	ls / tool	s								
M-1	Lecture	e with di	scussion.								
М-2			scussion.								
М-3	Labora	tory exe	rcises.								
Evaluatior	n metho	ods (F -	progressive, P - final)								
S-1	F	Continu	ous assessment: laboratory	reports and activ	ity.						
S-2	Р	Exam.									
5-3	Р	Final te	st.								
	Desigr	ned lear	ning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Cours	e content	Teaching methods	Evaluation methods
Knowledg	е			-	•						
simple organ	ias basic l ic compo	unds, kno	e on the structure, reactivity of ws basic methods for ethods for analyses of organic	MSE_1A_W02 MSE_1A_W03 MSE_1A_W05 MSE_1A_W06	P6S_WG P6S_WK	P65_WG	C-2 C-3	T-A-2 T-L-2 T-L-3 T-L-4 T-W-3	T-W-4 T-W-5 T-W-6 T-W-7 T-W-8	M-1 M-2 M-3	S-1 S-2 S-3
Skills				1		•	1	-			
MSE_1A_C03 The studen is transformatic databases ar	s able to p ons on the	e basis of	perform basic synthetic informations taken from ire.	MSE_1A_U01 MSE_1A_U05 MSE_1A_U06 MSE_1A_U09 MSE_1A_U12	P6S_UO P6S_UW	P6S_UW	C-1 C-3	T-A-1 T-L-1 T-L-2 T-L-3 T-W-1	T-W-2 T-W-3 T-W-4 T-W-5	M-1 M-2	S-3
MSE_1A_C03 The studen is	_U02 s able to p	orepare th	e basic laboratory report.	MSE_1A_U03	P6S_UW	P6S_UW	C-2	T-L-1 T-L-2	T-L-3 T-L-4	M-3	S-1
Social con	npeten	ces		1				-			
MSE_1A_C03 The student i life and scien	is aware o	of the imp	ortance of organic chemistry in	MSE_1A_K01 MSE_1A_K02	P6S_KK	P6S_WK	C-3	T-L-1 T-W-1 T-W-3 T-W-4	T-W-5 T-W-6 T-W-7 T-W-8	M-1 M-2 M-3	S-2 S-3
Outcor	mes	Grade		E	valuation cr	iterion					
Knowledg	е										
MSE_1A_C03	_W01	2,0									
		- / -	Positive grade of the final test ar	nd exam (more that	n 55% correct a	nswers)					
		3,5									
		4,0 4,5									
		5,0									
Skills											
MSE_1A_C03	_U01	2,0									
		3,0	Positive grade of the final test (n	nore than 55% corr	ect answers)						
		3,5								_	
		4,0 4,5									
		4,5 5,0									
		5,0									

Faculty of Chemical Technology and Engineering

Skills		
MSE_1A_C03_U02	2,0	
	3,0	Positive evaluation of the laboratoty report
	3,5	
	4,0	
	4,5	
	5,0	
Other social com	petenc	es
MSE_1A_C03_K01	2,0	
	3,0	Positive grade of the final test and exam (more than 55% correct answers)

MSE_IA_C03_K01	2,0	
	3,0	Positive grade of the final test and exam (more than 55% correct answers)
	3,5	
	4,0	
	4,5	
	5,0	

Required reading

1. John McMurry, Organic Chemistry, Brooks/cole, 2012, 8e

2. J. J. Li, C. Limberakis, D. A. Pflum, Modern Organic Synthesis in the laboratory. A collection of standard experimental procedures, OXFORD University Press, 2007

3. Clayden, Greeves, Warren, Wothers, Organic Chemistry, Oxford, 2004

4. K. Peter C. Vollhardt, Organic Chemistry Structure and Function, W. H. Freeman, 2014

Supplementary reading

1. Jacques Mortier, Arene Chemistry, Wiley, 2016

2. W. CARRUTHERS, IAIN COLDHAM, MODERN METHODS OF ORGANIC SYNTHESIS, Cambridge University Press, 2004

Field of st								1	
	tudy	Materials Science and Engineering							
Mode of s	tudy	stati	onary	Level		first c	cycle	34/7714	~1
Graduate	's qualification	inży	nier	I				WTil(Lh
Fields of s	science	-	neering and	technology					
Discipline	s of science	mate	erials engine	ering (100%)					
Education	nal profile	gene	eral academ	ic					
Module									
Course ur	nit	Mat	erials Proc	essina					
Code			1A_S_C04						
	pecialisation		_17_3_004	C					
Administe	ering faculty	Department of Polymer and Biomaterials Science							
ECTS		6,0		ECTS (forms)		6,0			
Form of c	ourse credit	cred	lits	Language		english		-	
Electives				Elective group		<u> </u>		-	
Form of ir	nstruction	Cod	Semester	Hours	EC	CTS	Weight	Realization	Credit
lecturing	course	Α	3	15		,5	0,25	K	credits
laboratory		L	3	15		, <u>5</u>	0,25	K	credits
lecture	,	W	3	30		,9 ,0	0,20	K	credits
Leading to				a (Miroslawa.ElF				i k	creates
Other tea	chers	(Agr	nieszka.Koch	zak@zut.edu.pl), manska@zut.ed				rzysztof Kowal	czyk@zut.edu.pl),
		Prze	piórski Jacel	(Jacek.Przepior					
Prerequis	1		· · ·						
W-1	Basics of chemistry	/ and	· · ·						
W-1 Module/co	Basics of chemistry	/ and e <i>s</i>	physics	< (Jacek.Przepion	ski@zı	ut.edu.p	l), Wróblewska	a Agnieszka	
W-1 Module/co C-1	Basics of chemistry purse unit objective To gain the knowle	/ and es dge, s	physics skills and com	k (Jacek.Przepion	ski@zı	ut.edu.p	l), Wróblewska	a Agnieszka	· · ·
W-1 Module/cc C-1 Course cc	Basics of chemistry purse unit objective To gain the knowle potent divided into	/ and es dge, s vario	physics skills and com	<pre>< (Jacek.Przepior: petences in the fie instruction</pre>	ski@zu	ut.edu.p	l), Wróblewska g of various engin	a Ágnieszka neering materials	Number of hours
W-1 Module/cc C-1 Course cc T-A-1	Basics of chemistry ourse unit objective To gain the knowle ontent divided into Calculations of hea	/ and es dge, s <i>vario</i> t tran	physics skills and com pus forms of sfer and rheol	k (Jacek.Przepion petences in the fie instruction logical parameters	ski@zu eld of pi	rocessing ying the	l), Wróblewska g of various engin	a Ágnieszka neering materials	Number of hours
W-1 Module/cc C-1 Course cc T-A-1 T-A-2	Basics of chemistry ourse unit objective To gain the knowle ontent divided into Calculations of hea Mesoporous silica r	y and y es dge, s vario t tran materi	physics skills and com pus forms of sfer and rheol	k (Jacek.Przepion petences in the fie instruction logical parameters	ski@zu eld of pi	rocessing ying the	l), Wróblewska g of various engin	a Ágnieszka neering materials	Number of hours 5 5
W-1 Module/co C-1 Course co T-A-1 T-A-2 T-A-3	Basics of chemistry ourse unit objective To gain the knowle ontent divided into Calculations of hea Mesoporous silica r Exercises on castin	y and y es dge, s vario t tran nateri	physics skills and com pus forms of sfer and rheol	k (Jacek.Przepion petences in the fie instruction logical parameters	ski@zu eld of pi	rocessing ying the	l), Wróblewska g of various engin	a Ágnieszka neering materials	Number of hours 5 5 2
W-1 Module/cc C-1 Course cc T-A-1 T-A-2 T-A-3 T-A-4	Basics of chemistry Durse unit objective To gain the knowle ontent divided into Calculations of hea Mesoporous silica r Exercises on castin Exercises on weldir	y and p es dge, s vario t tran t tran nateri ng	physics skills and com ous forms of sfer and rheol als characteri	k (Jacek.Przepion petences in the fie <i>instruction</i> logical parameters zation methods - j	ski@zu eld of pr s underl ournal	rocessing ying the club	l), Wróblewska g of various engin processing of m	a Ágnieszka neering materials	Number of hours 5 5 2 3
W-1 Module/co C-1 Course co T-A-1 T-A-2 T-A-3 T-A-4 T-L-1	Basics of chemistry Durse unit objective To gain the knowle ontent divided into Calculations of hea Mesoporous silica r Exercises on castin Exercises on veldir Principles of proces Injection moulding	v and p es dge, s vario t tran nateri ng ng ssing o of pol	physics skills and com ous forms of sfer and rheol als characteri of thermoplas ymeric mater	k (Jacek.Przepion petences in the fie <i>instruction</i> logical parameters zation methods - j	ski@zu eld of pr s underl ournal	rocessing ying the club	l), Wróblewska g of various engin processing of m	a Ágnieszka neering materials	Number of hours 5 5 2 3 5 5
W-1 Module/co C-1 Course co T-A-1 T-A-2 T-A-3 T-A-4 T-L-1 T-L-2	Basics of chemistry ourse unit objective To gain the knowle ontent divided into Calculations of hea Mesoporous silica r Exercises on castin Exercises on weldir Principles of proces Injection moulding Electrospinning of	v and p es dge, s vario t tran matering ng ssing c of pol polym	physics skills and com ous forms of sfer and rheo als characteri of thermoplas ymeric mater er nanofibres	k (Jacek.Przepion petences in the fie <i>instruction</i> logical parameters ization methods - j tic materials (extru ials (2h)	ski@zu eld of pr s underl ournal	rocessing ying the club	l), Wróblewska g of various engin processing of m	a Ágnieszka neering materials	Number of hours 5 2 3 5 5 5 5 5 5 5 5 5 5
W-1 Module/co C-1 Course co T-A-1 T-A-2 T-A-3 T-A-3 T-A-4 T-L-1 T-L-2 T-L-2 T-L-3	Basics of chemistry ourse unit objective To gain the knowle ontent divided into Calculations of hea Mesoporous silica r Exercises on castin Exercises on castin Exercises on weldir Principles of proces Injection moulding Electrospinning of Synthesis (fabricat	v and p es dge, s vario t tran materi ng ssing o of pol polym ion) of	physics skills and com ous forms of sfer and rheol als characteri of thermoplas ymeric mater er nanofibres f MCM-41 mat	k (Jacek.Przepion petences in the fie <i>instruction</i> logical parameters ization methods - j tic materials (extru ials (2h)	eld of pr underl ournal	rocessing ying the club	l), Wróblewska g of various engin processing of m	a Ágnieszka neering materials	Number of hours 5 5 2 3 5 5 5 5 5 5 5 5 5
W-1 Module/co C-1 Course co T-A-1 T-A-2 T-A-3 T-A-3 T-A-4 T-L-1 T-L-2 T-L-2 T-L-3 T-W-1	Basics of chemistry ourse unit objective To gain the knowle ontent divided into Calculations of hea Mesoporous silica r Exercises on castin Exercises on castin Principles of proces Injection moulding Electrospinning of Synthesis (fabricat Principles of polym	v and p es dge, s vario t trans matering ng ssing o of pol polym ion) of er me	physics skills and com ous forms of sfer and rheol als characteri of thermoplas ymeric mater er nanofibres f MCM-41 mat It rheology	k (Jacek.Przepion petences in the fie <i>instruction</i> logical parameters zation methods - j tic materials (extru ials (2h)	eld of pr underl ournal	rocessing ying the club	l), Wróblewska g of various engin processing of m oforming) (3h)	a Agnieszka neering materials aterials	Number of hours 5 5 2 3 5 5 5 5 5 3
W-1 Module/co C-1 Course co T-A-1 T-A-2 T-A-3 T-A-4 T-L-1 T-L-2 T-L-2 T-L-3 T-W-1 T-W-2	Basics of chemistry ourse unit objective To gain the knowle ontent divided into Calculations of hea Mesoporous silica r Exercises on castin Exercises on veldin Principles of proces Injection moulding Electrospinning of Synthesis (fabricat Principles of polym Introduction to polym	v and p es dge, s vario t tran materi ng ng ssing c of pol polym ion) of er me ymer p	physics skills and com ous forms of sfer and rheol als characteri of thermoplas ymeric mater er nanofibres f MCM-41 mat It rheology	k (Jacek.Przepion petences in the fie <i>instruction</i> logical parameters zation methods - j tic materials (extru ials (2h)	eld of pr underl ournal	rocessing ying the club	l), Wróblewska g of various engin processing of m oforming) (3h)	a Agnieszka neering materials aterials	Number of hours 5 5 2 3 5 5 5 5 5 5 3 4
W-1 Module/co C-1 Course co T-A-1 T-A-2 T-A-3 T-A-3 T-A-4 T-L-1 T-L-2 T-L-2 T-L-3 T-W-1 T-W-2 T-W-3	Basics of chemistry ourse unit objective To gain the knowle ontent divided into Calculations of hea Mesoporous silica r Exercises on castin Exercises on castin Exercises on weldir Principles of proces Injection moulding Electrospinning of Synthesis (fabricat Principles of polym Introduction to poly Processing of rubbe	v and p es dge, s dge, s vario t tran materi ng of pol polym ion) of er me ymer p ers	physics skills and com ous forms of sfer and rheol als characteri of thermoplas ymeric mater er nanofibres f MCM-41 mat It rheology processing (ex	k (Jacek.Przepion petences in the fie <i>instruction</i> logical parameters zation methods - j tic materials (extru ials (2h)	eld of pr underl ournal	rocessing ying the club	l), Wróblewska g of various engin processing of m oforming) (3h)	a Agnieszka neering materials aterials	Number of hours 5 2 3 5 5 5 5 5 5 3 4 1
W-1 Module/co C-1 Course co T-A-1 T-A-2 T-A-3 T-A-3 T-A-4 T-L-1 T-L-2 T-L-3 T-W-1 T-W-2 T-W-3 T-W-4	Basics of chemistry Durse unit objective To gain the knowle ontent divided into Calculations of hea Mesoporous silica r Exercises on castin Exercises on castin Principles of proces Injection moulding Electrospinning of Synthesis (fabricat Principles of polym Introduction to poly Processing of rubbo	v and p es dge, s vario t tran matering ng ssing o of pol polym ion) of er me ymer p ers vens t	physics skills and com ous forms of sfer and rheol als characteri of thermoplas ymeric mater er nanofibres f MCM-41 mat lt rheology processing (ex-	k (Jacek.Przepion petences in the fie <i>instruction</i> logical parameters zation methods - j tic materials (extru ials (2h) rerial	eld of pr underl ournal	rocessing ying the club	l), Wróblewska g of various engin processing of m oforming) (3h)	a Agnieszka neering materials aterials	Number of hours 5 2 3 5 5 3 5 3 4 1 2
W-1 Module/co C-1 Course co T-A-1 T-A-2 T-A-3 T-A-3 T-A-4 T-L-1 T-L-2 T-L-2 T-L-3 T-W-1 T-W-2 T-W-3	Basics of chemistry ourse unit objective To gain the knowle ontent divided into Calculations of hea Mesoporous silica r Exercises on castin Exercises on castin Exercises on weldir Principles of proces Injection moulding Electrospinning of Synthesis (fabricat Principles of polym Introduction to poly Processing of rubbe	v and p es dge, s vario t tran materi g ng ssing c of pol polym ion) of er me ymer p ers vens t - appl	physics skills and com ous forms of sfer and rheol als characteri of thermoplas ymeric mater er nanofibres f MCM-41 mat lt rheology processing (e) echnologies ications and s	c (Jacek.Przepion petences in the fie <i>instruction</i> logical parameters zation methods - j tic materials (extru ials (2h) erial ctrusion, injection i synthesis routes	eld of pr underl ournal	rocessing ying the club	l), Wróblewska g of various engin processing of m oforming) (3h)	a Agnieszka neering materials aterials	Number of hours 5 2 3 5 5 5 5 3 5 3 4 1
W-1 Module/co C-1 Course co T-A-1 T-A-2 T-A-3 T-A-4 T-L-1 T-L-2 T-L-2 T-L-3 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5	Basics of chemistry ourse unit objective To gain the knowle ontent divided into Calculations of hea Mesoporous silica r Exercises on castin Exercises on veldin Principles of proces Injection moulding Electrospinning of Synthesis (fabricat Principles of polym Introduction to poly Processing of rubba Fibres and non-wow Ceramic materials	v and p es dge, s dge, s vario t tran materi ng of pol polym ion) of er me ymer p ers vens t - appl	physics skills and com ous forms of sfer and rheol als characteri of thermoplas ymeric mater er nanofibres f MCM-41 mat It rheology processing (ex echnologies ications and s ications and s	c (Jacek.Przepior	eld of pr underl ournal	rocessing ying the club	l), Wróblewska g of various engin processing of m oforming) (3h)	a Agnieszka neering materials aterials	Number of hours 5 5 2 3 5 5 5 5 5 5 3 4 1 2 3 4 1 2 3
W-1 Module/co C-1 Course co T-A-1 T-A-2 T-A-3 T-A-3 T-A-4 T-L-1 T-L-2 T-L-3 T-U-3 T-W-1 T-W-2 T-W-3 T-W-3 T-W-5 T-W-6	Basics of chemistry Durse unit objective To gain the knowle ontent divided into Calculations of hea Mesoporous silica r Exercises on castin Exercises on castin Exercises on veldir Principles of proces Injection moulding Electrospinning of Synthesis (fabricat Principles of polym Introduction to poly Processing of rubbo Fibres and non-wow Ceramic materials	v and p es dge, s vario t tran matering ng ssing c of pol polym ion) of er me ymer p ers vens t - appl - appl	physics skills and com ous forms of sfer and rheol als characteri of thermoplas ymeric mater er nanofibres f MCM-41 mat lt rheology processing (ex- echnologies ications and s ications and s	c (Jacek.Przepion petences in the fie <i>instruction</i> logical parameters zation methods - j tic materials (extru ials (2h) cerial ctrusion, injection i synthesis routes synthesis routes synthesis routes rials	eld of pr underl ournal usion al	rocessing ying the club	i), Wróblewska g of various engin processing of m noforming) (3h)	neering materials aterials	Number of hours 5 5 2 3 5 5 5 5 3 4 1 2 3 4 1 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3
W-1 Module/co C-1 Course co T-A-1 T-A-2 T-A-3 T-A-4 T-L-1 T-L-2 T-L-3 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-5 T-W-6 T-W-7	Basics of chemistry Durse unit objective To gain the knowle ontent divided into Calculations of hea Mesoporous silica r Exercises on castin Exercises on castin Principles of proces Injection moulding Electrospinning of Synthesis (fabricat Principles of polym Introduction to poly Processing of rubbe Fibres and non-wow Ceramic materials Production of meso	v and j es dge, s vario t tran materi ig ng ssing c of pol polym ion) of er me ymer p ers vens t - appl - appl porou s of m	physics skills and com ous forms of sfer and rheol als characteria of thermoplas ymeric mater er nanofibres f MCM-41 mat lt rheology processing (ex echnologies lications and s ications and s is silica mater etallic materia	c (Jacek.Przepior petences in the fie <i>instruction</i> logical parameters zation methods - j tic materials (extru ials (2h) terial ctrusion, injection in synthesis routes synthesis routes ials als (hot working, co	eld of province of	rocessing ying the club nd therm	i), Wróblewska g of various engin processing of m oforming) (3h) noforming, castir	a Agnieszka	Number of hours 5 2 3 5 5 5 5 3 4 1 2 3 4 1 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 5 5 5 5 5 5 5 5 5 5 5 5
W-1 Module/co C-1 Course co T-A-1 T-A-2 T-A-3 T-A-3 T-A-4 T-L-1 T-L-2 T-L-2 T-L-2 T-U-3 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-5 T-W-6 T-W-7 T-W-8	Basics of chemistry ourse unit objective To gain the knowle ontent divided into Calculations of hea Mesoporous silica r Exercises on castin Exercises on castin Exercises on weldin Principles of proces Injection moulding Electrospinning of Synthesis (fabricat Principles of polym Introduction to poly Processing of rubbe Fibres and non-wow Ceramic materials Production of meso	v and p es dge, s dge, s vario t tran materi g ng ssing o of pol polym ion) of er me vers t vens t - appl oporou s of m ing, di	physics skills and com ous forms of sfer and rheol als characteria of thermoplas ymeric mater er nanofibres f MCM-41 mat lt rheology processing (ex echnologies lications and s ications and s is silica mater etallic materia	c (Jacek.Przepior petences in the fie <i>instruction</i> logical parameters zation methods - j tic materials (extru ials (2h) terial ctrusion, injection in synthesis routes synthesis routes ials als (hot working, co	eld of province of	rocessing ying the club nd therm	i), Wróblewska g of various engin processing of m oforming) (3h) noforming, castir	a Agnieszka	Number of hours 5 2 3 5 5 5 5 5 5 3 4 1 2 3 4 1 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 3 3 3 3 3 3 3 3 3
W-1 Module/co C-1 Course co T-A-1 T-A-2 T-A-3 T-A-4 T-L-1 T-L-2 T-L-2 T-L-3 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-5 T-W-6 T-W-5 T-W-6 T-W-7 T-W-8 T-W-9 T-W-10 T-W-11	Basics of chemistry Durse unit objective To gain the knowle ontent divided into Calculations of hea Mesoporous silica r Exercises on castin Exercises on castin Exercises on weldir Principles of proces Injection moulding Electrospinning of Synthesis (fabricat Principles of polym Introduction to poly Processing of rubbo Fibres and non-wow Ceramic materials Ceramic materials Production of meso Forming operations Casting (sand casti	v and p es dge, s dge, s vario t tran materi g ng ssing o of pol polym ion) of er me vers t vens t - appl oporou s of m ing, di	physics skills and com ous forms of sfer and rheol als characteria of thermoplas ymeric mater er nanofibres f MCM-41 mat lt rheology processing (ex echnologies lications and s ications and s is silica mater etallic materia	c (Jacek.Przepior petences in the fie <i>instruction</i> logical parameters zation methods - j tic materials (extru ials (2h) terial ctrusion, injection in synthesis routes synthesis routes ials als (hot working, co	eld of province of	rocessing ying the club nd therm	i), Wróblewska g of various engin processing of m oforming) (3h) noforming, castir	a Agnieszka	Number of hours 5 5 2 3 5 5 5 5 3 5 3 4 1 2 3 4 1 2 3 2 3 2 3 2 3 2 3 2 3 2
W-1 Module/co C-1 Course co T-A-1 T-A-2 T-A-3 T-A-4 T-L-1 T-L-2 T-L-3 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-5 T-W-6 T-W-7 T-W-8 T-W-9 T-W-10	Basics of chemistry Durse unit objective To gain the knowle ontent divided into Calculations of hea Mesoporous silica r Exercises on castin Exercises on veldin Principles of proces Injection moulding Electrospinning of Synthesis (fabricat Principles of polym Introduction to poly Processing of rubbe Fibres and non-wow Ceramic materials Ceramic materials Production of meso Forming operations Casting (sand casti Powder Metallurgy	v and j es dge, s vario t tran materi g ng ssing c of pol polym ion) of er me ymer p ers vens tr - appl - appl porot s of m ing, di	physics skills and com ous forms of sfer and rheol als characteria of thermoplas ymeric mater er nanofibres f MCM-41 mat it rheology processing (e) echnologies ications and s ications and s is silica materia e casting, invo	c (Jacek.Przepior	eld of province of	rocessing ying the club nd therm	i), Wróblewska g of various engin processing of m oforming) (3h) noforming, castir	a Agnieszka	Number of hours 5 2 3 5 5 5 5 5 5 3 4 1 2 3 4 1 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 3 3 3 3 3 3 3 3 3
W-1 Module/co C-1 Course co T-A-1 T-A-2 T-A-3 T-A-4 T-L-1 T-L-2 T-L-3 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-5 T-W-6 T-W-5 T-W-6 T-W-7 T-W-8 T-W-9 T-W-10 T-W-10 T-W-11 T-W-12	Basics of chemistry Durse unit objective To gain the knowle Durse unit objective To gain the knowle Durse unit objective To gain the knowle Durse unit objective Calculations of hea Mesoporous silica r Exercises on castin Exercises on castin Exercises on castin Exercises on veldir Principles of process Injection moulding Electrospinning of Synthesis (fabricat Principles of polym Introduction to poly Processing of rubbe Fibres and non-wow Ceramic materials Production of meso Forming operations Casting (sand casti Powder Metallurgy Welding	v and j es dge, s vario t tran materi ig ng ssing c of pol polym ion) of er me ymer p ers vens t - appl - appl porot s of m ing, di d ther	physics skills and com ous forms of sfer and rheol als characteri of thermoplas ymeric mater er nanofibres f MCM-41 mat lt rheology processing (ex- ications and s ications and s is silica mater etallic materia e casting, inve mo-chemical	c (Jacek.Przepior	eld of province of	rocessing ying the club nd therm	i), Wróblewska g of various engin processing of m oforming) (3h) noforming, castir	a Agnieszka	Number of hours 5 5 2 3 5 5 5 5 3 5 3 4 1 2 3 4 1 2 3 2 3 2 3 2 3 2 3 2 3 2

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			racary or enem					.9			
			s of activity						Nun	nber of	f hours
			e literature								20
		ation of									10
	· ·	•	laboratory exercises								15
		udy of lit									20
			written reports lectures								10 30
	· ·	udy of lit									30
		tations	erature								10
-		ing for th	ne exam								20
		-									
Teaching m M-1	Lectur		5								
		e atory exe	rcisos								
		s with di									
			progressive, P - final)		·,						
5-1 5-2	F		ous assessment: laboratory i	reports and activ	/ity						
5-2	Р	Final te	SL		1		1	1			<u> </u>
I	Desigr	ned lear	ning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes f or qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course	e content	Teaching methods	Evaluation methods
Knowledge				1							
MSE_1A_CO4_V The student ha methods of end	as the k	nowledge ng materia	of common aspect of processing ls	MSE_1A_W02 MSE_1A_W07	P65_WG	P6S_WG	C-1	T-A-1 T-A-2 T-A-3 T-A-4 T-L-1 T-L-2 T-L-3 T-W-1 T-W-2 T-W-3	T-W-4 T-W-5 T-W-6 T-W-7 T-W-8 T-W-9 T-W-9 T-W-10 T-W-11 T-W-12	M-1 M-2 M-3	S-1 S-2
Skills										1	
MSE_1A_C04_L The student ha target enginee	as skills		on of appropriate methods for ocessing	MSE_1A_U08	P6S_UK	P65_UW	C-1	T-A-1 T-A-2 T-A-3 T-A-4 T-L-1 T-L-2 T-L-3 T-W-1 T-W-2 T-W-3	T-W-4 T-W-5 T-W-6 T-W-7 T-W-8 T-W-9 T-W-10 T-W-11 T-W-12	M-1 M-2 M-3	S-1 S-2
Social com	peten	ces									
	nderstar		portance of processing of cal applications	MSE_1A_K02	P65_KK	P6S_WK	C-1	T-A-1 T-A-2 T-A-3 T-A-4 T-L-1 T-L-2 T-L-3 T-W-1 T-W-2 T-W-2 T-W-3	T-W-4 T-W-5 T-W-6 T-W-7 T-W-8 T-W-9 T-W-10 T-W-10 T-W-11 T-W-12	M-1 M-2 M-3	S-1 S-2
Outcom	ies	Grade		E	Evaluation cr	iterion					
Knowledge		·]									
MSE_1A_C04_V	W01	2,0 3,0 3,5 4,0 4,5	The student knows the fundame	ntals aspects of pro	ocessing of engi	neering materia	ls				
		5,0									

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Skills		
MSE_1A_C04_U01	2,0	
	3,0	The student can identify a suitable processing method for a given engineering material
	3,5	
	4,0	
	4,5	
	5,0	
Other social con	npetenc	es
MSE_1A_C04_K01	2,0	
	3,0	Student understands the importance of processing aspects of engineering materials
	3,5	
	4,0	
	4,5	
	5,0	
Required readin	g	
1. Chang Dae Har	n, RHEOLO	DGY AND PROCESSING OF POLYMERIC MATERIALS, Oxford University Press, 2007
2. Montgomery T.	Shaw Wi	lliam J. MacKnight, Introduction to Polymer Viscoelasticity, Wiley Interscience, 2005
3. G. Krauss, Stee	ls: Proces	ssing, Structure, and Performance, ASM International, Materials Park, 2005
4. M. Ashby, K. Jol	nnson, Ma	aterials and Design, The Art and Science of Material Selection in Product Design, Third Edition, Elsevier, 2014

Supplementary reading

1. Gert Strobl, The Physics of Polymers Concepts for Understanding Their Structures and Behavior, Springer, 2007

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Field of s	study	Mate	erials Scienc	e and Engineerir	ng				
Mode of	study	stati	ionary	Level		first	cycle		
Graduate	e's qualification	inży	nier					WTil	Ch
Fields of	f science			technology					
Disciplin	es of science	materials engineering (100%)							
· ·	onal profile	_	eral academ	-					
Module		gen							
	it	.	face Celena		-I Dh				
Course L				e and Interfac		enome	:nd		
Code		MSE	_1A_S_C05						\mathbf{O}
Field of s	specialisation	Dan	artmant of l	a argania Chamia			(and		
Administ	tering faculty	Envi	ronment of I	norganic Chemic gineering	arrec	nnology	y and		
ECTS		5,0		ECTS (forms)		5,0		_	
Form of	course credit	cred	lits	Language		englisł	ו	_	
Electives	S			Elective group				_	
Form of	instruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
lecturing	g course	Α	3	15	1	,0	0,25	К	credits
-	ry course	L	3	30		,0	0,50	К	credits
lecture	· j · · · · · · ·	w	3	15		,0	0,25	K	credits
Leading	toochor			sz (Dariusz.Mosz					creates
Other te		Che Koch	n Xuecheng nmańska Ag	(Xuecheng.Chen nieszka (Agniesz ski@zut.edu.pl),	n@zut. :ka.Koo	edu.pl), chmans	, Janus Ewa (Ev ka@zut.edu.pl), Moszyński Da	
Prerequi	isites								
W-1	none								
Module/o	course unit objectiv	es							
C-1	Student knows the								
C-2	Student knows fun								
С-3	Student knows the respective experin		experimenta	methods applied	to evai	late the	properties of in	terfaces and is at	ble to perform
Course c	content divided into	vario	ous forms of	instruction					Number of hours
T-A-1	Physics of Surfaces	s - calo	culations						2
T-A-2	Adsorption at Inter	faces	- calculations						3
T-A-3	Calculations using	the la	ws of electroc	hemistry.					2
T-A-4	Predicting the proc	ducts o	of an electrocl	nemical reaction					3
T-A-5	Simulation of Reac	tions a	at Liquid Surfa	aces					5
T-L-1	Monolayers observ	-							3
T-L-2	Adsorption/desorp	•							4
T-L-3	Determination of s								3
T-L-4	Surfactant structur measurements by				ace an	u interfa	iciai (ilquid/ilquid	i) Lension –	4
T-L-5	Measurements of e	electro	de potentials	and electromotive	e force i	n galvar		attan aslla	2
T-L-6	The phenomenon of	of pola		· II I II			nic and concentr	ation cells.	3
		•	rization in Da	niella's cell.			nic and concentr	ation cells.	3
T-L-7	Passivity of metals	;							
		urface			and ce	eramic a			3
T-L-7	Passivity of metals Determination of s	urface	e morphology	of metals, metallic			lloys and compo	sites with	3
T-L-7 T-L-8	Passivity of metals Determination of s electron microscop Elemental contrast The Physics of Sur	urface by t and e faces	e morphology energy dispers	of metals, metallic sive spectroscopy a	as a too	ols for el	lloys and compo emental mappin	sites with	3 4 3
T-L-7 T-L-8 T-L-9 T-W-1 T-W-2	Passivity of metals Determination of s electron microscop Elemental contrast The Physics of Sur Structure, surface	and e faces	e morphology energy dispers	of metals, metallic sive spectroscopy a	as a too	ols for el	lloys and compo emental mappin	sites with	3 4 3 3 2 1
T-L-7 T-L-8 T-L-9 T-W-1 T-W-2 T-W-3	Passivity of metals Determination of s electron microscop Elemental contrast The Physics of Sur Structure, surface Adsorption at Inter	faces faces	e morphology energy dispers hology of meta	of metals, metallic sive spectroscopy a	as a too	ols for el	lloys and compo emental mappin	sites with	3 4 3 3 2 1 2
T-L-7 T-L-8 T-L-9 T-W-1 T-W-2	Passivity of metals Determination of s electron microscop Elemental contrast The Physics of Sur Structure, surface	aurface by and e faces morph faces layers	e morphology energy dispers hology of meta	of metals, metallic sive spectroscopy a	as a too	ols for el	lloys and compo emental mappin	sites with	3 4 3 3 2 1

						ology an			.9				
Course co	ntent d	livided ir	nto various form	s of instru	ıction					Nur	nber o	f hours	
T-W-6	Fundar	mentals a	and laws of electro	chemistry								1	
T-W-7	The ele	ectrode p	otential. galvanic	(contact) c	ells.							1	
T-W-8	The ph	enomeno	on of polarization.	The pheno	menon of electr	olysis.						1	
T-W-9	Surfac	e corrosio	on resistance of m	etallic and	ceramic materia	als						1	
T-W-10	Surfac	tant and	their effect on the	interfaces							3		
Student w	orkload	d - forms	s of activity							Nui	Number of hours		
A-A-1	Partici	pation in	recitations									15	
A-A-2	self-stu	Jdy										15	
A-L-1	Partici	pation in	laboratory exercis	es								30	
A-L-2	analys	is of data	I									30	
A-W-1	Partici	pation in	lectures									15	
A-W-2	self-stu	udy of the	e literature									30	
A-W-3	prepar	ing for te	sts									15	
Teaching i	method	ls / tools	;										
M-1	inform	ative lect	ure										
М-2	metho	d of case	S										
М-3	Labora	tory exer	rcises										
M-4	case st	tudies											
Evaluation	n metho	ods (F - 1	orogressive, P -	final)									
S-1	F		ry reports	,									
S-2	F	Passing	5										
Knowledge		ned leari	ning outcomes		Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives		e content	Teaching methods	Evaluation methods	
their structur	concerni		face and interphase operties	phnomena,	MSE_1A_W03	P6S_WG P6S_WK	P6S_WG	C-1 C-2	T-W-1 T-W-2 T-W-3 T-W-4 T-W-5		M-1	S-2	
Skills									T-A-1	T-L-3			
MSE_1A_C05_ is able to use science and in	knowled	ge to solve ial phenom	e problems consernii nena	ng surface	MSE_1A_U01	P6S_UW	P6S_UW	C-3	T-A-2 T-A-3 T-A-4 T-A-5 T-L-1 T-L-2	T-L-4 T-L-5 T-L-6 T-L-7 T-L-7 T-L-8 T-L-9	M-2 M-3 M-4	S-1 S-2	
Social com	npeten	ces			1	1					_		
MSE_1A_C05_ is able to criti literature	_K01 ically ass	ess the kn	owledge and conten	t of	MSE_1A_K01	P6S_KK	P6S_WK	C-3	T-L-1 T-L-2 T-L-3 T-L-4 T-L-5	T-L-6 T-L-7 T-L-8 T-L-9	M-2	S-1	
Outcon	nes	Grade			E	valuation cr	iterion	1	1				
Knowledge	е	·											
MSE_1A_C05_	_W01	2,0 3,0 3,5 4,0 4,5 5,0	Knows a basic inform	nations abou	t surface science a	nd interfacial ph	nenomena						

Faculty of Chemical Technology and Engineering

Skills		
MSE_1A_C05_U01	2,0	
	3,0	is able to simple solve problems concerning surface and interfacial phenomena
	3,5	
	4,0	
	4,5	
	5,0	
Other social con	npetenc	es
MSE_1A_C05_K01	2,0	
	3,0	is able to analyse basing information about surface science and based on this draw simple conclusions regarding laboratory experiments
	3,5	
	4,0	
	4,5	
	5,0	
Required readin	g	
1. G.A. Somorjai, I	ntroducti	on to surface chemistry and catalysis, Wiley, 1994
Supplementary	reading	
1 Luisi Deseure II		Cilica based Mesonerous Materials for Diamodical Applications, smitherpropriations, 2011

1. Luigi Pasqua, Update on Silica-based Mesoporous Materials for Biomedical Applications, smithersrapra.com, 2011

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Field of s	study	Mate	erials Scienc	e and Engineeri	ng				
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Electives	S			Elective group				-	
Form of	instruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
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Faculty of Chemical Technology and Engineering

			Faculty of Chemic	car rechn	ology an		eem	ig			
Student wor	rkload	l - form	s of activity						Nur	nber of	f hours
A-L-2 II	nstruc	tions rea	ading, literature review								20
<i>A-L-3</i> F	Prepar	ing lab r	eports								10
	Particip	pation in	lectures								15
A-W-2 A	Additio	nal stud	ent work. Literature review.								45
Teaching m	ethod	ls / tool	S								
<i>M-1</i>	ecture	9									
M-2 A	Audito	rium exe	rcises								
<i>M-3</i> L	abora	tory exe	rcises								
Evaluation r	netho	ods (F -	progressive, P - final)								
S-1	F Reports										
5-2	Р	Exam									
C	Desigr	ned lear	ning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course	e content	Teaching methods	Evaluation methods
Knowledge					•						
MSE_1A_C06_W The student has and relations fo	s the ki	nowledge ous, liquid	of common thermodynamic laws I and solid state materials	MSE_1A_W02 MSE_1A_W03	P6S_WG P6S_WK	P6S_WG	C-1	T-W-1 T-W-2 T-W-3	T-W-4 T-W-5	M-1	5-2
Skills		· · ·									4
	s skills		tion of common thermodynamic and solid state materials	MSE_1A_U02 MSE_1A_U07	P6S_UW	P6S_UW	C-1	T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-L-1	T-L-2 T-L-3 T-L-4 T-L-5 T-L-6	M-2 M-3	S-1 S-2
Social comp	petend	ces									
	derstar		portance of known gaseous, liquid and solid state	MSE_1A_K01 MSE_1A_K02	P6S_KK	P6S_WK	C-1	T-A-2 T-A-3 T-A-4 T-A-5 T-L-1 T-L-2 T-L-3	T-L-5 T-L-6 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5	M-1 M-2 M-3	S-1 S-2
Outcome	es	Grade		E	valuation cr	iterion					
Knowledge											
MSE_1A_C06_W	/01	2,0 3,0 3,5 4,0 4,5 5,0	The student knows the fundamen	tals laws for gased	ous, liquid and s	olid state mater	rials				
Skills											
MSE_1A_C06_U	01	2,0 3,0 3,5 4,0 4,5 5,0	The student can calculate the fun	damentals thermo	odynamic param	eters for gaseo	us, liquio	l and sol	id state r	naterials	· · · · · · · · · · · · · · · · · · ·
Other social	l com		25								
MSE_1A_C06_K(-	2,0	Students knows the fundamental	s importance of th	ermodynamic la	ws					
Dam' 1	!!										
Required re	-										
1. John Ranki	n, The	mical th	ermodynamics : theory and a	pplications,, RC	Press/Taylor &	Francis, Boc	a Raton	, 2020			

Faculty of Chemical Technology and Engineering

Required reading

G.Price, Thermodynamics of chemical processes, Oxford University Press, Oxford, 2019
 T. Matsushita, K. Mukai, Chemical thermodynamics in materials science : from basic to practical applications, Springer, Singapore, 2018
 M. Pavelka, V. Klika, M. Grmela, Multiscale thermo-dynamics : introduction to Generic, Gruyter, Berlin, 2018

5. W. Ciesielczyk, Basic calculations of engineering thermodynamics,, Wydawnictwo PK, Kraków, 2015

6. A. Bejan, Advanced engineering thermodynamics,, John Wiley & Sons, Hoboken, 2006

7. M. Moran, H. Shapiro, Fundamentals of engineering thermodynamics, John Wiley & Sons, Chichester, 2006

8. M. Koretsky, Engineering and chemical thermodynamics, Wiley, Hoboken, 2012

Field of s		Mat	· · .		na			
	study	Mate	erials Scienc	ce and Engineeri	ny			
Mode of	study	stati	ionary	Level	firs	t cycle	34/77	
Graduate	e's qualification	inży	nier	I			- WTi	ICh
Fields of	science	engi	neering and	technology				
Disciplin	es of science	-		eering (100%)				
	onal profile		eral academ	-				
Module		90						
	·	Con	nputationa	l Methods in M	atSci: Data	a Science an	d	
Course u	init	Ana	lysis					Ģ
Code		MSE	_1A_S_C08a	3				
Field of s	specialisation							
Administ	tering faculty	Dep	artment of (Chemical and Pro	ocess Engine	eering		
ECTS		5,0		ECTS (forms)	5,0			
Form of	course credit	cred	lits	Language	engl	sh		
Electives	5	3		Elective group				
Form of	instruction	Cod	Semester	Hours	ECTS	Weight	Realizatio	on Credit
laborato	ry course	L	4	45	3,0	0,50	К	credits
lecture	,	w	4	30	2,0	0,50	К	credits
Leading	toachar	Pak	oczy Pafał (I	Rafal.Rakoczy@z				
			-		=	unl) Bakocz	Rafał (Bafal Ba	koczy@zut.edu.pl),
Other tea	achers			afal.Wrobel@zut				ikoczy@zuciedd.pi),
			· · ·					
Prerequi	sites		`					
Prerequi: W-1	sites No prerequisites		· · ·					
W-1	No prerequisites							
W-1	No prerequisites	'es		large scientific data	asets using a	variety of softv	vare and analytica	l tools
W-1 Module/c	No prerequisites course unit objectiv Gaining knowledge	<i>es</i> abou	t analysis of l	large scientific data racterize data taki			-	I tools
W-1 Module/c C-1 C-2	No prerequisites	<i>'es</i> e abou use so	t analysis of l ftware to cha	racterize data taki			-	
W-1 Module/c C-1 C-2	No prerequisites	ves e abou use so o vario	t analysis of l ftware to cha pus forms of	instruction	ng into accou		-	
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W-1 Module/c C-1 C-2 Course c T-L-1	No prerequisites course unit objectiv Gaining knowledge Student is able to content divided into A discovery orient	ves e abou use so o varic ed ana ed ana	t analysis of l ftware to cha ous forms of lysis of scien lysis of scien	<i>instruction</i> tific datasets - 1st	ng into accou part		-	Number of hours
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W-1 Module/c C-1 C-2 Course c T-L-1 T-L-2 T-L-3	No prerequisites Course unit objective Gaining knowledge Student is able to Content divided into A discovery orient A discovery orient Exploring data tec	<i>e abou</i> use so <i>vario</i> ed ana ed ana hnolog nt for	t analysis of l ftware to cha <i>Jusis of scien</i> lysis of scien liss nodelling – e	racterize data taki <i>instruction</i> tific datasets - 1st tific datasets - 2nd xercises	ng into accou part		-	Number of hours 5 5 5
W-1 Module/c C-1 C-2 Course c T-L-1 T-L-2 T-L-3 T-L-4	No prerequisites course unit objective Gaining knowledge Student is able to content divided into A discovery orient A discovery orient Exploring data teo Python environme	res e abou use so o varic ed ana ed ana hnolog nt for i gases	t analysis of I ftware to cha <i>bus forms of</i> lysis of scien lysis of scien jies modelling – e based on king	<i>instruction</i> tific datasets - 1st tific datasets - 2nd xercises etic gas theory	ng into accou part		-	Number of hours 5 5 5 5 5
W-1 Module/c C-1 C-2 Course c T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7	No prerequisites Course unit objective Gaining knowledge Student is able to Content divided into A discovery orient A discovery orient Exploring data tec Python environme Modelling of ideal	ves e abou use so o varic ed ana ed ana ed ana hnolog nt for gases cistica i	t analysis of l ftware to cha <i>Jus forms of</i> lysis of scien lysis of scien jies modelling – e based on kind n technical ca	iracterize data taki instruction tific datasets - 1st tific datasets - 2nd xercises etic gas theory alculation	ng into accou part		-	Number of hours 5 5 5 5 5 10
W-1 Module/c C-1 C-2 Course c T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-W-1	No prerequisites Course unit objective Gaining knowledge Student is able to Content divided into A discovery orient A discovery orient Exploring data tec Python environme Modelling of ideal Application of Stat Fundamental of di	ves e abou use so o varic ed ana ed ana hnolog nt for i gases istica i lab in t gital d	t analysis of l ftware to cha ous forms of lysis of scien lysis of scien jies modelling – e based on kind n technical calc echnical calc ata science a	iracterize data taki instruction tific datasets - 1st tific datasets - 2nd xercises etic gas theory alculation	ng into accou part		-	Number of hours 5 5 5 5 10
W-1 Module/c C-1 C-2 Course c T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-W-1 T-W-2	No prerequisites Course unit objective Gaining knowledge Student is able to Content divided into A discovery orient A discovery orient Exploring data tec Python environme Modelling of ideal Application of Stat Fundamental of di Data processing a	<i>e</i> abou use so <i>varic</i> ed ana ed ana ed ana int for gases istica i lab in t gital da nd visu	t analysis of l ftware to cha ous forms of lysis of scien lysis of scien jies modelling – e based on kind n technical calc ata science a Jalisation	racterize data taki instruction tific datasets - 1st tific datasets - 2nd xercises etic gas theory alculation rulation nd analysis	ng into accou part		-	Number of hours 5 5 5 5 10 10 5
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W-1 Module/c C-1 C-2 Course c T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-W-1 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5	No prerequisites Course unit objective Gaining knowledge Student is able to Student is able to Content divided into A discovery orient A discovery orient Exploring data tec Python environme Modelling of ideal Application of Stat Fundamental of di Data processing a Python programm Modelling phenom	<i>e</i> abou use so o vario ed ana ed ana ed ana ed ana int for gases istica i lab in t gital d nd visu ing lan ena or s of dat	t analysis of l ftware to cha ous forms of lysis of scien- lysis of scien- lys	instruction tific datasets - 1st tific datasets - 2nd xercises etic gas theory alculation nd analysis	ng into accou part		-	Number of hours 5 5 5 10 10 5
W-1 Module/c C-1 C-2 Course c T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-W-1 T-W-1 T-W-2 T-W-3 T-W-3 T-W-3 T-W-5 T-W-5 T-W-6	No prerequisites Course unit objective Gaining knowledge Student is able to Student is able to Content divided into A discovery orient A discovery orient Exploring data tec Python environme Modelling of ideal Application of Stat Application of Mat Fundamental of di Data processing a Python programm Modelling of experim	ves e abou use so o varic ed ana ed ana ed ana ed ana int for gases istica i lab in t gital da ing lan ing lan eena or s of dat eents (I	t analysis of l ftware to cha ous forms of lysis of scien lysis of scien jies modelling – e based on kine n technical calc ata science a Jalisation guage for mo basis of kine ca science DOE)	instruction tific datasets - 1st tific datasets - 2nd xercises etic gas theory alculation nd analysis	ng into accou part		-	Number of hours 5 5 5 10 10 5
W-1 Module/c C-1 C-2 Course c T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-W-1 T-W-1 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 Student	No prerequisites Course unit objective Gaining knowledge Student is able to Content divided into A discovery orient A discovery orient Exploring data tec Python environme Modelling of ideal Application of Stat Fundamental of di Data processing a Python programm Modelling of experim Wodelling of experim	ves e abou use so o varic ed ana ed ana ed ana ed ana int for gases istica i lab in t gital da ing lan ing lan eena or s of dat eents (I	t analysis of l ftware to cha ous forms of lysis of scien lysis of scien jies modelling – e based on kine n technical calc ata science a Jalisation guage for mo basis of kine ca science DOE)	instruction tific datasets - 1st tific datasets - 2nd xercises etic gas theory alculation nd analysis	ng into accou part		-	Number of hours 5 5 5 10 10 10 5 7 5 5 5 5 7 5 7 5 5 7 5 7 7 7 7 7 7 7 7 7 7 7 7 7 7
W-1 Module/c C-1 C-2 Course c T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-W-1 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-5 Student A-L-1	No prerequisites Course unit objective Gaining knowledge Student is able to Student is able to Course divided into A discovery orient A discovery orient Exploring data tec Python environme Modelling of ideal Application of Stat Application of Mat Fundamental of di Data processing a Python programm Modelling phenom Statistical analysis Design of experim workload - forms o Attendind classes	res e abou use so o varic ed ana ed ana ed ana ed ana int for gases cistica i lab in t gital da ing lan iena or s of dat ents (I f activ	t analysis of l ftware to cha ous forms of lysis of scien lysis of scien jies modelling – e based on kine n technical calc ata science a Jalisation guage for mo basis of kine ca science DOE)	instruction tific datasets - 1st tific datasets - 2nd xercises etic gas theory alculation nd analysis	ng into accou part		-	Number of hours 5 5 5 10 10 10 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 6 5 7 6 5 6 5 7 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7
W-1 Module/c C-1 C-2 Course c T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-W-1 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-5 T-W-6 Student A-L-1 A-L-2	No prerequisites Course unit objective Gaining knowledge Student is able to Student is able to Course unit objective Student is able to Courtent divided into A discovery orient A discovery orient Exploring data tec Python environme Modelling of ideal Application of Stat Application of Mat Fundamental of di Data processing a Python programm Modelling phenom Statistical analysis Design of experim workload - forms o Attendind classes Individual consultation	ves e abou use so o vario ed ana ed ana ed ana ed ana int for i gases cistica i lab in t gital d nd visu ing lan iena or s of dat ents (I f activ	t analysis of l ftware to cha ous forms of lysis of scien lysis of scien jies modelling – e based on kine n technical calc ata science a Jalisation guage for mo basis of kine ca science DOE)	instruction tific datasets - 1st tific datasets - 2nd xercises etic gas theory alculation nd analysis	ng into accou part		-	Number of hours 5 5 10 10 10 5
W-1 Module/c C-1 C-2 Course c T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-W-1 T-W-1 T-W-2 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 Student A-L-1 A-L-2 A-L-3	No prerequisites Course unit objective Gaining knowledge Student is able to Student is able to Content divided into A discovery orient A discovery orient Exploring data tec Python environme Modelling of ideal Application of Stat Application of Mat Fundamental of di Data processing a Python programm Modelling phenom Statistical analysis Design of experim workload - forms o Attendind classes Individual consulta	<i>es</i> e abou use so o vario ed ana ed ana ed ana ed ana int for i gases cistica i lab in t gital d ing lan iena or s of dat ents (I <i>f activ</i> ations	t analysis of l ftware to cha ous forms of lysis of scien lysis of scien jies modelling – e based on kine n technical calc ata science a Jalisation guage for mo basis of kine ca science DOE)	instruction tific datasets - 1st tific datasets - 2nd xercises etic gas theory alculation nd analysis	ng into accou part		-	Number of hours Number of hours 5 5 10 10 10 10 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 7 5 6 9
W-1 Module/c C-1 C-2 Course c T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-W-1 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-5 T-W-6 Student A-L-1 A-L-2 A-L-3 A-L-4	No prerequisites Course unit objective Gaining knowledge Student is able to Student is able to Course unit ovided into A discovery orient A discovery orient Exploring data tec Python environme Modelling of ideal Application of Stat Application of Mat Fundamental of di Data processing a Python programm Modelling phenom Statistical analysis Design of experim workload - forms o Attendind classes Individual consulta Preparing for tests self-study of litera	<i>es</i> e abou use so o vario ed ana ed ana ed ana ed ana int for i gases cistica i lab in t gital d ing lan iena or s of dat ents (I <i>f activ</i> ations	t analysis of l ftware to cha ous forms of lysis of scien lysis of scien jies modelling – e based on kine n technical calc ata science a Jalisation guage for mo basis of kine ca science DOE)	instruction tific datasets - 1st tific datasets - 2nd xercises etic gas theory alculation nd analysis	ng into accou part		-	Number of hours 5 5 5 10 10 10 10 5 5 5 10 10 5
W-1 Module/c C-1 C-2 Course c T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-W-1 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-5 T-W-6 Student A-L-1 A-L-2 A-L-3 A-L-4 A-W-1	No prerequisites Course unit objective Gaining knowledge Student is able to Student is able to Courtent divided into A discovery orient A discovery orient Exploring data tec Python environme Modelling of ideal Application of Stat Application of Mat Fundamental of di Data processing a Python programm Modelling phenom Statistical analysis Design of experim workload - forms o Attendind classes Individual consulta Preparing for tests self-study of litera Attending classes	ves e abou use so o vario ed ana ed ana ed ana ed ana int for i gases cistica i lab in t gital d nd visu ing lan iena or s of dat ents (I f activ ations s ture	t analysis of l ftware to cha ous forms of lysis of scien lysis of scien jies modelling – e based on kine n technical calc ata science a Jalisation guage for mo basis of kine ca science DOE)	instruction tific datasets - 1st tific datasets - 2nd xercises etic gas theory alculation nd analysis	ng into accou part		-	Number of hours 5 5 10 10 10 10 5 5 5 5 10 10 5 6
W-1 Module/c C-1 C-2 Course c T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-W-1 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-5 T-W-6 Student A-L-1 A-L-2 A-L-3 A-L-4	No prerequisites Course unit objective Gaining knowledge Student is able to Student is able to Course unit ovided into A discovery orient A discovery orient Exploring data tec Python environme Modelling of ideal Application of Stat Application of Mat Fundamental of di Data processing a Python programm Modelling phenom Statistical analysis Design of experim workload - forms o Attendind classes Individual consulta Preparing for tests self-study of litera	<i>es</i> e abou use so o varic ed ana ed ana ed ana ed ana ed ana istica i lab in t gital d ing lan ing lan ena or s of dat ents (I <i>f activ</i> ations s ture	t analysis of l ftware to cha ous forms of lysis of scien lysis of scien jies modelling – e based on kine n technical calc ata science a Jalisation guage for mo basis of kine ca science DOE)	instruction tific datasets - 1st tific datasets - 2nd xercises etic gas theory alculation nd analysis	ng into accou part		-	Number of hours 5 5 10 <

Teaching n	nethod	ls / tool	's								
М-1	Lectur	е									
М-2	Labora	tory									
Evaluation	metho	ods (F -	progressive, P - final)								
S-1	Р	passing	j test								
5-2	F	activity	evaluation								
	Desigr	ned lear	rning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course	e content	Teaching methods	Evaluation methods
Knowledge	,										
MSE_1A_C08a Knows the prin a variety of so	nciples o	of analysis and analysis	s of large scientific datasets using tical tools	MSE_1A_W01 MSE_1A_W05	P6S_WG P6S_WK	P6S_WG	C-1	T-W-1 T-W-2 T-W-3	T-W-4 T-W-5	M-1	S-1
Skills											
MSE_1A_C08a Student is able account e. g. s	e to use		to characterize data taking into	MSE_1A_U05	P6S_UW	P6S_UW	C-2	T-L-1 T-L-2 T-L-3	T-L-4 T-L-5 T-L-6	M-2	S-2
Social com	peten	ces									
MSE_1A_C08a Student is able		uss progr	ramming problem in the team.	MSE_1A_K02	P65_KK	P6S_WK	C-1 C-2	T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7	T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6	M-1 M-2	S-1 S-2
Outcom	nes	Grade		E	valuation cri	iterion					
Knowledge	ò										
MSE_1A_C08a	_W01	2,0									
		3,0	Student describes selected issues	s at a basic level (score => 50%)						
		3,5									
		4,0 4,5									
		5,0									
Skills			1								
MSE_1A_C08a	_U01	2,0									
		-,-	Student solves selected issues at	t a basic level(scor	re => 50%)						
		3,5									
		4,0 4,5									
		5,0									
Other socia	al com		es								
MSE_1A_C08a		2,0									
			Student solves selected issues at	t a basic level(scor	re => 50%)						
		3,5									
		4,0									
		4,5 5,0									
Required r	oadinc										
	-		gramming: An Introduction to	Computer Scier	nce, 2002						
Supplemer				· · ·							
	-	-	n, and A.L. Bleloch, How to Mo	del It: Problem S	olving for the	Computer Aq	e, 1994				
l					-						

Field of s	study	Mate	erials Scienc	e and Engineerin	g				
Mode of :	study	stati	onary	Level		first c	ycle	\ A / T · I .	
Graduate	e's qualification	inży	nier	I				WTil	Ch
Fields of	science	engi	neering and	technology					
Discipline	es of science	mate	erials engine	eering (100%)					
-	nal profile	_	eral academ	-					
Module	•								
		Com	putational	Methods in Ma	tSci:	Simula	ation and		
Course u			leling						G
Code		MSE	_1A_S_C08b						
Field of s	specialisation								
Administ	ering faculty	Dep	artment of C	Catalytic and Sorb	ent M	aterials	Engineering		
ECTS		5,0		ECTS (forms)		5,0			
Form of a	course credit	cred	its	Language		english			
Electives	;	3		Elective group					
Form of i	instruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
laborator	ry course	L	4	45	3,	0	0,50	к	credits
lecture	_	w	4	30	2,	0	0,50	к	credits
Leading	teacher	Wró	hel Rafał (Ra	afal.Wrobel@zut.e	du pl			I	
Other tea		Kiełk	basa Karolin		sa@zu	ut.edu.p	ol), Rakoczy Ra	afał (Rafal.Rako	oczy@zut.edu.pl),
Prerequis	citoc	1010			euu.pi)				
W-1	No prerequisites								
Module/C C-1	course unit objectiv		o occumption	ns of Langmuir isoth	orm				
C-1 C-2				/ steps in gas-solid		n			
C-3				damental physical-			omena		
Course a	ontent divided into		-						Number of hours
T-L-1	Application of Matl								10
T-L-2	Application of Stat								5
T-L-3	Python environme	nt for I	modelling - ex	kercises					5
T-L-4	Modelling of gas a	dsorpt	ion on solids						5
T-L-5	Modelling of gas so	olid rea	action						5
T-L-6	When is modeling		•	•					5
T-L-7	When is modeling								5
T-L-8	Computer-aided de	-							5
T-W-1				al equation, interpo		smooth	ing		5
T-W-2		•		on of complex equat	tion				5
T-W-3	Statistical analysis								5
T-W-4 T-W-5	Design of experime Modelling of gas a								5
T-W-5									
		-							-
Ctudant	Modelling of gas so	olid rea	action						5
	Modelling of gas so workload - forms of	olid rea	ity						5 Number of hours
A-L-1	Modelling of gas so workload - forms of Participation in lab	olid rea f activ orator	action <i>ity</i> y exercises						5 Number of hours 45
A-L-1 A-L-2	Modelling of gas so workload - forms of Participation in lab Solving programm	olid rea f activ orator	action <i>ity</i> y exercises						5 Number of hours
A-L-1	Modelling of gas so workload - forms of Participation in lab Solving programm Consultations	olid rea f activ orator ing pro	action <i>ity</i> y exercises						5 Number of hours 45 40
A-L-1 A-L-2 A-L-3	Modelling of gas so workload - forms of Participation in lab Solving programm	olid rea f activ orator ing pro	action <i>ity</i> y exercises						5Number of hours45405
A-L-1 A-L-2 A-L-3 A-W-1	Modelling of gas so workload - forms of Participation in lab Solving programm Consultations participation in lec	olid rea f activ orator ing pro	action <i>ity</i> y exercises						5 Number of hours 45 40 5 30

Teaching m	nethoc	ls / tool	s							
M-1	Lecture	e								
M-2 I	Labora	tory								
Evaluation	metho		progressive, P - final)							
5-1	Р	Zalicze	nie							
5-2	F	Ocena	aktywności							
]	Desigr	ned leai	rning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course content	Teaching methods	Evaluation methods
Knowledge										
	assum	ption of L	angmuir ishothrm	MSE_1A_W01	P6S_WG P6S_WK	P6S_WG	C-1	T-W-5	M-1	S-1
MSE_1A_C08b_ Student knows		ntary step	os in gas-solid reaction	MSE_1A_W01	P6S_WG P6S_WK	P6S_WG	C-2		M-1	S-1
Skills										
MSE_1A_C08b_ Student is able gas adsorption	to mod	lel in pytł ie surface	non programming language the	MSE_1A_U02	P6S_UW		C-3	T-L-3 T-L-5 T-L-4	M-2	S-1
Social comp	oeten	ces		1				ļ	1	
MSE_1A_C08b_ Student is able	K01 to disc	uss progr	amming problem in the team.	MSE_1A_K03	P6S_KO	P6S_WK	C-3	T-L-3 T-L-4 T-L-5	M-2	S-2
Outcom		Grade		E	valuation cri	terion				
Knowledge										
MSE_1A_C08b_	W01	2,0								
		3,0	Student is able to describe assun	nptions of Langmu	ir isotherm					
		3,5								
		4,0								
		4,5 5,0								
MSE_1A_C08b_	W02	2,0								
		3,0	Student describes selected issue	s at a basic level(xam score = >	50%)				
		3,5								
		4,0								
		4,5								
		5,0								
Skills		5,0								
MSE_1A_C08b_	1101	2,0								
	001	3,0	Student is able to write a program	n in Duthon Jongun	ao modelling ad	corntion phone	monon			
		3,5			ige modelling ad	sorption prieno	menon			
		4,0								
		4,0								
		5,0								
Other cocio	Leom									
Other socia										
MSE_1A_C08b_	KUI	2,0								
		3,0	Student is able to explain the pro	gramming solution	n to the other me	embers of the g	roup			
		3,5								
		4,0								
		4,5								
[5,0								
Required re	-									
1. John M. Ze	elle, Py	thon Pro	gramming: An Introduction to	o Computer Scie	nce, 2002					

L			-						
Field of s	study	Mate	erials Scienc	e and Engineeri	ng				
Mode of	study	stati	ionary	Level		first c	ycle) A (TT) I	~
Graduat	e's qualification	inży	nier	I				WTil	Ch
Fields of	fscience	engi	neering and	l technology					
Disciplin	nes of science	mat	erials engine	eering (100%)					
· ·	onal profile	-	eral academ	-					
Module		5							
Course u		Intr	o to Experi	imental Metho	ds: Nai	nomate	erials		
		-	ohasis						G
Code	enerialization	INSE	_1A_S_C09a	1				- 🔪 🔳	
	specialisation tering faculty	Don	artmont of N	Nanomaterials P	hycicacl	homistr			
ECTS		4,0		ECTS (forms)	-	4,0	у	-	
			!!+-			-		-	
	course credit	cred	lits	Language		english		_	
Electives	-	4		Elective group					
Form of	instruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
laborato	ory course	L	4	45	3,	0	0,50	К	credits
lecture		W	4	15	1,	0	0,50	К	credits
Leading	teacher	Mijo	wska Ewa (E	Ewa.Borowiak-Pa	len@zu	ıt.edu.p	I)		
1		Bara	anowska iola				cuu.pi), Ei i iu	y Minosiawa	
Other te	eachers	(Mir Paw	oslawa.ElFra eł (Pawel.Ko	anta (Jolanta.Bar ay@zut.edu.pl), l ochmanski@zut.e a (Agnieszka.Pie	⁼ ryska S edu.pl),	Sebastia Mijowsl	ka Ewa (Ewa.l		
Prerequi	isites	(Mire Paw Pieg	oslawa.ElFra eł (Pawel.Ko at Agnieszka	ay@zut.edu.pl), l ochmanski@zut.e a (Agnieszka.Pie	Fryska S edu.pl), gat@zu	Sebastia Mijowsl it.edu.p	ka Ewa (Ewa.)	Borowiak-Palen	
		(Mire Paw Pieg	oslawa.ElFra eł (Pawel.Ko at Agnieszka	ay@zut.edu.pl), l ochmanski@zut.e a (Agnieszka.Pie	Fryska S edu.pl), gat@zu	Sebastia Mijowsl it.edu.p	ka Ewa (Ewa.)	Borowiak-Palen	
Prerequi W-1	isites Knowledge of the I	(Mire Paw Pieg basic c	oslawa.EİFra eł (Pawel.Ko at Agnieszk course in mati	ay@zut.edu.pl), l ochmanski@zut.e a (Agnieszka.Pie hematics, physics	Fryska S edu.pl), gat@zu and cher	Sebastia Mijowsl ut.edu.p mistry at	ka Ewa (Ewa.l l) t the elementar	Borowiak-Palen y level	@zut.edu.pl),
Prerequi W-1	isites Knowledge of the I	(Mire Paw Pieg basic c	oslawa.ElFra eł (Pawel.Ko at Agnieszk course in mati	ay@zut.edu.pl), l ochmanski@zut.e a (Agnieszka.Pie hematics, physics	Fryska S edu.pl), gat@zu and cher	Sebastia Mijowsl ut.edu.p mistry at	ka Ewa (Ewa.l l) t the elementar	Borowiak-Palen y level	@zut.edu.pl),
Prerequi W-1 Module/c C-1	isites Knowledge of the l course unit objectiv The purpose of the	(Mire Paw Pieg basic c es e corse ng ma	oslawa.EİFra eł (Pawel.Ko at Agnieszka course in matl e is to enrich t terials	ay@zut.edu.pl), l ochmanski@zut.e a (Agnieszka.Pie hematics, physics he students' know	Fryska S edu.pl), gat@zu and cher	Sebastia Mijowsl ut.edu.p mistry at	ka Ewa (Ewa.l l) t the elementar	Borowiak-Palen y level	@zut.edu.pl),
Prerequi W-1 Module/c C-1	isites Knowledge of the l course unit objectiv The purpose of the groups of engineri	(Mira Paw Pieg basic c res e corse ng ma o varic	oslawa.ElFra eł (Pawel.Ko at Agnieszk course in math e is to enrich t terials	ay@zut.edu.pl), l ochmanski@zut.e a (Agnieszka.Pie hematics, physics the students' know <i>instruction</i>	Fryska S edu.pl), gat@zu and cher	Sebastia Mijowsl It.edu.p mistry at	ka Ewa (Ewa.l l) t the elementar n experimental	Borowiak-Palen y level	@zut.edu.pl), cluding the main
Prerequi W-1 Module/c C-1 Course c	isites Knowledge of the I course unit objectiv The purpose of the groups of engineri content divided into	(Mire Paw Pieg basic c res e corse ng ma o vario ent nar	oslawa.ElFra eł (Pawel.Ko at Agnieszk course in mati e is to enrich t terials ous forms of nofillers on rh	ay@zut.edu.pl), l ochmanski@zut.e a (Agnieszka.Pie hematics, physics the students' know <i>instruction</i> eological propertie	Fryska S edu.pl), gat@zu and cher rledgean es of mor	Sebastia Mijowsl It.edu.p mistry at d skills in nomer di	ka Ewa (Ewa.l l) t the elementar n experimental ispersions.	Borowiak-Palen y level nanomaterials in	@zut.edu.pl), cluding the main Number of hours
Prerequi W-1 Module/c C-1 Course c T-L-1	isites Knowledge of the l course unit objectiv The purpose of the groups of engineri content divided into Influence of differe	(Mire Paw Pieg basic c es e corse ng ma o vario ent nar ties of	oslawa.ElFra eł (Pawel.Ko at Agnieszk course in math e is to enrich t terials ous forms of nofillers on rho	ay@zut.edu.pl), l ochmanski@zut.e a (Agnieszka.Pie hematics, physics the students' know <i>instruction</i> eological propertie ites (tensile prope	Fryska S edu.pl), gat@zu and cher rledgean es of mor rties as a	Sebastia Mijowsl ut.edu.p mistry at d skills in nomer di a functio	ka Ewa (Ewa.l l) t the elementar n experimental ispersions. on of temperatu	Borowiak-Palen y level nanomaterials in	@zut.edu.pl), cluding the main Number of hours 5
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Prerequi. W-1 Module/c C-1 Course c T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-W-1 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 Student A-L-1 A-L-2 A-L-3 A-L-4	isites Knowledge of the l course unit objectiv The purpose of the groups of engineri content divided into Influence of differe Mechanical proper Mechanical proper Synthesis of carbo Purification proces Microscopic observ Mechanical proper Nanocarbons: Grap Functionalized/mo Carbon in Polymer Nanoparticle Disper Evaluation of mech workload - forms or participation in lab preparation for lab preparing for tests	(Mino Paw Pieg basic c es e corse ng ma o varice ent nar ties of ties of ties of ties of ties of s of ok vation ties te ohene, dified s ersions f activ porator orts tures	oslawa.ElFra eł (Pawel.Ko at Agnieszka course in matł e is to enrich t terials <i>pus forms of</i> nofillers on rhe nanocompos otubes in the otained carbo of purified ca esting of nano , fullerenes, ca nanocarbons l properties o <i>rity</i> y exercises y exercises	ay@zut.edu.pl), l ay@zut.edu.pl), l achmanski@zut.e a (Agnieszka.Pie hematics, physics the students' know <i>instruction</i> eological propertie ites (tensile prope ites (bending and presence of three on material rbon nanotubes. E materials arbon nanotubes,	Fryska S edu.pl), gat@zu and cher rledgean es of mor rties as a compres different	Sebastia Mijowsl It.edu.p mistry at d skills in nomer di a functio ssion tes t metallio I analysi	ka Ewa (Ewa.l l) t the elementar n experimental ispersions. on of temperatu ts). c catalysts s of the sample	Borowiak-Palen y level nanomaterials in re).	@zut.edu.pl), cluding the main Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5

Faculty of Chemical Technology and Engineering

Teaching m	ethoc	ls / tool	ls							
			presentation							
			sion during lectures and labo	oratories						
	self stu		j							
Evaluation	moth	nds (F -	progressive, P - final)							
S-1	P		completion of lectures and	laboratories						
5-2	F		ory reports	laboracories						
5-2 5-3	F		t activity during laboratories							
3-3	Г 	studen			1	1				
C	Desigr	ned lea	rning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes f or qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course content	Teaching methods	Evaluatic method
Knowledge										
MSE_1A_C09a_ basic knowledg main groups of	je in ex		al nanomaterials including the	MSE_1A_W03	P6S_WG P6S_WK	P6S_WG	C-1	T-W-1 T-W-3 T-W-2 T-W-4	M-1 M-3	S-1
Skills	engine	gat			1					1
MSE_1A_C09a_ skills in synthes	sis and	characte	rization of nanomaterials nginering materials	MSE_1A_U07	P6S_UW	P6S_UW	C-1	T-L-1 T-L-3	M-2 M-3	S-2 S-3
Social comp										
MSE_1A_C09a_ The student un application of e	derstar		nportance of fabrication and omaterials	MSE_1A_K02	P6S_KK	P6S_WK	C-1		M-1 M-2 M-3	S-1 S-2
Outcome	es	Grade		E	Evaluation cr	iterion				
Knowledge			1							
MSE_1A_C09a_	W01	2,0								
		3,0	from 50 to 55% of percentage (points						
		3,5								
		4,0								
		4,5								
		5,0								
Skills			•							
MSE_1A_C09a_	U01	2,0								
l		3,0	from 50 to 55% of percentage	points						
		3,5								
		4,0 4,5								
		<i>4,5</i> <i>5,0</i>								
Other socia	l com		<u></u>							
MSE_1A_C09a_		2,0								
		3,0	from 50 to 55% of percentage (oints						
		3,5								
		4,0								
		4,5								
		5,0								
Required re	adino									
-	-		rreira Michael Ashby, Nanon	naterials, Nanoted	chnologies and	l Design, Butt	erworth	-Heinemann, 2	2009, ISF	3N:
9780750681				· · · · ·						

2. Dieter Vollath, Nanoparticles - Nanocomposites - Nanomaterials: An Introduction for Beginners, Wiley-VCH, 2013, ISBN: 978-3527334605

3. Wei-Hong Zhong, Bin Li, Russell G. Maguire, Vivian T. Dang, Jo Anne Shatkin, Gwen M. Gross, Michael C. Richey, Nanoscience and Nanomaterials - Synthesis, Manufacturing and Industry Impacts, DEStech Publications, 2012, ISBN-13 : 978-1605950136

			<u> </u>						
Field of s	study	Mate	erials Scienc	e and Engineeri	ing				
Mode of	study	stati	ionary	Level		first	cycle		
Graduate	e's qualification	inży	nier	I			-	WTil(Lh
Fields of	•		neering and	technology					
	es of science			ering (100%)					
	nal profile	-	eral academ	-					
	inal prome	gen							
Module		Intr	o to Evnori	mental Metho	der Bi	mator	riale		
Course u	ınit		oto Experi phasis	mental Metho		Jinatei	lais		C
Code		MSE	_1A_S_C09b						
Field of s	specialisation								
Administ	tering faculty	Dep	artment of P	olymer and Bio	materia	als Scie	nce		
ECTS	5 5	4,0		ECTS (forms)		4,0		-	
	course credit	cred	lits	Language		englist	า	-	
Electives		4		Elective group		crigiisi	•	-	
	instruction	Cod	Semester	Hours		TS	Weight	Realization	Credit
laborato	ry course	L	4	45	3	,0	0,50	К	credits
lecture		W	4	15	1	,0	0,50	К	credits
Leading	teacher	El Fr	ay Mirosław	a (Miroslawa.Ell	Fray@z	ut.edu.	pl)		
Other te	achers	(Mir Paw	oslawa.EĺFra eł (Pawel.Ko	nta (Jolanta.Bar y@zut.edu.pl), chmanski@zut. a (Agnieszka.Pie	Fryska edu.pl)	Sebasti , Mijows	ian (Sebastian. ska Ewa (Ewa.E	Fryska@zut.edi	u.pl), Kochmański @zut.edu.pl),
Prerequi	sites								
W-1	Knowledge of the k	basic c	ourse in math	nematics, physics	and che	emistry a	at the elementar	/ level	
Module/c	course unit objectiv	es							
C-1	The purpose of the groups of enginering the second	corse	e is to enrich t terials	he students' knov	vledgea	nd skills	in experimental	biomaterials inclu	iding the main
Course c	content divided into	vario	ous forms of	instruction					Number of hours
T-L-1	Viscosity Measurer	nent l	Jsing a Brookf	ield Viscometer					5
T-L-2	Refractive index of	selec	ted materials	and its changes of	during ci	rystalliza	ation		5
T-L-3	Mechanical proper	ties of	biomaterials	(tensile propertie	s as a fu	inction c	of temperature)		5
T-L-4	Acid and alkaline h	ydroly	sis of biocellu	ılose.					5
T-L-5	Functionalization o	fbioc	ellulose by me	etal oxide nanopa	rticles.				5
T-L-6	Morphology charac	terisa	tion of synthe	sized samples.					5
T-L-7	Mechanical proper	ties te	sting of bioma	aterials					15
T-W-1	Nanoceramics: Nar		talline Function	onal Oxide Materia	als, Corr	pound (Crystals		3
T-W-2	Organic Nanomate								2
T-W-3	Evaluation of mech			fbiomaterials					5
T-W-4	Nanocomposites as		ant Materials						3
T-W-5	Nanofiber Biomate	rials							2
Student	workload - forms of	activ	vity						Number of hours
A-L-1	Participation in lect	tures							45
A-L-2	individual literature	e stud	ies						35
A-L-3	consultations								10
A-W-1	Participation in lec								15
A-W-2	Individual literature	e stud	ies						5
A-W-3	preparing for tests								10
Teaching	g methods / tools								
M-1	lectures with prese	entatio	on						
М-2	subject discussion	during	g lectures and	laboratories					

Teaching	metho	ds / tool	'S								
M-3	self st		-								
Evaluation	n meth	ods (F -	progressive, P - final)								
S-1	Р	1	completion of lectures and	laboratories							
5-2	F		ory reports								
S-3	F		t activity during laboratories	5							
						Reference to					T
	Desig	ned lear	rning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes f for qualifications at PQF 6, 7 or 8	learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Cours	e content	Teaching methods	Evaluatio method
Knowledg	е			- I	•		1				
MSE_1A_C09 basic knowle groups of eng	dge in ex	perimenta materials	al bioomaterials including variou	USE_1A_W02 MSE_1A_W07	P6S_WG	P6S_WG	C-1	T-W-1 T-W-2 T-W-3	T-W-4 T-W-5	M-1 M-2	S-1 S-2
Skills											
MSE_1A_C09 skills in synth various grou	nesis and	character inering ma	rization of biomaterials including aterials	MSE_1A_U03 MSE_1A_U07	P6S_UW	P6S_UW	C-1	T-L-1 T-L-2	T-L-3	M-1 M-2	S-1 S-2
Social con	npeten	ces									
MSE_1A_C09 The student of application of the student of the studen	understa		nportance of fabrication and naterials	MSE_1A_K02	Р65_КК	P6S_WK	C-1	T-L-1 T-L-2 T-L-3 T-W-1	T-W-2 T-W-3 T-W-4 T-W-5	M-1 M-2	S-1 S-2
Outcor	mes	Grade		E	Evaluation cr	iterion					<u></u>
Knowledg	е										
MSE_1A_C09	<u>ь_wo</u> т	2,0 3,0 3,5 4,0 4,5 5,0	from 50 to 55% of percentage p	points							
Skills											
MSE_1A_C09	b_U01	2,0 3,0 3,5 4,0 4,5 5,0	from 50 to 55% of percentage p	points							
Other soc	ial com	petence	es								
MSE_1A_C09	b_K01	2,0 3,0 3,5 4,0 4,5 5,0	from 50 to 55% of percentage p	points							
Required	reading		1								
-			-Zhen Yu, Polymer nanocom	posites. Woodhea	d Publishing I	nc., 2006					
	·		er Handbook of Nanomateria			, 2000					
	-		Handbook of Nanoparticles,		-						
3. Mahmoo											

Field of s	study	Mate	erials Scienc	e and Engineeri	ng				
Mode of	study	stati	ionary	Level		first o	cycle	1.1.1	- 1
Graduate	e's qualification	inży	nier				-	WTil	h
Fields of	•			l technology					
Disciplin	es of science	-	-	eering (100%)					
	nal profile		eral academ						
Module		gen							
		F	ational Due						
Course u	Init	-		perties of Mat	eriais				Ch
Code		MSE	_1A_S_C10						
	specialisation								
Administ	tering faculty	Dep	artment of N	Nanomaterials Pl	hysicoo	hemist	ry		
ECTS		6,0		ECTS (forms)		6,0			
Form of o	course credit	exar	mination	Language		english	l		
Electives	5			Elective group					
Form of i	instruction	Cod	Semester	Hours	EC	CTS	Weight	Realization	Credit
lecturing	, course	Α	4	30	2	,0	0,30	К	credits
laborato	ry course	L	4	30	2	,0	0,30	К	credits
lecture		w	4	30	2	,0	0,40	К	examination
		Miio	wska Ewa (F	Ewa.Borowiak-Pa	len@z	ut.edu.r))		
Leading	teacher								owiak
Leading		-	ak-Nejman I	Ewelina (Ewelina	.Kusia	k@zut.e	edu.pl), Mijows	ka Ewa (Ewa.Boi	Owiak-
Leading Other tea		Kusi		Ewelina (Ewelina ol), Wilpiszewska				ka Ewa (Ewa.Boı iszewska@zut.ec	
	achers sites	Kusi Pale	n@zut.edu.p	ol), Wilpiszewska	a Katar	zyna (K	atarzyna.Wilpi	iszewska@zut.ec	
Other tea	achers	Kusi Pale	n@zut.edu.p	ol), Wilpiszewska	a Katar	zyna (K	atarzyna.Wilpi	iszewska@zut.ec	
Other tea Prerequis W-1	achers sites Knowledge of the I course unit objectiv	Kusi Pale	n@zut.edu.ŗ course in matł	ol), Wilpiszewska hematics, physics	a Katar and che	zyna (K	atarzyna.Wilpi t the elementar	iszewska@zut.ec y level	lu.pl)
Other tea Prerequis W-1	achers sites Knowledge of the I	Kusi Pale Dasic c es rse is	n@zut.edu.p course in math to gain the st	ol), Wilpiszewska hematics, physics udents' knowledge	a Katar and che	zyna (K emistry a kills in the	atarzyna.Wilp t the elementar e understanding	iszewska@zut.ec y level	lu.pl)
Other tea Prerequis W-1 Module/c C-1	achers sites Knowledge of the l course unit objectiv The aim of the cou	Kusi Pale pasic c es rse is ty. The	n@zut.edu.p course in math to gain the st e students wil	ol), Wilpiszewska nematics, physics udents' knowledga I have competenco	a Katar and che	zyna (K emistry a kills in the	atarzyna.Wilp t the elementar e understanding	iszewska@zut.ec ry level g of properties of m	lu.pl)
Other tea Prerequis W-1 Module/c C-1	achers sites Knowledge of the I course unit objectiv The aim of the cou of their functionalit	Kusi Pale pasic c es rse is ty. The vario	n@zut.edu.p course in math to gain the st e students wil pus forms of	ol), Wilpiszewska hematics, physics udents' knowledge I have competence instruction	a Katar and che e and sk es of te	zyna (K emistry a kills in th am work	atarzyna.Wilp t the elementar e understanding in the lab.	iszewska@zut.ec ry level g of properties of m	lu.pl)
Other tea Prerequis W-1 Module/c C-1 Course c	achers sites Knowledge of the l course unit objectiv The aim of the cou of their functionali content divided into Current state of th Band theory of ser	Kusi Pale pasic c es rse is ty. The vario e art o nicond	n@zut.edu.p course in math to gain the st e students wil ous forms of of Functional N luctors: Calcu	ol), Wilpiszewska hematics, physics udents' knowledge I have competence <i>instruction</i> Materials - student lations of band ga	a Katar and che e and sk es of te 's prese p energ	zyna (K emistry a kills in the am work entations	atarzyna.Wilp t the elementar e understanding in the lab.	iszewska@zut.ec ry level g of properties of m	lu.pl) naterials in terms Number of hours
Other tea Prerequis W-1 Module/c C-1 Course c T-A-1 T-A-2 T-A-3	achers sites Knowledge of the l course unit objectiv The aim of the cou of their functionali content divided into Current state of th Band theory of ser Calculations of the	Kusi Pale pasic c es rse is ty. The vario e art o nicond photo	n@zut.edu.p course in math to gain the st e students wil fous forms of of Functional N luctors: Calcu pocatalytic activ	ol), Wilpiszewska hematics, physics udents' knowledge I have competence <i>instruction</i> Materials - student lations of band ga vity and quantum	a Katar and che e and sk es of te 's prese p energ	zyna (K emistry a kills in the am work entations	atarzyna.Wilp t the elementar e understanding in the lab.	iszewska@zut.ec ry level g of properties of m	lu.pl) naterials in terms Number of hours 10
Other tea Prerequis W-1 Module/c C-1 Course c T-A-1 T-A-2 T-A-3 T-A-4	achers sites Knowledge of the l course unit objectiv The aim of the cou of their functionali content divided into Current state of th Band theory of ser Calculations of the Calculations of rea	Kusi Pale pasic c es rse is ty. The vario e art o nicond photo ction r	n@zut.edu.p course in math to gain the st e students wil ous forms of of Functional N luctors: Calcu ocatalytic activ rates and kine	ol), Wilpiszewska hematics, physics udents' knowledge I have competence <i>instruction</i> Materials - student lations of band ga vity and quantum etics	a Katar and che e and sk es of tes 's prese p energ efficien	zyna (K emistry a kills in the am work entations	atarzyna.Wilp t the elementar e understanding in the lab.	iszewska@zut.ec ry level g of properties of m	lu.pl) naterials in terms Number of hours 10 4 4 1
Other tea Prerequis W-1 Module/c C-1 Course c T-A-1 T-A-2 T-A-3 T-A-4 T-A-5	achers sites Knowledge of the l course unit objectiv The aim of the cou of their functionali content divided into Current state of th Band theory of ser Calculations of the Evaluation of polyr	Kusi Pale Dasic c es rse is ty. The vario e art o nicond photo ction r mer de	n@zut.edu.p course in math to gain the st e students wil pus forms of of Functional N luctors: Calcu ocatalytic activ rates and kine egradation and	ol), Wilpiszewska hematics, physics udents' knowledge I have competence <i>instruction</i> Materials - student lations of band ga vity and quantum etics d depolymerization	a Katar and che e and sk es of tes 's prese p energ efficien	zyna (K emistry a kills in the am work entations	atarzyna.Wilp t the elementar e understanding in the lab.	iszewska@zut.ec ry level g of properties of m	lu.pl) naterials in terms Number of hours 10 4 4 1 3
Other tea Prerequis W-1 Module/c C-1 Course c T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6	achers sites Knowledge of the l course unit objectiv The aim of the cou of their functionali content divided into Current state of th Band theory of ser Calculations of the Calculations of rea Evaluation of polyr thermal degradatio	Kusi Pale pasic c es rse is ty. The vario e art o nicond photo ction r mer de on tech	n@zut.edu.p course in math to gain the st e students wil ous forms of of Functional N luctors: Calcu ocatalytic activ rates and kine gradation and hniques for st	ol), Wilpiszewska hematics, physics udents' knowledge I have competence <i>instruction</i> Materials - student lations of band ga vity and quantum etics d depolymerization	a Katar and che e and sk es of tes 's prese p energ efficien	zyna (K emistry a kills in the am work entations	atarzyna.Wilp t the elementar e understanding in the lab.	iszewska@zut.ec ry level g of properties of m	haterials in terms Number of hours 10 4 1 3 3 3
Other tea Prerequis W-1 Module/c C-1 Course c T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6 T-A-7	achers sites Knowledge of the l course unit objectiv The aim of the cour of their functionality content divided into Current state of th Band theory of ser Calculations of the Calculations of rea Evaluation of polyr thermal degradation	Kusi Pale pasic c es rse is ty. The vario e art o nicond photo ction r mer de on tech al deg	n@zut.edu.p course in math to gain the st e students wil ous forms of of Functional N luctors: Calcu ocatalytic active rates and kine egradation and hniques for st pradation	ol), Wilpiszewska hematics, physics udents' knowledge I have competence <i>instruction</i> Materials - student lations of band ga vity and quantum etics d depolymerization	a Katar and che e and sk es of tes 's prese p energ efficien	zyna (K emistry a kills in the am work entations	atarzyna.Wilp t the elementar e understanding in the lab.	iszewska@zut.ec ry level g of properties of m	lu.pl) naterials in terms Number of hours 10 4 4 1 3 3 3 3
Other tea Prerequis W-1 Module/c C-1 Course c T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6 T-A-7 T-A-8	achers sites Knowledge of the B Course unit objectiv The aim of the cou of their functionali Content divided into Current state of th Band theory of ser Calculations of the Calculations of rea Evaluation of polyr thermal degradatio Modelling of therm participation in page	Kusi Pale Dasic c es rse is ty. The vario e art o nicond photo ction r mer de on tech al deg ssing t	n@zut.edu.p course in math to gain the st e students wil ous forms of of Functional N luctors: Calcu ocatalytic active rates and kine egradation and hniques for st pradation est	ol), Wilpiszewska hematics, physics udents' knowledge I have competence <i>instruction</i> Materials - student lations of band ga vity and quantum etics d depolymerization ability testing	a Katar and che e and sk es of tea 's prese p energ efficien n	zyna (K emistry a kills in the am work entations ly cy	atarzyna.Wilp t the elementar e understanding in the lab.	iszewska@zut.ec ry level g of properties of m	lu.pl) naterials in terms Number of hours 10 4 4 1 3 3 3 3 2
Other tea Prerequis W-1 Module/c C-1 Course c T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6 T-A-7 T-A-8 T-L-1	achers sites Knowledge of the B course unit objectiv The aim of the cou of their functionali content divided into Current state of th Band theory of ser Calculations of the Calculations of rea Evaluation of polyr thermal degradatio Modelling of therm participation in pas Adsorption and ph	Kusi Pale pasic c es rse is ty. The vario e art o nicond photo ction r mer de on tech al deg ssing t otocat	n@zut.edu.p course in math to gain the st e students wil ous forms of of Functional N luctors: Calcu ocatalytic activ rates and kine gradation and hniques for st pradation est alytic remova	ol), Wilpiszewska hematics, physics udents' knowledge I have competence <i>instruction</i> Materials - student lations of band ga vity and quantum etics d depolymerization ability testing	a Katar and che e and sk es of tea 's prese p energ efficien n	zyna (K emistry a kills in the am work entations ly cy	atarzyna.Wilp t the elementar e understanding in the lab.	iszewska@zut.ec ry level g of properties of m	lu.pl) naterials in terms Number of hours 10 4 4 1 3 3 3 3 3 2 5
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Other tea Prerequis W-1 Module/c C-1 Course c T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6 T-A-7 T-A-8 T-L-1 T-L-2 T-L-3	achers sites Knowledge of the B Course unit objectiv The aim of the cou of their functionali Content divided into Current state of th Band theory of ser Calculations of the Calculations of rea Evaluation of polyr thermal degradatio Modelling of therm participation in pas Adsorption and pho Photoactive buildir Plasticizing of biop	Kusi Pale Dasic c es rse is ty. The vario e art o nicond photo ction r mer de on tech aal deg ssing t otocat ng mat olyme	n@zut.edu.p course in math to gain the st e students wil ous forms of of Functional N fuctors: Calcu potatalytic activ rates and kine gradation and hniques for st gradation est alytic remova cerials for air p rs	ol), Wilpiszewska hematics, physics udents' knowledge I have competence <i>instruction</i> Materials - student lations of band ga vity and quantum etics d depolymerization ability testing	a Katar and che e and sk es of tea 's prese p energ efficien n	zyna (K emistry a kills in the am work entations ly cy	atarzyna.Wilp t the elementar e understanding in the lab.	iszewska@zut.ec ry level g of properties of m	lu.pl) naterials in terms Number of hours 10 4 4 1 3 3 3 3 3 3 5 5 5 5 5
Other tea Prerequis W-1 Module/c C-1 Course c T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6 T-A-7 T-A-8 T-L-1 T-L-2 T-L-3 T-L-4	achers sites Knowledge of the B course unit objectiv The aim of the cou of their functionali content divided into Current state of th Band theory of ser Calculations of the Calculations of rea Evaluation of polyr thermal degradatio Modelling of therm participation in pas Adsorption and ph Photoactive buildir Plasticizing of biop Water soluble poly	Kusi Pale pasic c es rse is ty. The vario e art o nicond photo ction r mer de on tech al deg ssing t otocat olyme mers f	n@zut.edu.p course in math to gain the st e students will ous forms of of Functional N luctors: Calcu ocatalytic active rates and kine egradation and hniques for st gradation est alytic remova cerials for air p rs for technical a	ol), Wilpiszewska hematics, physics udents' knowledge I have competence <i>instruction</i> Materials - student lations of band ga vity and quantum etics d depolymerization ability testing	a Katar and che e and sk es of tex 's prese p energ efficien n pollutar	zyna (K emistry a kills in the am work entations ly cy	atarzyna.Wilp t the elementar e understanding in the lab.	iszewska@zut.ec ry level g of properties of m	lu.pl) haterials in terms Number of hours 10 4 4 1 3 3 3 3 3 3 5 5 5 5 5 5 5
Other tea Prerequis W-1 Module/c C-1 Course c T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6 T-A-7 T-A-8 T-L-1 T-L-2 T-L-3 T-L-4 T-L-5	achers sites Knowledge of the B Course unit objectiv The aim of the cou of their functionalif Content divided into Current state of th Band theory of ser Calculations of the Calculations of rea Evaluation of polyr thermal degradatio Modelling of therm participation in pas Adsorption and ph Photoactive buildir Plasticizing of biop Water soluble poly Synthesis of porou	Kusi Pale Dasic co es rse is ty. The vario e art o photo ction r mer de on tech al deg ssing t otocat og mat olyme mers f s mole	n@zut.edu.p course in mathem to gain the st e students will ous forms of f Functional N luctors: Calcu ocatalytic active rates and kine gradation and hniques for st gradation est alytic remova cerials for air p rs for technical a ecular structu	ol), Wilpiszewska hematics, physics udents' knowledge l have competence <i>instruction</i> Materials - student lations of band ga vity and quantum etics d depolymerization ability testing ability testing ability testing application res with different p	a Katar and che e and sk es of ter 's prese p energ efficien n pollutar	zyna (K emistry a kills in the am work entations ly cy nts	atarzyna.Wilpi t the elementar e understanding in the lab.	iszewska@zut.ec ry level g of properties of m	lu.pl) naterials in terms Number of hours 10 4 4 1 3 3 3 3 3 3 5 5 5 5 5 5 5 5 5 5 5 5
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Other tea Prerequis W-1 Module/c C-1 Course c T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6 T-A-7 T-A-8 T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6	achers sites Knowledge of the B Course unit objectiv The aim of the cou of their functionali Content divided into Current state of th Band theory of ser Calculations of the Calculations of rea Evaluation of polyr thermal degradatio Modelling of therm participation in pas Adsorption and pho Photoactive buildir Plasticizing of biop Water soluble poly Synthesis of porou Adsorption propert	Kusi Pale pasic c es rse is ty. The vario e art o nicond photo ction r mer de on tech al deg ssing t otocat olyme mers f s mole ies of erties of	n@zut.edu.p course in math to gain the st e students will ous forms of of Functional N luctors: Calcu ocatalytic active rates and kine egradation and hniques for st gradation est alytic remova cerials for air p rs for technical a ecular structur porous molec of Functional	ol), Wilpiszewska hematics, physics udents' knowledge I have competence <i>instruction</i> Materials - student lations of band ga vity and quantum etics d depolymerization ability testing I of air and water purification res with different p cular structures wit Materials: Genera	a Katar and che e and sk es of ter b energ efficien n pollutar poorous of th differ	zyna (K emistry a kills in the am work entations ly cy nts distributi rent poro	atarzyna.Wilpi t the elementar e understanding in the lab.	iszewska@zut.ec ry level g of properties of m	lu.pl) haterials in terms Number of hours 10 4 1 4 4 1 3 3 3 3 3 5 5 5 5 5 5 5 5 5 5 5 5 5 5
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Other tea Prerequis W-1 Module/c C-1 Course c T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6 T-A-7 T-A-6 T-A-7 T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-W-1 T-W-2	achers sites Knowledge of the B Course unit objectiv The aim of the cou of their functionali Content divided into Current state of th Band theory of ser Calculations of the Calculations of rea Evaluation of polyr thermal degradatio Modelling of therm participation in pae Adsorption and phe Photoactive buildir Plasticizing of biop Water soluble poly Synthesis of porou Adsorption propert Fundamental Prope	Kusi Pale Dasic c es rse is ty. The vario e art o nicond photo ction r mer de on tech al deg ssing t otocat ng mat olyme mers f s mole cies of erties ogies	n@zut.edu.p course in math to gain the st estudents will ous forms of of Functional N luctors: Calcu ocatalytic active rates and kine egradation and hniques for st gradation est alytic remova cerials for air p rs for technical a ecular structur porous molect of Functional for Functional nal Materials	ol), Wilpiszewska hematics, physics udents' knowledge I have competence <i>instruction</i> Materials - student lations of band ga vity and quantum etics d depolymerization ability testing ability testing ability testing application res with different p cular structures with Materials: Genera I Materials	a Katar and che e and sk es of tea 's prese p energ efficien n pollutar porous o th differ I Conce	zyna (K emistry a kills in the am work entations ly cy nts distributi rent poro pts	atarzyna.Wilpi t the elementar e understanding in the lab.	iszewska@zut.ec ry level g of properties of m	lu.pl) naterials in terms Number of hours 10 4 4 1 3 3 3 3 3 3 3 3 5 5 5 5 5 5 5 5 5 5 5
Other tea Prerequis W-1 Module/C C-1 Course c T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6 T-A-7 T-A-8 T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-W-1 T-W-2 T-W-3	achers sites Sites Knowledge of the B Course unit objectiv The aim of the cou of their functionali Content divided into Current state of th Band theory of ser Calculations of the Calculations of rea Evaluation of polyr thermal degradatio Modelling of therm participation in pas Adsorption and phe Photoactive buildir Plasticizing of biop Water soluble poly Synthesis of porou Adsorption propert Fundamental Prope Processing technol Future Trends in Fu	Kusi Pale Dasic c es rse is ty. The vario e art o nicond photo ction r mer de on tech al deg ssing t otocat olyme mers f s mole ies of erties ogies unction	n@zut.edu.p course in math to gain the st e students will ous forms of of Functional N luctors: Calcu ocatalytic active rates and kine egradation and hniques for st gradation est alytic remova cerials for air p rs for technical a ecular structur porous molec of Functional for Functiona nal Materials aterials and d	ol), Wilpiszewska hematics, physics udents' knowledge I have competence <i>instruction</i> Materials - student lations of band ga vity and quantum etics d depolymerization ability testing I of air and water purification res with different p cular structures wit Materials I Materials evices: Fundamen	a Katar and che e and sk es of tex 's prese p energ efficien n pollutar poorous o th differ I Conce	zyna (K emistry a kills in the am work entations y cy cy hts distributi rent poro pts d prepara	atarzyna.Wilp t the elementar e understanding in the lab.	iszewska@zut.ec ry level g of properties of m	lu.pl) haterials in terms Number of hours 10 4 1 4 4 1 3 3 3 3 3 3 5 5 5 5 5 5 5 5 5 5 5 5 5
Other tea Prerequis W-1 Module/c C-1 Course c T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6 T-A-7 T-A-6 T-A-7 T-A-6 T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-W-1 T-W-2 T-W-3 T-W-4	achers sites Sites Knowledge of the B Course unit objectiv The aim of the cou of their functionali Content divided into Current state of th Band theory of ser Calculations of rea Evaluation of polyr thermal degradatio Modelling of therm participation in pas Adsorption and ph Photoactive buildir Plasticizing of biop Water soluble poly Synthesis of porou Adsorption propert Fundamental Prop Processing technol Future Trends in Fit	Kusi Pale Dasic c es rse is ty. The vario e art o photo ction r mer de on tech al deg ssing t otocat ng mat otocat ng mat otocat ng mat otocat s mole cies of erties of erties of erties of erties of sed ma	n@zut.edu.p course in mathematics to gain the steps students will ous forms of f Functional N luctors: Calcu ocatalytic active rates and kine gradation and hniques for st gradation rest alytic remova cerials for air p rs for technical a ecular structur porous molect of Functional for Functional for Functional nal Materials aterials and d on of semicono	ol), Wilpiszewska hematics, physics udents' knowledge l have competence <i>instruction</i> Materials - student lations of band ga vity and quantum etics d depolymerization ability testing ability testing ability testing ul of air and water purification res with different p cular structures with Materials: Genera I Materials evices: Fundamen ductor materials a	a Katar and che e and sk es of ter 's prese p energ efficien n pollutar pollutar porous o th differ I Conce	zyna (K emistry a kills in the am work entations ly cy cy nts distributi rent poro pts d prepara ces	atarzyna.Wilpi t the elementar e understanding in the lab.	iszewska@zut.ec	lu.pl) haterials in terms Number of hours 10 4 1 4 4 1 3 3 3 3 3 3 5 5 5 5 5 5 5 5 5 5 5 5 6 4 4 4 1 1 2
Other tea Prerequis W-1 Module/c C-1 Course c T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6 T-A-7 T-A-6 T-A-7 T-A-8 T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5	achers sites Sites Knowledge of the B Course unit objectiv The aim of the cou of their functionali Content divided into Current state of th Band theory of ser Calculations of the Calculations of rea Evaluation of polyr thermal degradatio Modelling of therm participation in pas Adsorption and ph Photoactive buildir Plasticizing of biop Water soluble poly Synthesis of porou Adsorption propert Fundamental Prop Processing technol Future Trends in Fu Semiconductor-bas	Kusi Pale Dasic c es rse is ty. The vario e art o nicond photo ction r mer de on tech al deg ssing t otocat ng mat olyme mers f s mole cies of erties ogies unction sed ma olicatio ne pho	n@zut.edu.p course in math to gain the st estudents will ous forms of of Functional N luctors: Calcu becatalytic active rates and kine gradation and hniques for st gradation est alytic remova cerials for air p rs for technical a ecular structur porous molece of Functional for Functional for Functional for Functional aterials and d on of semicono potocatalytic active	ol), Wilpiszewska hematics, physics udents' knowledge I have competence <i>instruction</i> Materials - student lations of band ga vity and quantum etics d depolymerization ability testing ability testing ability testing application res with different p cular structures with Materials: Genera I Materials evices: Fundamen ductor materials a ctivity: Mechanism	a Katar and che e and sk es of tea 's prese p energ efficien n pollutar poorous o th differ I Conce itals and nd devi s, conce	zyna (K emistry a kills in the am work entations ly cy cy nts distributi rent poro pts d prepara ces	atarzyna.Wilpi t the elementar e understanding in the lab.	iszewska@zut.ec	Iu.pl) naterials in terms Number of hours 10 4 10 4 10 4 11 3 3 3 3 3 3 3 3 3 3 5 5 5 5 5 5 4 4 4 4 1 2 5 5 5 5 5 5 5 5 5 5 5 5 5 5 6 6 7 7 7 7 7 7 7

		raculty of chem		ology all			9			
Course co	ontent a	ivided into various forms of instr	uction					Nur	nber of	f hours
T-W-9		merization, degradation and destruc radability testing methods	tion; degradatior	n types and pr	operties chan	ges,				3
T-W-10	Additiv (rheolo	res affecting polymer stability (UV lig bgy modifiers, surface active additive ers with improved resistance				nctional	ty			3
T-W-11		pation in the zero-term exam								3
Student w	vorkload	l - forms of activity						Nur	nber of	f hours
A-A-1		pation in recitations								30
A-A-2		ing for tests								13
A-A-3	Self-st	udy of the literature								15
A-A-4	Consu	tations								2
A-L-1	partici	pation in laboratory exercises								30
A-L-2	prepar	ation to laboratory exercises								10
A-L-3	prepar	ation of reports								10
A-L-4	partici	pating in tests								10
A-W-1	partici	pation in lectures								30
A-W-2	Individ	ual literature studies								13
A-W-3	prepar	ation for the exam								15
A-W-4	The ex									1
A-W-5	Consu	tations								2
Teaching	methor	ls / tools								
M-1		s with presentation								
M-2		t discussion during lectures, auditoriu	um excercises an	d laboratories						
M-3	self stu	-								
Evaluatio		ods (F - progressive, P - final)								
S-1	P	written exam								
5-1 5-2	F	written completion of exercises and	laboratories							
5-2 S-3	F	laboratory reports								
5-5 S-4	F	student activity during auditory exc	ercise							
5-4				1	Reference to		1		1	1
	Desigi	ned learning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Cours	e content	Teaching methods	Evaluation methods
Knowledg	e									
terms of the	f the und	erstanding of properties of materials in ality.	MSE_1A_W06	P6S_WG		C-1	T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6	T-W-7 T-W-8 T-W-9 T-W-10 T-W-11	M-1	S-1
Skills				1	1	1			1	
MSE_1A_C10 the ability to their function	characte	rize the properties of materials in terms of	f MSE_1A_U07	P6S_UW	P6S_UW	C-1	T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6 T-A-7	T-A-8 T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-5	M-2 M-3	S-1 S-3
Social cor	npeten	ces								
MSE_1A_C10 Students is a work in grou	ble to pe	form all task on time and cooperate and	MSE_1A_K02	P65_KK	P6S_WK	C-1	T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6 T-A-7 T-A-8 T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5	T-L-6 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 T-W-8 T-W-7 T-W-8 T-W-9 T-W-10 T-W-11	M-1 M-2	S-1 S-3

Faculty of Chemical Technology and Engineering

Outcomes	Grade	Evaluation criterion
Knowledge		·
MSE_1A_C10_W01	2,0	
	3,0	from 50 to 55% of percentage points
	3,5	
	4,0	
	4,5	
	5,0	
Skills		
MSE_1A_C10_U01	2,0	
	3,0	from 50 to 55% of percentage points
	3,5	
	4,0	
	4,5	
	5,0	
Other social cor	mpetenc	es
MSE_1A_C10_K01	2,0	
	3,0	from 50 to 55% of percentage points
	3,5	
	4,0	
	4,5	
	5,0	
Required readir	ng	
	-	ndelin J. Wright, The Science and Engineering of Materials , Cengage Learning, 2017, ISBN-13: 978-
2 Traugott Fische	or Matoria	als Science for Engineering Students, Academic Press, 2008, ISBN-13, 978-0123735874

2. Traugott Fischer, Materials Science for Engineering Students, Academic Press, 2008, ISBN-13: 978-0123735874

3. Susan Trolier-McKinstry, Robert E. Newnham, Materials Engineering: Bonding, Structure, and Structure-Property Relationships, Cambridge University Press, 2017, ISBN-13: 978-1107103788

			-						
Field of s	study	Mate	erials Scienc	e and Engineeri	ng				
Mode of s	study	stati	onary	Level		first o	cycle	14/701/	~1
Graduate	e's qualification	inży	nier					WTil(_h
Fields of	science	engi	neering and	technology					
Discipline	es of science	materials engineering (100%)							
Educatio	nal profile	general academic							
Module									
Course u	ınit	Phase Transformations & Microstructure of Materials							
Code		MSE	_1A_S_C11						
Field of s	pecialisation								C
Administ	ering faculty	Dep	artment of F	olymer and Bio	materia	als Scier	nce		
ECTS		5,0		ECTS (forms)		5,0			
Form of a	course credit	cred	its	Language		english	l		
Electives	;			Elective group					
Form of i	instruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
lecturing		A	4	15		,0	0,30	K	credits
-	ry course	L	4	30		,0	0,30	K	credits
lecture		w	4	30		,0	0,40	K	credits
Leading	taachar			a (Miroslawa.Elf					creates
Other tea Prerequis		(Kar	olina.Kielbas	a (Miroslawa.Elf sa@zut.edu.pl), manska@zut.ec	Kochm	ańska A	Agnieszka		zut.edu.pl),
W-1	Fundamentals of m	nather	natics, physic	s and chemistry					
Module/c	course unit objectiv	es							
C-1	To gain the knowle materials	edge, s	kills and com	petences in the a	rea of p	nase trar	nsformations and	microstructure o	of engineering
Course c	ontent divided into	vario	us forms of	instruction					Number of hours
T-A-1	Determination of d	liffusio	n coefficients	and activation er	nergy				5
T-A-2	Isothermal and nor thermograms	n-isoth	ermal crystal	lization process of	fpolyme	ers – ana	lysis and interpre	etation of DSC	3
T-A-3	The glass transition	n temp	perature – ana	alysis and interpre	tation c	f DSC th	ermograms		2
T-A-4	Study of temperatu Raman spectra	ure ph	ase transition	s in TiO2- analysi	s and in	terpreta	tion of XRD diffra	ctograms and	5
T-L-1	Measurement and	predic	tion of phase	transformation ki	netics				5
T-L-2	Ferrous alloys: stee	els, Ca	st Irons						5
T-L-3	Nonferrous alloys:	Coppe	er, Aluminum,	Titanium, Magnes	sium an	d Its Allo	ys		5
T-L-4	Heat treatment of	alloys							5
T-L-5	Crystallization fron								5
T-L-6	Glass transition ter Dislocations and St	•					ianci Elin Evictori	c. Clip in Cingle	5
T-W-1	Crystals: Plastic De	forma	tion of Polycr	inisms; Characteri	SLICS OI	Disiocali	ions: Silb System	s; slip in single	
	Grain Size Reduction Recrystallization; C	on; So	lid-Solution St				y Twinning; Strei	igenering by	4
T-W-2	Grain Size Reduction Recrystallization; C Development of m	on; So Grain C icrostr	lid-Solution St Growth Tucture in iron	-carbon alloys	iin Hard	ening; Re	y Twinning; Strer ecovery		4
T-W-2 T-W-3	Grain Size Reduction Recrystallization; G	on; So Grain C icrostr d Prop	lid-Solution St Growth ucture in iron erty Changes	-carbon alloys in Iron-Carbon All	iin Hard	ening; Re	y Twinning; Strer ecovery		
	Grain Size Reduction Recrystallization; C Development of m Microstructural and	on; So Grain C icrostr d Prop transf	lid-Solution St Growth ucture in iron erty Changes ormation diag	-carbon alloys in Iron-Carbon All yrams)	iin Hard loys (Pe	ening; Re	y Twinning; Strer ecovery		2
T-W-3	Grain Size Reduction Recrystallization; C Development of m Microstructural and Time temperature Modeling of mass to Modeling of heat tr	on; So Grain C icrostr d Prop transf transfe ransfe	lid-Solution St Growth ucture in iron erty Changes ormation diag er process in p	rengthening; Stra -carbon alloys in Iron-Carbon All grams) phase transformati	in Hard loys (Pe ion on	ening; Re arlite; Ba	y Twinning; Strei ecovery ainite; Spheroidite		2
T-W-3 T-W-4 T-W-5 T-W-6	Grain Size Reduction Recrystallization; Construction Development of m Microstructural and Time temperature Modeling of mass to Modeling of heat tr Nucleation theory,	on; So Grain C icrostr d Prop transfe ransfe incluc	lid-Solution St Growth ucture in iron erty Changes ormation diag er process in p process in p ling solid-stat	rengthening; Stra -carbon alloys in Iron-Carbon All grams) ohase transformati hase transformati e nucleation (hom	in Hard loys (Pe ion on logeneo	ening; Re arlite; Ba	y Twinning; Strei ecovery ainite; Spheroidite		2 4 3 3 3
T-W-3 T-W-4 T-W-5 T-W-6 T-W-7	Grain Size Reduction Recrystallization; C Development of m Microstructural and Time temperature Modeling of mass t Modeling of heat tr Nucleation theory, Crystallites growth	on; So Grain C icrostr d Prop transf transf ransfe incluc and n	lid-Solution St Growth ucture in iron erty Changes ormation diag er process in p process in p ling solid-stat norphology of	rrengthening; Stra -carbon alloys in Iron-Carbon All grams) ohase transformat hase transformati e nucleation (hom polymeric materi	in Hard loys (Pe ion on logeneo	ening; Re arlite; Ba	y Twinning; Strei ecovery ainite; Spheroidite		2 4 3 3 3 3 3 3
T-W-3 T-W-4 T-W-5 T-W-6	Grain Size Reduction Recrystallization; Construction Development of m Microstructural and Time temperature Modeling of mass to Modeling of heat tr Nucleation theory,	on; So Grain C icrostr d Prop transfe ransfe incluc and n on du	lid-Solution St Growth ucture in iron erty Changes ormation diag r process in p ing solid-stat norphology of ring drawing a	rrengthening; Stra -carbon alloys in Iron-Carbon All grams) ohase transformati hase transformati e nucleation (hom polymeric materi and shearing	in Hard loys (Pe ion on ogeneo als	ening; Re arlite; Ba	y Twinning; Strei ecovery ainite; Spheroidite		2 4 3 3 3

			racury or chemi		ology all			'9			
Course co	ntent d	ivided i	nto various forms of instr	uction					Nur	nber o	f hours
T-W-10	Therma	al phase	transitions in polymers								3
Student w	orkload	I - form	s of activity						Nur	nber o	f hours
A-A-1	Particip	pation in	recitations								15
A-A-2	prepar	ing of wr	itten reports								10
A-A-3	self-stu	idy of th	e literature								5
A-L-1	parcitp	ation in	laboratory exercises								30
A-L-2	individ	ual study	/ of literature								10
A-L-3	consul	ations									5
A-L-4		-	en reports								15
A-W-1		ation in									30
A-W-2			ture studies								8
A-W-3		tations									3
A-W-4	prepar	ing for te	ests								20
Teaching i	method	ls / tools	5								
M-1	lecture	s with p	resentation								
М-2	subject	discuss	ion during lectures and labo	ratories							
М-3	self stu	ıdies									
Evaluation	n metho	ods (F -	progressive, P - final)								
5-1	Р	written	completion of lectures and la	aboratories							
5-2	F	laborato	ory reports								
S-3	F	student	activity during laboratories	and discussion							
	Desigr	ned lear	ning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course	e content	Teaching methods	Evaluation methods
Knowledge	е			1	1	1				1	1
	has the ki		of common aspect of phase ture in engineering materials	MSE_1A_W03	P6S_WG P6S_WK	P6S_WG	C-1	T-W-1 T-W-2 T-W-3	T-W-6 T-W-7 T-W-8	M-1 M-2	S-1 S-2
Skills				1	Į	Į					1
	has the ki ons and m		of common aspect of phase ture characterization of	MSE_1A_U07	P6S_UW	P6S_UW	C-1	T-A-1 T-A-2 T-A-3 T-A-4	T-L-1 T-L-2 T-L-3 T-L-4	M-1 M-2	S-1 S-2
Social com	npeteno	ces								1	1
	s aware o		ortance of phase ture in engineering materials	MSE_1A_K04	P6S_KR		C-1	T-A-1 T-A-2 T-A-3 T-A-4	T-L-1 T-L-2 T-L-3 T-L-4	M-1 M-2	S-1 S-2
Outcor	nes	Grade		E	valuation cr	iterion					
Knowledge	е	·									
MSE_1A_C11_		2,0									
		,	Positive grade of the final test (n	nore than 55% corr	ect answers)						
		3,5									
		4,0 4,5									
		5,0									
Skills											
MSE_1A_C11_	_U01	2,0									
		3,0	Positive grade of the final test (n	nore than 55% corr	ect answers)						
		3,5									
		4,0 4,5									
		4,5 5,0									
L		- / -									

Faculty of Chemical Technology and Engineering

Other social com	petence	es
MSE_1A_C11_K01	2,0	
	3,0	Positive grade of the final test (more than 55% correct answers)
	3,5	
	4,0	
	4,5	
	5,0	

Required reading

1. W. D. Callister, D. G. Rethwisch, Materials Science and Engineering An introduction, Wiley, 2014

2. M. DeGraef and M. E. McHenry, Structure of Materials: An Introduction to Crystallography, Diffraction, and Symmetry, Cambridge University Press, NY, 2007

3. W. Massa, Crystal Structure Determination, Springer, New York, NY, 2004

4. M. Ashby, K. Johnson, Materials and Design, The Art and Science of Material Selection in Product Design, Third Edition, Elsevier, 2014

Field of s Mode of	study	1						-	
Mode of	study	Mate	rials Scienc	e and Engineeri	ng				
	study	statio	onary	Level		first o	cycle		
Graduate	e's qualification	inżyr	nier					WTil	Ch
Fields of		-		technology					
	es of science	-	-	eering (100%)					
	onal profile		ral academ	-					
Module	inal prome	gene							
Course L	Init			Biochemical Ei	nginee	ering			C
Code		MSE_	_1A_S_C12						
	specialisation								
Administ	tering faculty	Depa	artment of C	Chemical and Pro	ocess E	Inginee	ring		
ECTS		4,0		ECTS (forms)		4,0			
Form of	<i>course credit</i>	credi	ts	Language		english	1		
Electives	S			Elective group					
Form of	instruction	Cod	Semester	Hours	EC	CTS	Weight	Realization	Credit
lecturing		Α	4	15	1	,0	0,25	K	credits
project c	-	P	4	30		,0	0,50	K	credits
lecture		w	4	15		,0	0,25	K	credits
				_				ĸ	creates
Leading	teacher			upak Agata (Ag				Dales and Dafak	
Other te	achers		al.Rakoczy@	upak Agata (Ag Zut.edu.pl)	ata.Ma	rkowska	a@zut.edu.pl),	какосzу катаг	
Prerequi	isites								
W-1	Basic knowledge of	fbiolog	gy and chemi	stry, finshed cour	se of m	athemati	ics		
Module/a	course unit objective								
	Louise unit objective	es							
C-1	The objective of the (bio)chemical and processes themsel	e cours (bio)pr ves, es	ocess engine specially large	ers well-trained in	chemi	cal and b	oiochemical proc	ess equipment as	s well as the
C-1	The objective of th (bio)chemical and (processes themselv complex the install	e cours (bio)proves, es ation is	ocess engine specially large s.	ers well-trained ir e-scale ones. They	chemi	cal and b	oiochemical proc	ess equipment as	s well as the regardless of how
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C-1 Course c T-A-1	The objective of the (bio)chemical and (processes themselv complex the install content divided into Fermentation kinet	e cours (bio)proves, es lation is <i>variou</i> tics and	ocess engine specially large s. <i>us forms of</i> d model proce	ers well-trained ir e-scale ones. They instruction esses	chemi are ab	cal and b	oiochemical proc	ess equipment as	s well as the regardless of how Number of hours 5
C-1 Course c	The objective of the (bio)chemical and of processes themselve complex the install content divided into	e cours (bio)proves, es ation is <i>variou</i> ics and lation o	ocess engine specially large s. <i>us forms of</i> d model proc of boreactor	ers well-trained in e-scale ones. They <i>instruction</i> esses process dynamics	chemi are ab	cal and b	oiochemical proc	ess equipment as	s well as the regardless of how
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C-1 Course c T-A-1 T-A-2 T-A-3	The objective of the (bio)chemical and of processes themselver complex the install content divided into Fermentation kinet Modeling and simu Predicting Reactor Preparation of own	e cours (bio)proves, es ation is variou cics and lation o biomas projec otics, t	ocess engine specially large s. d model proce of boreactor p ss concentrat ct (Examples biofertilizers, nes and antib	ers well-trained in e-scale ones. They instruction esses process dynamics tion of topics related t biopesticides, blo podies, natural pro	o Bioprod o Bioprod ducts).	cal and b le to des ocess En ucts; fer	piochemical proc ign, automate, a gineering: bioen mented food and	ess equipment as and control them lergy, d	s well as the regardless of how Number of hours 5
C-1 Course c T-A-1 T-A-2 T-A-3 T-P-1	The objective of the (bio)chemical and of processes themselver complex the install content divided into Fermentation kinet Modeling and simu Predicting Reactor Preparation of own biofactories, probi- drink, production of	e cours (bio)prives, es ation is variou ics and lation o bioma projec otics, b vaccir nd bioo	ocess engine specially large s. <i>us forms of</i> d model proce of boreactor (ss concentrate t (Examples biofertilizers, nes and antib chemical eng	ers well-trained in e-scale ones. They instruction esses process dynamics tion of topics related t biopesticides, blo bodies, natural pro ineering? Biotech	o Bioprod o Bioprod od prod ducts). nology	cal and b le to des ocess En ucts; fer	piochemical proc ign, automate, a gineering: bioen mented food and	ess equipment as and control them lergy, d	s well as the regardless of how Number of hours 5
C-1 Course c T-A-1 T-A-2 T-A-3 T-P-1 T-W-1	The objective of the (bio)chemical and oprocesses themselver complex the install content divided into Fermentation kinet Modeling and simu Predicting Reactor Preparation of own biofactories, probi- drink,production of What is chemical a	e cours (bio)prives, es ation is variou cics and lation o biomas projec otics, b vaccir nd bioo steriliz	ocess engine specially large s. <i>us forms of</i> d model proce of boreactor p ss concentrat ct (Examples biofertilizers, nes and antib chemical eng ation in biop	ers well-trained in e-scale ones. They instruction esses process dynamics tion of topics related t biopesticides, blo bodies, natural pro ineering? Biotech rocess engineering	o Biopro o Biopro od prod ducts). nology	cal and b le to des ocess En ucts; fer and Biop	piochemical proc ign, automate, a gineering: bioen mented food and rocess engineer	ess equipment as and control them lergy, d	s well as the regardless of how Number of hours Number of hours 5 5 5 30 2
C-1 Course c T-A-1 T-A-2 T-A-3 T-P-1 T-W-1 T-W-2	The objective of the (bio)chemical and of processes themselver complex the install content divided into Fermentation kinet Modeling and simu Predicting Reactor Preparation of own biofactories, probi- drink,production of What is chemical a Media formulation/	e cours (bio)prives, es ation is variou ics and lation o bioma projec otics, t vaccir nd bioo steriliz velopm	ocess engine specially large s. <i>us forms of</i> d model proce of boreactor ss concentral tt (Examples biofertilizers, nes and antib chemical eng ation in biopri-	ers well-trained in e-scale ones. They instruction esses process dynamics tion of topics related t biopesticides, blo odies, natural pro ineering? Biotech rocess engineering wth kinetics. Effe	o Bioprod o Bioprod ducts). nology g ct of cu	cal and b le to des ocess En ucts; fer and Biop	iochemical proc ign, automate, a gineering: bioen mented food and rocess engineer ditions.	ess equipment as and control them lergy, d	s well as the regardless of how Number of hours 5 5 5 30 2 2 2
C-1 Course c T-A-1 T-A-2 T-A-3 T-P-1 T-W-1 T-W-2 T-W-3	The objective of the (bio)chemical and oprocesses themselv complex the install content divided into Fermentation kinet Modeling and simu Predicting Reactor Preparation of own biofactories, probidrink,production of What is chemical a Media formulation/ Industrial strain de	e cours (bio)prives, es ation is <i>variou</i> ics and lation o biomas projec otics, t vaccir nd bioo steriliz velopm	ocess engine specially large s. <i>us forms of</i> d model proce of boreactor ss concentral ct (Examples biofertilizers, nes and antib chemical eng ation in biop nent. Cell gro	ers well-trained in e-scale ones. They instruction esses process dynamics tion of topics related t biopesticides, blo odies, natural pro ineering? Biotech rocess engineering wth kinetics. Effe	o Bioprod o Bioprod ducts). nology g ct of cu	cal and b le to des ocess En ucts; fer and Biop	iochemical proc ign, automate, a gineering: bioen mented food and rocess engineer ditions.	ess equipment as and control them lergy, d	s well as the regardless of how Number of hours Number of hours 5 5 30 2
C-1 Course c T-A-1 T-A-2 T-A-3 T-P-1 T-W-1 T-W-2 T-W-3 T-W-4	The objective of the (bio)chemical and of processes themselver complex the install content divided into Fermentation kinet Modeling and simu Predicting Reactor Preparation of own biofactories, probi- drink,production of What is chemical a Media formulation/ Industrial strain de Bioreactor design &	e cours (bio)prives, es ation is variou ics and lation o biomas projec otics, t vaccir nd bioo steriliz velopm s scale nologie	ocess engine specially large s. <i>us forms of</i> d model proce of boreactor p ss concentrat ct (Examples biofertilizers, nes and antib chemical eng ation in biopp nent. Cell gro up (e.g. airlif	ers well-trained in e-scale ones. They instruction esses process dynamics tion of topics related t biopesticides, blo podies, natural pro ineering? Biotech rocess engineering wth kinetics. Effect t reactor, stirred a	o Bioprod o Bioprod ducts). nology ct of cu	cal and b le to des ocess En ucts; fer and Biop ture con driven et	piochemical proc ign, automate, a gineering: bioen mented food and rocess engineer ditions. c.)	ess equipment as and control them lergy, d	s well as the regardless of how Number of hours Number of hours 5 5 5 30 2 2 2 2 3
C-1 Course c T-A-1 T-A-2 T-A-3 T-P-1 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-6	The objective of the (bio)chemical and oprocesses themselv complex the install content divided into Fermentation kinet Modeling and simu Predicting Reactor Preparation of own biofactories, probi- drink,production of What is chemical a Media formulation/ Industrial strain de Bioreactor design & Fermentation techn	e cours (bio)prives, es ation is <i>variou</i> ics and lation o biomas projec otics, te vaccir nd bioo steriliz velopm & scale nologie	ocess engine specially large s. <i>us forms of</i> d model proce of boreactor ss concentrat ct (Examples bofertilizers, nes and antib chemical eng ation in bioprenent. Cell gro nent. Cell gro nent. Cell gro tup (e.g. airlift es enzymes. Mo	ers well-trained in e-scale ones. They instruction esses process dynamics tion of topics related t biopesticides, blo podies, natural pro ineering? Biotech rocess engineering wth kinetics. Effect t reactor, stirred a	o Bioprod o Bioprod ducts). nology ct of cu	cal and b le to des ocess En ucts; fer and Biop ture con driven et	piochemical proc ign, automate, a gineering: bioen mented food and rocess engineer ditions. c.)	ess equipment as and control them lergy, d	s well as the regardless of how Number of hours Number of hours 5 5 5 30 2 2 2 2 3 3 3 3
C-1 Course c T-A-1 T-A-2 T-A-3 T-P-1 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6	The objective of the (bio)chemical and oprocesses themsel- complex the install content divided into Fermentation kinet Modeling and simu Predicting Reactor Preparation of own biofactories, probi- drink,production of What is chemical a Media formulation/ Industrial strain de Bioreactor design & Fermentation techn Large-scale produc	e cours (bio)prives, es ation is variou ics and lation of biomas projec otics, b vaccir nd bioo steriliz velopm s scale nologie tion of <i>activi</i>	ocess engine specially large s. d model proce of boreactor of boreactor ss concentral tt (Examples biofertilizers, nes and antib chemical eng ation in biopr nent. Cell gro tup (e.g. airlif	ers well-trained in e-scale ones. They instruction esses process dynamics tion of topics related t biopesticides, blo podies, natural pro ineering? Biotech rocess engineering wth kinetics. Effect t reactor, stirred a	o Bioprod o Bioprod ducts). nology ct of cu	cal and b le to des ocess En ucts; fer and Biop ture con driven et	piochemical proc ign, automate, a gineering: bioen mented food and rocess engineer ditions. c.)	ess equipment as and control them lergy, d	s well as the regardless of how Number of hours Number of hours 5 5 5 30 2 2 2 2 3 3 3 3 3 3
C-1 Course c T-A-1 T-A-2 T-A-3 T-P-1 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 Student	The objective of the (bio)chemical and oprocesses themselv complex the install content divided into Fermentation kinet Modeling and simu Predicting Reactor Preparation of own biofactories, probi- drink,production of What is chemical a Media formulation/ Industrial strain de Bioreactor design & Fermentation techn Large-scale product	e cours (bio)proves, es ation is variou ics and lation of bioma: projec otics, t vaccir nd bioo steriliz velopn s scale hologie ttion of <i>activi</i> itations	ocess engine specially large s. <i>us forms of</i> d model proce of boreactor ss concentrat ct (Examples biofertilizers, nes and antib chemical eng ation in biop ment. Cell gro pup (e.g. airlif es enzymes. Mo ity s	ers well-trained in e-scale ones. They instruction esses process dynamics tion of topics related t biopesticides, blo podies, natural pro ineering? Biotech rocess engineering wth kinetics. Effect t reactor, stirred a	o Bioprod o Bioprod ducts). nology ct of cu	cal and b le to des ocess En ucts; fer and Biop ture con driven et	piochemical proc ign, automate, a gineering: bioen mented food and rocess engineer ditions. c.)	ess equipment as and control them lergy, d	s well as the regardless of how Number of hours 5 5 5 30 2 2 2 2 2 2 3 3 3 3 3 3 Number of hours
C-1 Course c T-A-1 T-A-2 T-A-3 T-P-1 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-5 Student A-A-1	The objective of the (bio)chemical and oprocesses themselv complex the install content divided into Fermentation kinet Modeling and simu Predicting Reactor Preparation of own biofactories, probi- drink,production of What is chemical a Media formulation/ Industrial strain de Bioreactor design & Fermentation techn Large-scale product workload - forms of Participation in rec	e cours (bio)prives, es ation is variou ics and lation of biomas projec otics, te vaccir nd bioo steriliz velopm \$ scale nologie tion of <i>activi</i> itations	ocess engine specially large s. <i>us forms of</i> d model proce of boreactor ss concentrat ct (Examples biofertilizers, nes and antib chemical eng ation in biop ment. Cell gro pup (e.g. airlif es enzymes. Mo ity s	ers well-trained in e-scale ones. They instruction esses process dynamics tion of topics related t biopesticides, blo podies, natural pro ineering? Biotech rocess engineering wth kinetics. Effect t reactor, stirred a	o Bioprod o Bioprod ducts). nology ct of cu	cal and b le to des ocess En ucts; fer and Biop ture con driven et	piochemical proc ign, automate, a gineering: bioen mented food and rocess engineer ditions. c.)	ess equipment as and control them lergy, d	s well as the regardless of how Number of hours 5 5 5 5 30 2 2 2 2 2 3 3 Number of hours 3 15
C-1 Course c T-A-1 T-A-2 T-A-3 T-P-1 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 Student A-A-1 A-A-2	The objective of the (bio)chemical and oprocesses themselv complex the install content divided into Fermentation kinet Modeling and simu Predicting Reactor Preparation of own biofactories, probi- drink,production of What is chemical a Media formulation/ Industrial strain de Bioreactor design & Fermentation techn Large-scale product workload - forms of Participation in rec preparing of writte	e cours (bio)prives, es ation is variou ics and lation of biomas projec otics, te vaccir nd bioo steriliz velopm \$ scale nologie tion of <i>activi</i> itations	ocess engine specially large s. <i>us forms of</i> d model proce of boreactor ss concentrat ct (Examples biofertilizers, nes and antib chemical eng ation in biop ment. Cell gro pup (e.g. airlif es enzymes. Mo ity s	ers well-trained in e-scale ones. They instruction esses process dynamics tion of topics related t biopesticides, blo podies, natural pro ineering? Biotech rocess engineering wth kinetics. Effect t reactor, stirred a	o Bioprod o Bioprod ducts). nology ct of cu	cal and b le to des ocess En ucts; fer and Biop ture con driven et	piochemical proc ign, automate, a gineering: bioen mented food and rocess engineer ditions. c.)	ess equipment as and control them lergy, d	s well as the regardless of how Number of hours Number of hours 5 5 30 2 2 2 2 3
C-1 Course c T-A-1 T-A-2 T-A-3 T-P-1 T-W-1 T-W-2 T-W-2 T-W-3 T-W-4 T-W-5 T-W-5 Student A-A-1 A-A-2 A-A-3	The objective of the (bio)chemical and oprocesses themselv complex the install content divided into Fermentation kinet Modeling and simu Predicting Reactor Preparation of own biofactories, probidrink, production of What is chemical a Media formulation/ Industrial strain de Bioreactor design & Fermentation techn Large-scale production of workload - forms of Participation in rec preparing of writte	e cours (bio)proves, es ation is variou ics and lation of biomas projec otics, k vaccir nd bio steriliz velopn s scale nologie tion of <i>activi</i> itations n rapon ure	ocess engine specially large s. <i>us forms of</i> d model proce of boreactor p ss concentral ct (Examples biofertilizers, nes and antib chemical eng ation in biop nent. Cell gro up (e.g. airlif es enzymes. Mo ity s rts	ers well-trained in e-scale ones. They instruction esses process dynamics tion of topics related t biopesticides, blo bodies, natural pro jineering? Biotech rocess engineering wth kinetics. Effect t reactor, stirred a edical and Industr	o Bioprod o Bioprod ducts). nology ct of cu	cal and b le to des ocess En ucts; fer and Biop ture con driven et	piochemical proc ign, automate, a gineering: bioen mented food and rocess engineer ditions. c.)	ess equipment as and control them lergy, d	s well as the regardless of how Number of hours 5 5 30 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3 3 3 3
C-1 Course c T-A-1 T-A-2 T-A-3 T-P-1 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 Student A-A-1 A-A-2 A-A-3 A-A-3 A-A-4 A-P-1 A-P-2	The objective of the (bio)chemical and oprocesses themselv complex the install content divided into Fermentation kinet Modeling and simu Predicting Reactor Preparation of own biofactories, probi- drink,production of What is chemical a Media formulation/ Industrial strain de Bioreactor design & Fermentation techn Large-scale product workload - forms of Participation in rec preparing of writte self-study of literat Consultations preparation of own consultations	e cours (bio)proves, es ation is ver, es ation is ver, es ation is ics and bioma projec otics, t vaccir nd bioo steriliz velopm steriliz velopm scale nologie tion of <i>activi</i> itations n rapoi	ocess engine specially large s. <i>us forms of</i> d model proce of boreactor p ss concentral t (Examples biofertilizers, nes and antib chemical eng ation in biop nent. Cell gro oup (e.g. airlif enzymes. Mo ity s rts	ers well-trained in e-scale ones. They instruction esses process dynamics tion of topics related t biopesticides, blo bodies, natural pro jineering? Biotech rocess engineering wth kinetics. Effect t reactor, stirred a edical and Industr	o Bioprod o Bioprod ducts). nology ct of cu	cal and b le to des ocess En ucts; fer and Biop ture con driven et	piochemical proc ign, automate, a gineering: bioen mented food and rocess engineer ditions. c.)	ess equipment as and control them lergy, d	s well as the regardless of how Number of hours 5 5 30 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3 3 3 3
C-1 Course c T-A-1 T-A-2 T-A-3 T-P-1 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 Student A-A-1 A-A-2 A-A-3 A-A-4 A-P-1 A-P-2 A-P-3	The objective of the (bio)chemical and oprocesses themselv complex the install content divided into Fermentation kinet Modeling and simu Predicting Reactor Preparation of own biofactories, probidrink,production of What is chemical a Media formulation/ Industrial strain de Bioreactor design & Fermentation techn Large-scale product workload - forms of Preparing of written self-study of literat Consultations preparation of own	e cours (bio)proves, es ation is variou ics and lation of bioma: projec otics, k vaccir nd bioo steriliz velopm x scale nologie tion of <i>activi</i> itations n rapoi ure	ocess engine specially large s. <i>us forms of</i> d model proce of boreactor p ss concentral t (Examples biofertilizers, nes and antib chemical eng ation in biop nent. Cell gro oup (e.g. airlif enzymes. Mo ity s rts	ers well-trained in e-scale ones. They instruction esses process dynamics tion of topics related t biopesticides, blo bodies, natural pro jineering? Biotech rocess engineering wth kinetics. Effect t reactor, stirred a edical and Industr	o Bioprod o Bioprod ducts). nology ct of cu	cal and b le to des ocess En ucts; fer and Biop ture con driven et	piochemical proc ign, automate, a gineering: bioen mented food and rocess engineer ditions. c.)	ess equipment as and control them lergy, d	s well as the regardless of how Number of hours 5 5 30 2 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3 3 3
C-1 Course c T-A-1 T-A-2 T-A-3 T-P-1 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 Student A-A-1 A-A-2 A-A-3 A-A-3 A-A-4 A-P-1 A-P-2	The objective of the (bio)chemical and oprocesses themselv complex the install content divided into Fermentation kinet Modeling and simu Predicting Reactor Preparation of own biofactories, probi- drink,production of What is chemical a Media formulation/ Industrial strain de Bioreactor design & Fermentation techn Large-scale product workload - forms of Participation in rec preparing of writte self-study of literat Consultations preparation of own consultations	e cours (bio)prives, es ation is variou ics and lation of biomas projec otics, te vaccir nd bioo steriliz velopm scale nologie tion of <i>activi</i> itations n rapoi ure projec	ocess engine specially large s. <i>us forms of</i> d model proce of boreactor p ss concentral t (Examples biofertilizers, nes and antib chemical eng ation in biop nent. Cell gro oup (e.g. airlif enzymes. Mo ity s rts	ers well-trained in e-scale ones. They instruction esses process dynamics tion of topics related t biopesticides, blo bodies, natural pro jineering? Biotech rocess engineering wth kinetics. Effect t reactor, stirred a edical and Industr	o Bioprod o Bioprod ducts). nology ct of cu	cal and b le to des ocess En ucts; fer and Biop ture con driven et	piochemical proc ign, automate, a gineering: bioen mented food and rocess engineer ditions. c.)	ess equipment as and control them lergy, d	s well as the regardless of how Number of hours 5 5 30 2 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3 3 3

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Student wo	rkload	d - form	s of activity						Nur	nber of	f hours
<i>A-W-3</i> i	individ	ual cons	ultations								2
A-W-4 p	prepar	ation for	test								5
Teaching m	ethoc	ls / tool	s								
M-1	lecture	s									
M-2 0	disscu	sion duri	ng lectures and seminar								
<i>M-3</i>	Private	e study									
Evaluation i	metho	ods (F -	progressive, P - final)								
S-1	F	lectures	s with presentation								
S-2	F	semina	r								
S-3	F	private	study								
E	Designed learning outcomes Reference to the learning outcomes designed for the fields of study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the learning outcomes for qualifications at study Reference to the l									Teaching methods	Evaluatio methods
Knowledge											
design, can ana	isplays alyze ki ate bio	netics of l reactor m	ensive knowledge of bioreactor bioreactor processes, design or odels based upon bioproducts s criteria	MSE_1A_W02	P6S_WG	P6S_WG	C-1	T-A-1 T-W-1 T-W-2 T-W-3	T-W-4 T-W-5 T-W-6	M-1 M-2 M-3	S-1 S-2 S-3
Skills				1	ł	I				1	
	ole crit		lyze biochemical engineering erpret experimental biochemical	MSE_1A_U05	P6S_UW	P6S_UW	C-1	T-A-1 T-A-2 T-W-1 T-W-2	T-W-3 T-W-4 T-W-5 T-W-6	M-1 M-2 M-3	S-1 S-2 S-3
Social comp	peten	ces									
MSE_1A_C12_K Student can ac engineering in	quire a		ation for the role of biochemical d academia.	MSE_1A_K02	P6S_KK	P6S_WK	C-1	T-A-2 T-A-3 T-P-1 T-W-1	T-W-2 T-W-3 T-W-4 T-W-5	M-1 M-2 M-3	S-1 S-2 S-3
Outcome	es	Grade		E	valuation cr	iterion					
Knowledge		1	L								
MSE_1A_C12_W	V01	2,0									
		- / -	51% of test points, 30% of proje	ct points							
		3,5									
		4,0 4,5									
		5,0									
Skills			L								
MSE_1A_C12_U	J01	2,0									
			Have a fundamental understandi calculations.	ng of chemostats a	and their applica	tions, and be al	ble to pe	rform th	e corresp	onding	
		3,5									
		4,0									
		4,5									
		5,0									
Other socia			es								
ISE_1A_C12_K	:01	2,0									
		3,0 3,5	Student is able to finish all task o	luring course with t	the help of the c	colleaguss and a	teacher				
		3,5									
		4,5									
		5,0									
	toh, Ju	n-ichi Ho d and En	priuchi, Fumitake Yoshida, Bio larged Edition, Wiley, 2015, 2 ochemical Engineering and B	2			eers, Cl	nemists	and Bi	ologists,	. 2nd,

2. Ghasem D. Najafpour, Biochemical Engineering and Biotechnology,, Elsevier Science, 2011, 2

3. Michael L. Shuler, Fikret Kargi, Matthew DeLisa, Bioprocess Engineering: Basic Concepts (Prentice Hall International Series in the Physical and Chemical Engineering Sciences), Prentice Hall, 2007, 3

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Supplementary reading

1. Francoise Simon, Glen Giovannetti, Managing Biotechnology: From Science to Market in the Digital Age, John Wiley & Sons, 2017

2. A. H. Scragg (Editor), Bioreactors in Biotechnology: A Practical Approach, E. Horwood,, 1991, 1

3. Chemical Engeenering Journals, 2019, Frontiers in Chemical Engineering, Chemical Engineering Journal, Journal of Chemical Engineering, Journal of Chemical Engineering & Process Technology, International Journal of Chemical Engineering and others

			<u> </u>						
Field of s	tudy	Mate	erials Scienc	e and Engineeri	ng				
Mode of s	study	stati	ionary	Level		first o	cycle	14/2014	~ 1
Graduate	's qualification	inży	nier	I				WTil	_h
Fields of :	science	engi	ineering and	l technology					
Discipline	es of science	mat	erials engine	eering (100%)					
Educatior	nal profile	gene	eral academ	lic					
Module									
Course ui	nit	Sma	art and Nai	nomaterials					
Code			_1A_S_C13						
	pecialisation								C
	ering faculty	Dep	artment of N	Aaterials Techno	logy				
ECTS		6,0		ECTS (forms)		6,0			
Form of c	course credit	exar	mination	Language		english	1	-	
Electives				Elective group				-	
Form of i	nstruction	Cod	Semester	Hours	EC	CTS	Weight	Realization	Credit
lecturing		A	4	15		,0	0,25	K	credits
laborator		L	4	30		,0	0,50	K	credits
lecture	jeeuse	w	4	15		,0	0,25	K	examination
Leading t	taachar			dra (Sandra.Pas		-			cxummuton
Prerequis W-1 Module/co	sites The lecture aims in chemistry is requir ourse unit objective	Karc getti ed	olina (Karolir	na.Wilgosz@zut.	edu.pl)				du.pl), Wenelska
C-1	2	n prov with li	iquid crystals	and high tempera	ture ma	bout nar aterials -	nomaterials, the intriduction duri	ir structure, and p ng lectures, and v	roperties. Students vill get more
Course co	ontent divided into	vario	ous forms of	instruction					Number of hours
T-A-1	Optical properties	of 1D	material (e.g.	singlewalled carb	on nand	otubes) -	UV-Vis spectrur	n analysis	2
T-A-2	Vibronic properties	of 2D) materials (C	NTs, graphene, TM	1D) - Ra	man res	ponse interpreta	ition	3
Т-А-З	3D types high tem					-	,		3
T-A-4	Analysis on the oxi				-				2
T-A-5	Chemical structure				-		-		2
T-A-6	Different technique				on of lic	quid crys	stals – case studi	es	3
T-L-1 T-L-2	Study on high temp Morphological stud					A)			5
T-L-2	Determination of th		J 1			-	using the therm	al polarizing	5
	microscope. Determination of th	he ten	nperature of p	ohase transitions a	nd thei	r energy	effects of liquid	crystals using	
T-L-4	differential scannin	-	-						5
T-L-5	Measurements of L			-		es (1D n	naterial)		5
T-L-6	Study on 1D & 2D		-	•		vio en -l	ntical area		5
T-W-1 T-W-2	Layered materials One-dimensional m							>	3
T-W-2 T-W-3	High temperature			· · ·			01150		2
T-W-3	3D types high tem								3
T-W-5	Liquid crystals – cla						LC, lyotropic LC	and their	2
	properties			-					
T-W-6	Liquid crystalline p	-		tion, chemical stru	ucture a	ind prope	erties.		3
Student v	workload - forms of	activ	vity						Number of hours

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			Taculty of chem					<u>'9</u>			
Student v	vorkloa	d - form	s of activity						Nur	nber o	f hours
A-A-1	Partici	pation in	recitations								15
A-A-2	Prepa	ration for	recitations								13
A-A-3	Taking) part in e	exam.								2
A-L-1	Partici	pation in	laboratory classes								30
A-L-2	Prepa	ration for	laboratory exercises								60
A-L-3	Taking	part in e	exam.								2
A-L-4	Prepa	ration of	reports								28
A-W-1	Partici	pation in	lectures.								15
A-W-2	Gettin	g acquai	nted with literature (articles	s, books, patents)							12
A-W-3	Partici	pation in	consultations								2
A-W-4	Acces	sion to th	ne exam								1
Teaching	metho	ds / tool	ς								
M-1			z ture (presentation prepared	in PowerPoint)							
M-2		discussi									
			progressive, P - final)								
S-1	P	Written									
S-2	F		torm during lectures, laborat		· · ·	es					
S-3	F	Report	preparation (at auditorium c	lasses and labora	itories)						
	Desig	ned lear	rning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Cours	e content	Teaching methods	Evaluatior methods
Knowledg	ie										
MSE 1A C13	B_W01 cribes sel	ected issu	es concerning smart and	MSE_1A_W03 MSE_1A_W04	P6S_WG P6S_WK	P6S_WG	C-1	T-W-1 T-W-2 T-W-3	T-W-4 T-W-5 T-W-6	M-1	S-1
Skills	115							1-00-5	1-00-0		
MSE_1A_C13		smart an	d nanomaterials	MSE_1A_U07	P6S_UW	P6S_UW	C-1	T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6	T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-5 T-L-6	M-2	S-2 S-3
Social cor	npeten	ces									
MSE_1A_C13 The student application c	understa	nds the im Ind nanom	nportance of fabrication and naterials	MSE_1A_K02	P65_KK	P6S_WK	C-1	T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6 T-L-1 T-L-2 T-L-2 T-L-3	T-L-4 T-L-5 T-U-6 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6	M-1	S-1 S-3
Outco	mes	Grade		E	valuation cri	iterion					
Knowledg	ie	-	1								
MSE_1A_C13		2,0 3,0 3,5 4,0 4,5 5,0	Student describes selected issu	es at a basic level (score => 50%)						
Skills		5,0									
SKIIIS MSE_1A_C13	8 1101	20									
M3L_1A_U13	,_001	2,0 3,0 3,5 4,0 4,5 5,0	Student describes selected issu	es at a basic level (score => 50%)						

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Other social com	petenc	es
MSE_1A_C13_K01	2,0	
	3,0	Student describes selected issues at a basic level (score => 50%)
	3,5	
	4,0	
	4,5	
	5,0	

Required reading

1. Yury Gogotsi (editor), Nanomaterials Handbook, CRC Press/Taylor & Francis Group, cop. 2017., 2017

2. Kalia Susheel (editor), Organic-inorganic hybrid nanomaterials, Springer-Verlag, Berlin, 2015

3. Nikos Tagmatarchis (editor), Advances in carbon nanomaterials : science and applications, Pan Stanford Publishing, Singapore, 2012

4. Malkiat S. Johal, Understanding nanomaterials, CRC Press/Taylor & Francis Grou, 2011

Supplementary reading

1. Rich Falcon (editor), Smart Nanomaterials: Synthesis, Properties and Applications, NY RESEARCH PRESS, NY USA, 2017

2. Guozhong Cao, Ying W, Nanostructures and nanomaterials : synthesis, properties and applications, World Scientific, New Jersey, 2011

Field - C			riale Scienc	e and Engineerir	าต				
Field of s	study	Mate	inais scienc	e and Engineerii	.9				
Mode of	f study	statio	onary	Level		first c	ycle	3477717	~ 1
Graduate	te's qualification	inżyr	nier					WTil(Lh
Fields of	f science	engir	neering and	technology					
Disciplin	nes of science			eering (100%)					
•	onal profile		ral academ	-					
Module		5							
Course u	unit	Mate	erials Char	acterization a	nd Ana	lytical	Techniques		
Code			1A_S_C14			i y ci cu i	reeninques		
	specialisation								C
	tering faculty	Dena	artment of (Catalytic and Sor	hont Ma	atorials	Engineering		
ECTS		5,0		ECTS (forms)		5,0	Engineering		
	course credit	credi	ite	Language		english			
Electives		Cieui		Elective group		engiish			
						TC			C "'
	instruction	Cod	Semester	Hours	ECT		Weight	Realization	Credit
	ory course	L	5	30	3,0		0,50	K	credits
lecture		W	5	30	2,0	0	0,50	К	credits
Leading	teacher			afal.Wrobel@zut.					
Other te	eachers	Paler	n@zut.edu.p	Zofia (Zofia.Len ol), Moszyński Da ki⊚zut edu pl) S	ariusz (E	Dariusz	.Moszynski@zi		piórski Jacek
			al.Wrobel@z			,			
Prerequi	isites								
Prerequi W-1	<i>isites</i>	(Rafa				,			
W-1		(Rafa				,			
W-1 Module/d	no prerequirement	(Rafa s es	al.Wrobel@z	zut.edu.pl)					
W-1 Module/c C-1	no prerequirement	(Rafa s es les of r	al.Wrobel@z	nt analytical techn					Number of hours
W-1 Module/c C-1	no prerequirement <i>course unit objectiv</i> Learning of princip <i>content divided into</i> Analysis of surface Spectroscopy	(Rafa s es les of r variou	most importa us forms of osition by X-r	nt analytical techn instruction ay Photoelectron	iques				Number of hours 5
W-1 Module/c C-1 Course c	no prerequirement <i>course unit objectiv</i> Learning of princip <i>content divided into</i> Analysis of surface Spectroscopy Transmission elect analysis	(Rafa s es les of r variou compo	most importa us forms of osition by X-r crosopy and	nt analytical techn instruction ay Photoelectron microanalysis - sar	iques mple pre	eparatio	n, observations a		
W-1 Module/c C-1 Course c T-L-1	no prerequirement <i>course unit objectiv</i> Learning of princip <i>content divided into</i> Analysis of surface Spectroscopy Transmission elect analysis Raman spectrosco	(Rafa es les of r variou compo ron mio	most importa us forms of osition by X-r crosopy and a powerful teo	nt analytical techn instruction ay Photoelectron microanalysis - sar	iques mple pre	eparatio	n, observations a		5
W-1 Module/c C-1 Course c T-L-1 T-L-2	no prerequirement <i>course unit objectiv</i> Learning of princip <i>content divided into</i> Analysis of surface Spectroscopy Transmission elect analysis Raman spectrosco presentation and in Temperature-progr	(Rafa s es les of r variou compo ron mic py as a nterpre ramme	most importa us forms of osition by X-r crosopy and a powerful tec etation d chemisorpt	nt analytical techn instruction ay Photoelectron microanalysis - sar	niques mple pre	eparation es inves	n, observations a	rements, data	5
W-1 Module/c C-1 Course c T-L-1 T-L-2 T-L-2	no prerequirement <i>course unit objectiv</i> Learning of princip <i>content divided into</i> Analysis of surface Spectroscopy Transmission elect analysis Raman spectrosco presentation and ir Temperature-progr strength, identify t High-resolution sol	(Rafa s es les of r variou compo ron mic py as a nterpre ramme he surf ution-s	most importa us forms of osition by X-r crosopy and a powerful teo etation d chemisorpt face acidity state NMR as	nt analytical techn instruction ay Photoelectron microanalysis - sar chnique in carbon i tion of gases on th a versatile techniq	niques mple pre nanotube e surface	eparation es inves e of mei	n, observations a stigations: mesur tals, analysis of t	rements, data	5
W-1 Module/c C-1 Course c T-L-1 T-L-2 T-L-2 T-L-3 T-L-4	no prerequirement <i>course unit objectiv</i> Learning of princip <i>content divided into</i> Analysis of surface Spectroscopy Transmission elect analysis Raman spectrosco presentation and ir Temperature-progr strength, identify t	(Rafa es les of r variou compo ron mid ron mid ron mid ramme he surf ution-s chemi	most importa us forms of osition by X-r crosopy and ta powerful teo etation d chemisorpt face acidity tate NMR as cal structure	nt analytical techn instruction ay Photoelectron microanalysis - sar chnique in carbon of tion of gases on th a versatile technic of a polymeric ma	niques mple pre nanotube e surface que provi terial	eparation es inves e of mei iding qu	n, observations a stigations: mesur tals, analysis of t	rements, data	5 5 5 5
W-1 Module/c C-1 Course c T-L-1 T-L-2 T-L-3 T-L-4 T-L-5	no prerequirement <i>course unit objectiv</i> Learning of princip <i>content divided into</i> Analysis of surface Spectroscopy Transmission elect analysis Raman spectrosco presentation and in Temperature-progr strength, identify t High-resolution sol information on the Cold field emission Surface analysis by	(Rafa s es les of r variou compo ron mid ron mid ron mid ron mid ron mid ron mid ron mid ron mid ron mid ron mid s ron mid s ron mid ron mid ron mid ron mid s ron mid ron ron mid ron ron mid ron ron mid ron ron ron ron mid ron ron ron ron mid ron	most importa us forms of osition by X-r crosopy and te etation d chemisorpt face acidity state NMR as cal structure ing electron t	nt analytical techn instruction ay Photoelectron microanalysis - sar chnique in carbon u tion of gases on th a versatile techniq of a polymeric ma microscopy with m	niques mple pre nanotube e surface que provi terial nicroanal	eparation es inves e of met iding qu	n, observations a stigations: mesur tals, analysis of t	rements, data	5 5 5 5 5 5
W-1 Module/c C-1 Course c T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6 T-W-1	no prerequirement course unit objective Learning of princip content divided into Analysis of surface Spectroscopy Transmission elect analysis Raman spectroscop presentation and in Temperature-prograting strength, identify t High-resolution sol information on the Cold field emission Surface analysis by	(Rafa es es les of r variou compo ron mid ron mid compo ramme he surf ution-s chemi scann y X-ray copy	al.Wrobel@z most importa us forms of osition by X-r crosopy and to ta powerful teo tation d chemisorpt face acidity state NMR as cal structure ing electron to Photoelectron	nt analytical techn instruction ay Photoelectron microanalysis - sar chnique in carbon i tion of gases on th a versatile techniq of a polymeric ma microscopy with m on Spectroscopy ar	niques mple pre nanotube e surface que provi terial nicroanal	eparation es inves e of met iding qu	n, observations a stigations: mesur tals, analysis of t	rements, data	5 5 5 5 5 5 5 5
W-1 Module/c C-1 Course c T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6	no prerequirement <i>course unit objectiv</i> Learning of princip <i>content divided into</i> Analysis of surface Spectroscopy Transmission elect analysis Raman spectrosco presentation and in Temperature-progr strength, identify t High-resolution sol information on the Cold field emission Surface analysis by	(Rafa es les of r variou compo ron mic py as a nterpre ramme he surf ution-s chemi scann y X-ray copy ron mic	al.Wrobel@z most importa us forms of osition by X-r crosopy and i a powerful teo etation d chemisorpt face acidity state NMR as cal structure ing electron i Photoelectro croscopy and	nt analytical techn instruction ay Photoelectron microanalysis - sar chnique in carbon of tion of gases on th a versatile techniq of a polymeric ma microscopy with m on Spectroscopy ar I microanalysis	niques mple pre nanotube e surface que provi terial nicroanal	eparation es inves e of met iding qu	n, observations a stigations: mesur tals, analysis of t	rements, data	5 5 5 5 5 5 5
W-1 Module/c C-1 Course c T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6 T-W-1 T-W-2 T-W-2 T-W-3	no prerequirement course unit objective Learning of princip content divided into Analysis of surface Spectroscopy Transmission elect analysis Raman spectroscop Temperature-progr strength, identify t High-resolution sol information on the Cold field emission Surface analysis by Electron Spectrosco Transmission elect Scanning electron	(Rafa es es les of r variou compo ron mic ron mic ron mic scann y X-ray copy ron mic ros	al.Wrobel@z most importa us forms of osition by X-r crosopy and a powerful teo etation d chemisorpt face acidity state NMR as cal structure ing electron Photoelectro croscopy and copy and mic	nt analytical techn instruction ay Photoelectron microanalysis - sar chnique in carbon of tion of gases on th a versatile technic of a polymeric ma microscopy with m on Spectroscopy ar I microanalysis croanalysis	niques mple pre nanotube e surface que provi terial nicroanal nid Auger	eparation es inves e of mei iding qu lysis	n, observations a stigations: mesur tals, analysis of t valitative and qua	rements, data the bonding antitative	5 5 5 5 5 5 5 5 4
W-1 Module/a C-1 Course c T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-W-1 T-W-1 T-W-2 T-W-3 T-W-4	no prerequirement course unit objective Learning of princip content divided into Analysis of surface Spectroscopy Transmission elect analysis Raman spectroscop Temperature-progr strength, identify t High-resolution sol information on the Cold field emission Surface analysis by Electron Spectrrosco Transmission elect Scanning electron	(Rafa es les of r variou compo compo ron mid py as a nterpre ramme he surf ution-s chemi scann y X-ray copy ron mid scann g X-ray copy g micros	al.Wrobel@z most importa us forms of osition by X-r crosopy and a powerful teo etation ed chemisorpt face acidity state NMR as cal structure ing electron of Photoelectron croscopy and copy and mic oscopy, atom	nt analytical techn instruction ay Photoelectron microanalysis - sar chnique in carbon of tion of gases on th a versatile technic of a polymeric ma microscopy with m on Spectroscopy ar I microanalysis croanalysis ic force microscop	niques mple pre nanotube e surface jue provi terial nicroanal nd Auger y, electro	eparation es inves e of mer iding qu lysis	n, observations a stigations: mesur tals, analysis of t valitative and qua	rements, data the bonding antitative	5 5 5 5 5 5 5 4 4
W-1 Module/c C-1 Course c T-L-1 T-L-2 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6 T-W-1 T-W-2 T-W-2 T-W-3 T-W-4 T-W-5	no prerequirement course unit objective Learning of princip content divided into Analysis of surface Spectroscopy Transmission elect analysis Raman spectroscop presentation and in Temperature-prograture-prograture-progration Surface analysis by Electron Spectroscop Transmission elect Surface analysis by Electron Spectroscop Transmission elect Scanning electron Scanning tunnelling	(Rafa es es les of r variou compo compo compo ron mid py as a nterpre ramme he surf ution-s chemi- scann y X-ray copy g micros g micros f mate	al.Wrobel@z most importa us forms of osition by X-r crosopy and teo station d chemisorpt face acidity state NMR as cal structure ing electron to Photoelectro croscopy and mic oscopy, atom rials: microca	nt analytical techn instruction ay Photoelectron microanalysis - sar chnique in carbon in tion of gases on th a versatile techniq of a polymeric ma microscopy with m on Spectroscopy ar I microanalysis croanalysis ic force microscop	niques mple pre nanotube e surface jue provi terial nicroanal nd Auger y, electro grmograv	eparation es inves e of mer iding qu lysis	n, observations a stigations: mesur tals, analysis of t valitative and qua	rements, data the bonding antitative	5 5 5 5 5 5 5 4 4 3
W-1 Module/o C-1 Course c T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-W-1 T-W-2	no prerequirement Icourse unit objective Learning of princip content divided into Analysis of surface Spectroscopy Transmission elect analysis Raman spectroscop presentation and in Temperature-prograting strength, identify the High-resolution sole information on the Cold field emission Surface analysis by Electron Spectroscom Transmission elect Scanning electron Scanning tunnelling microscopy Thermal analysis of	(Rafa es es les of r variou compo ron mic py as a nterpre ramme he surf ution-s chemi scann y X-ray copy ron mic micros g micro f mate py - fur	al. Wrobel@z most importa us forms of osition by X-r crosopy and it a powerful teo etation d chemisorpt face acidity state NMR as cal structure ing electron it Photoelectro croscopy and copy and mic oscopy, atom rials: microca	nt analytical techn instruction ay Photoelectron microanalysis - sar chnique in carbon i tion of gases on th a versatile technic of a polymeric ma microscopy with m on Spectroscopy ar l microanalysis croanalysis ic force microscop alorymetry and the and materials analy	niques nanotube e surface ue provi terial nicroanal nd Auger y, electro ermograv ysis	eparation es inves e of mel iding qu lysis r r r r r r r r r r	n, observations a stigations: mesur tals, analysis of t talitative and qua microscopy, ion	rements, data the bonding antitative	5 5 5 5 5 5 5 4 4 4 3 6
W-1 Module/c C-1 Course c T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-5 T-W-6 T-W-7	no prerequirement Icourse unit objective Learning of princip content divided into Analysis of surface Spectroscopy Transmission elect analysis Raman spectroscop Temperature-progration and in Temperature-progration on the Cold field emission Surface analysis by Electron Spectrroscon Transmission elect Scanning electron Scanning tunnelling microscopy Thermal analysis o	(Rafa es es les of r variou compo co co compo co compo compo compo compo compo co co compo co co	al. Wrobel@z most importa us forms of osition by X-r crosopy and to ta powerful teo tation d chemisorpt face acidity state NMR as cal structure ing electron to Photoelectron croscopy and mic oscopy, atom rials: microca ndamentals a d techniques	nt analytical techn instruction ay Photoelectron microanalysis - sar chnique in carbon i tion of gases on th a versatile technic of a polymeric ma microscopy with m on Spectroscopy ar l microanalysis croanalysis ic force microscop alorymetry and the and materials analy	niques nanotube e surface ue provi terial nicroanal nd Auger y, electro ermograv ysis	eparation es inves e of mel iding qu lysis r r r r r r r r r r	n, observations a stigations: mesur tals, analysis of t talitative and qua microscopy, ion	rements, data the bonding antitative	5 5 5 5 5 5 5 4 4 4 3 6 3
W-1 Module/o C-1 Course c T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-W-1 T-W-1 T-W-2 T-W-3 T-W-3 T-W-5 T-W-5 T-W-5 T-W-5 Student	no prerequirement Course unit objective Learning of princip content divided into Analysis of surface Spectroscopy Transmission elect analysis Raman spectroscop presentation and ir Temperature-prograting strength, identify t High-resolution sol information on the Cold field emission Surface analysis by Electron Spectroscopy Transmission elect Scanning tunnelling microscopy Thermal analysis o Raman spectroscop	(Rafa es es les of r variou compo ron mid py as a nterpre ramme he surf ution-s chemid scann y X-ray copy ron mid micros g micro f mate py - fur ramme f activi	al. Wrobel@z most importa us forms of osition by X-r crosopy and b a powerful teo etation d chemisorpt face acidity state NMR as cal structure ing electron of Photoelectron croscopy and copy and mic oscopy, atom rials: microca ndamentals a d techniques <i>ity</i>	nt analytical techn instruction ay Photoelectron microanalysis - sar chnique in carbon i tion of gases on th a versatile technic of a polymeric ma microscopy with m on Spectroscopy ar l microanalysis croanalysis ic force microscop alorymetry and the and materials analy	niques nanotube e surface ue provi terial nicroanal nd Auger y, electro ermograv ysis	eparation es inves e of mel iding qu lysis r r r r r r r r r r	n, observations a stigations: mesur tals, analysis of t talitative and qua microscopy, ion	rements, data the bonding antitative	5 5 5 5 5 5 5 5 4 4 4 3 6 3 5
W-1 Module/a C-1 Course c T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6 T-W-1 T-W-2 T-W-3 T-W-3 T-W-3 T-W-5 T-W-5 T-W-6 T-W-7 Student A-L-1	no prerequirement course unit objective Learning of princip content divided into Analysis of surface Spectroscopy Transmission elect analysis Raman spectroscop Temperature-progg strength, identify t High-resolution sol information on the Cold field emission Surface analysis by Electron Spectrrosco Transmission elect Scanning electron Scanning tunnelling microscopy Thermal analysis o Raman spectrosco Temperature progr	(Rafa es es les of r variou compo ron mid py as a nterpre ramme he surf ution-s chemid scann y X-ray copy ron mid micros g micro f mate py - fur ramme f activi	al. Wrobel@z most importa us forms of osition by X-r crosopy and b a powerful teo etation d chemisorpt face acidity state NMR as cal structure ing electron of Photoelectron croscopy and copy and mic oscopy, atom rials: microca ndamentals a d techniques <i>ity</i>	nt analytical techn instruction ay Photoelectron microanalysis - sar chnique in carbon i tion of gases on th a versatile technic of a polymeric ma microscopy with m on Spectroscopy ar l microanalysis croanalysis ic force microscop alorymetry and the and materials analy	niques nanotube e surface ue provi terial nicroanal nd Auger y, electro ermograv ysis	eparation es inves e of mel iding qu lysis r r r r r r r r r r	n, observations a stigations: mesur tals, analysis of t talitative and qua microscopy, ion	rements, data the bonding antitative	5 5 5 5 5 5 5 5 4 4 4 3 6 3 5 <i>Number of hours</i>
W-1 Module/o C-1 Course o T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-5 T-L-6 T-W-1 T-W-1 T-W-2 T-W-3 T-W-3 T-W-3 T-W-5 T-W-5 T-W-5 T-W-5 T-W-5 Student A-L-1 A-L-2	no prerequirement course unit objective Learning of princip content divided into Analysis of surface Spectroscopy Transmission elect analysis Raman spectroscop Temperature-prograture-progration and in Temperature-progration on the Cold field emission Surface analysis by Electron Spectrosco Transmission elect Scanning electron Scanning tunnelling microscopy Thermal analysis of Raman spectrosco Transmission elect Scanning tunnelling microscopy Thermal analysis of Raman spectrosco Thermal analysis of Raman spectrosco Thermal analysis of Temperature prograture participation in lab	(Rafa es es les of r variou compo ron mid py as a nterpre ramme he surf ution-s chemi scann y X-ray copy ron mid scann y X-ray copy ron mid micros g micros f mate py - fur ramme f activi	al. Wrobel@z most importa us forms of osition by X-r crosopy and to etation d chemisorpt face acidity state NMR as cal structure ing electron to Photoelectron croscopy and copy and mic oscopy, atom rials: microca ndamentals a d techniques	nt analytical techn instruction ay Photoelectron microanalysis - sar chnique in carbon i tion of gases on th a versatile technic of a polymeric ma microscopy with m on Spectroscopy ar I microanalysis ic force microscop alorymetry and the and materials analy (TPR, TPO, TPD,) i	niques nanotube e surface ue provi terial nicroanal nd Auger y, electro ermograv ysis	eparation es inves e of mel iding qu lysis r r r r r r r r r r	n, observations a stigations: mesur tals, analysis of t talitative and qua microscopy, ion	rements, data the bonding antitative	5 5 5 5 5 5 5 5 4 4 4 4 3 6 3 5 <i>Number of hours</i> 30
W-1 Module/a C-1 Course o T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-W-1 T-W-2 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-5 T-W-6 T-W-5 T-W-6 T-W-7 Student A-L-1 A-L-2 A-L-3 A-L-4	no prerequirement Course unit objective Learning of princip content divided into Analysis of surface Spectroscopy Transmission elect analysis Raman spectroscop Transmission elect analysis Raman spectroscop presentation and in Temperature-prograture-progration on the Cold field emission Surface analysis by Electron Spectrrosco Transmission elect Scanning electron Scanning tunnelling microscopy Thermal analysis o Raman spectrosco Temperature progration participation in lab Consultations Preparation of rapo self-study of the lit	(Rafa es es les of r variou compo ron mid py as a nterpre ramme he surf ution-s chemi- i scann y X-ray copy ron mid scann y X-ray copy for nicros g micros g micros f mate py - fur ramme f activi oratory orts; da	al. Wrobel@z most importa us forms of osition by X-r crosopy and a powerful teo etation ed chemisorpt face acidity state NMR as cal structure ing electron a Photoelectron croscopy and copy and mic oscopy, atom rials: microca ndamentals a d techniques <i>ity</i> y ata evaluatior	nt analytical techn instruction ay Photoelectron microanalysis - sar chnique in carbon i tion of gases on th a versatile technic of a polymeric ma microscopy with m on Spectroscopy ar I microanalysis ic force microscop alorymetry and the and materials analy (TPR, TPO, TPD,) i	niques nanotube e surface ue provi terial nicroanal nd Auger y, electro ermograv ysis	eparation es inves e of mel iding qu lysis r r r r r r r r r r	n, observations a stigations: mesur tals, analysis of t talitative and qua microscopy, ion	rements, data the bonding antitative	5 5 5 5 5 5 5 5 5 4 4 4 4 4 4 3 6 3 5 <i>Number of hours</i> 30 4 28 28
W-1 Module/o C-1 Course c T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-W-1 T-W-2 T-W-2 T-W-3 T-W-3 T-W-3 T-W-5 T-W-5 T-W-5 T-W-5 Student A-L-1 A-L-2 A-L-3	no prerequirement Course unit objective Learning of princip content divided into Analysis of surface Spectroscopy Transmission elect analysis Raman spectroscop Temperature-progr strength, identify t High-resolution sol information on the Cold field emission Surface analysis by Electron Spectrosco Transmission elect Scanning electron Scanning tunnelling microscopy Thermal analysis o Raman spectrosco Temperature progr Scanning tunnelling microscopy Thermal analysis o Raman spectrosco Temperature progr Thermal analysis of Raman spectrosco Temperature progr Participation in lab Consultations Preparation of rapo	(Rafa es es les of r variou compo ron mid py as a nterpre ramme he surf ution-s chemi- i scann y X-ray copy ron mid scann y X-ray copy for nicros g micros g micros f mate py - fur ramme f activi oratory orts; da	al. Wrobel@z most importa us forms of osition by X-r crosopy and a powerful teo etation ed chemisorpt face acidity state NMR as cal structure ing electron a Photoelectron croscopy and copy and mic oscopy, atom rials: microca ndamentals a d techniques <i>ity</i> y ata evaluatior	nt analytical techn instruction ay Photoelectron microanalysis - sar chnique in carbon i tion of gases on th a versatile technic of a polymeric ma microscopy with m on Spectroscopy ar I microanalysis ic force microscop alorymetry and the and materials analy (TPR, TPO, TPD,) i	niques nanotube e surface ue provi terial nicroanal nd Auger y, electro ermograv ysis	eparation es inves e of mel iding qu lysis r r r r r r r r r r	n, observations a stigations: mesur tals, analysis of t talitative and qua microscopy, ion	rements, data the bonding antitative	5 5 5 5 5 5 5 5 4 4 4 4 3 6 3 5 <i>Number of hours</i> 30 4

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			s of activity						Nur	nber o	
		ire study									15
	•	m solvin	-								13
Teaching m			S								
	Lecture										
	Labora	-									
			progressive, P - final)								
S-1	F	Test									
S-2	Р	Passing)	-	1	1					
	Desigr	ned lear	rning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course	content	Teaching methods	
Knowledge				1						1	1
MSE_1A_C14_V Student proper		ribes mic	roscopy techniques	MSE_1A_W03	P6S_WG P6S_WK	P6S_WG	C-1	T-W-2 T-W-3	T-W-4	M-1	S-1 S-2
MSE_1A_C14_V Student descri temperature p	bes app	lications ned tech	and working principles of niques	MSE_1A_W05	P6S_WG P6S_WK		C-1	T-W-5	T-W-7	M-1	S-1 S-2
Skills				-	•						
MSE_1A_C14_U Student is able in most basic t	e to worl	k alone w	ith scanning electron microscopy	/ MSE_1A_U07	P6S_UW	P6S_UW	C-1	T-L-6		M-2	S-2
Social com	petend	ces			•						
MSE_1A_C14_k Student is able	<01 e to anal	yse expe	rimental data	MSE_1A_K02	P6S_KK	P6S_WK	C-1	T-L-1 T-L-2 T-L-3	T-L-4 T-L-5 T-L-6	M-2	S-2
Outcom	ies	Grade		E	valuation cri	iterion	I	1			
Knowledge											
MSE_1A_C14_V		2,0 3,0 3,5 4,0 4,5 5,0	Student is able in basic lavel to	describe microscop	y techniques						
MSE_1A_C14_V	W02	2,0 3,0 3,5 4,0 4,5 5,0	Student is able to explain workin	ng principles of TGA	and TPD techni	ques					
Skills											
MSE_1A_C14_U	JO1	2,0 3,0 3,5 4,0 4,5 5,0	Student is able to introduce the	sample into the mid	croscope and ob	tain sharp pictu	re at low	ı magnif	ications		
Other socia	al com		es								
MSE_1A_C14_k	-	2,0	Student is able to deliver most f	undamental informa	ation on the bas	sis of raw data o	btained	during e	experime	nts	
Required re	adina		1								
	-		ative Chemical Analysis, W. I	+ Freeman and C	ompany New	York 2010					
T. Damer C. I	1101115,	Quantita	acive chemical Analysis, W. r		ompany, New	101K, 2010					



Field of									
	study	Mate	rials Scienc	e and Engineeri	ng				
Mode of	f study	stati	onary	Level		first o	cycle	\A/T:16	* La
Graduat	te's qualification	inżyr	nier					WTil	-N
Fields o	of science	engii	neering and	l technology					
Disciplir	nes of science	mate	erials engine	eering (100%)					<u> </u>
Educati	ional profile	gene	ral academ	ic					
Module									
Course	unit	Poly	mer Synth	esis, Recycling	g & Sa	fety			C
Code		MSE_	1A_S_C15						
Field of	specialisation								
Adminis	stering faculty	Depa	artment of P	olymer and Bior	nateria	als Scier	nce		
ECTS		5,0		ECTS (forms)		5,0			
Form of	f course credit	exan	nination	Language		english			
Elective	25			Elective group					
Form of	finstruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
laborato	ory course	L	5	45	4	,0	0,70	К	credits
lecture		W	5	15	1	,0	0,30	К	examination
Leading	g teacher	El Fra	ay Mirosław	a (Miroslawa.ElF	ray@z	ut.edu.p	ol)		
Other te		Pasz (Agn	kiewicz San ieszka.Piega	ay@zut.edu.pl), l dra (Sandra.Pas at@zut.edu.pl), \ iszewska@zut.eo	zkiewio Nilpisz	z@zut. ewska k	edu.pl), Piegat Katarzyna	Agnieszka	
Prerequ									
W-1	Fundamentals of cl	hemist	ry and physic	CS					
Module/	/course unit objectiv								
C 1			النالم مسط ممسم	matamaga in the fir	اما مد م		unthania kanvalik	a and cofety in a	a viza a sa a sa ta la sa d
C-1	human aspects	dge, s	kills and com	petences in the fie	eld of po	olymer sy	ynthesis, recyclir	ng and safety in e	nvironmental and
					eld of po	olymer sy	ynthesis, recyclir		nvironmental and Number of hours
	human aspects	vario	us forms of	instruction	eld of po	olymer sy	ynthesis, recyclir		
Course T-L-1 T-L-2	human aspects	vario tion of	us forms of styrene in su	<i>instruction</i> uspension	eld of po	olymer s <u>y</u>	ynthesis, recyclir		Number of hours
Course T-L-1	human aspects content divided into Radical polymeriza Condensation polymeriza Hydrogels from pho	variou tion of mers fi	us forms of styrene in su rom renewab able monome	instruction uspension le resources ers					Number of hours 5
Course T-L-1 T-L-2	human aspects content divided into Radical polymeriza Condensation poly	variou tion of mers fi otocura te plas	us forms of styrene in su rom renewab able monome tics for recyc	instruction uspension le resources ers					Number of hours 5 5
Course T-L-1 T-L-2 T-L-3 T-L-4 T-L-5	human aspects content divided into Radical polymeriza Condensation polymeriza Hydrogels from pho- Preparation of was	variou tion of mers fi otocura te plas roperti	us forms of styrene in su rom renewab able monome tics for recyc es.	instruction uspension le resources ers					Number of hours 5 5 5
Course T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6	human aspects content divided into Radical polymeriza Condensation polymeriza Hydrogels from photogenergy Preparation of was physicochemical polymerication of plass Glycolysis of polymerical	variou tion of mers fi otocura te plas roperti stic rec ner ma	us forms of styrene in su rom renewab able monome tics for recyc es. cyclates terials (PET, p	instruction uspension le resources ers cling. Separation of polyurethane etc.)	fpolym				Number of hours 5 5 5 4 4 4
Course T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-5 T-L-6 T-L-7	human aspects content divided into Radical polymeriza Condensation poly Hydrogels from phe Preparation of was physicochemical pi Modification of plas Glycolysis of polymeriza Energy recycling of	variou tion of mers fi otocura te plas roperti stic rec ner ma f polyn	us forms of styrene in su rom renewab able monome tics for recyc es. cyclates terials (PET, p ner materials	instruction uspension le resources ers ling. Separation of polyurethane etc.)	f polym	er mater			Number of hours 5 5 4 4 4 4 3
Course T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-5 T-L-6 T-L-7 T-L-8	human aspects content divided into Radical polymeriza Condensation polymeriza Hydrogels from photogenerical polymerica Preparation of was physicochemical polymerica Glycolysis of polymerica Energy recycling of Migration of substation	variou tion of mers fi otocura te plas roperti stic rec her ma f polyn inces f	us forms of styrene in su rom renewab able monome tics for recyc es. cyclates terials (PET, p ner materials rom polymer	instruction uspension le resources ers cling. Separation of polyurethane etc.)	f polym	er mater			Number of hours 5 5 4 4 4 3 5
Course T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-5 T-L-6 T-L-7 T-L-8 T-L-9	human aspects content divided into Radical polymeriza Condensation polymeriza Hydrogels from phy Preparation of was physicochemical presentation of plass Glycolysis of polymeriza Energy recycling of Migration of substation Polymerization of P	variou tion of mers fi otocura te plas roperti stic rec ner ma f polyn nnces f PVAC u	us forms of styrene in su rom renewab able monome tics for recyc es. cyclates terials (PET, p ner materials rom polymer sing emulsion	instruction uspension le resources ers ling. Separation of polyurethane etc.) ic food packaging n technque	f polym	er mater			Number of hours 5 5 4 4 4 4 3
Course T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-5 T-L-6 T-L-7 T-L-8	human aspects content divided into Radical polymeriza Condensation polymeriza Hydrogels from photogenerical polymerica Preparation of was physicochemical polymerica Glycolysis of polymerica Energy recycling of Migration of substation	variou tion of mers fi otocura te plas roperti stic rec ner ma f polyn nces f PVAC u e from	us forms of styrene in su rom renewab able monome tics for recyc es. cyclates terials (PET, p ner materials rom polymer sing emulsion plant raw ma	instruction uspension le resources ers ling. Separation of polyurethane etc.) ic food packaging n technque aterial	f polym materia	er mater	ials based on the	2ir	Number of hours 5 5 4 4 4 3 5 5 5
Course T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-7 T-L-8 T-L-9 T-L-10 T-W-1 T-W-2	human aspects content divided into Radical polymeriza Condensation polymeriza Hydrogels from photomerical polymerication of was physicochemical polymerication of plass Glycolysis of polymerization of substate Polymerization of substate Obtaining limonemerications. Chain and step-group	variou tion of mers fi otocura te plas roperti stic rec ner ma f polyn mces f PVAC u e from ymers	us forms of styrene in su rom renewab able monome tics for recyc es. cyclates terials (PET, p ner materials rom polymer sing emulsion plant raw ma science: nom	instruction uspension le resources ers cling. Separation of polyurethane etc.) ic food packaging n technque aterial henclature, types c	f polym materia f polym	er mater	ials based on the	2ir 2ir	Number of hours 5 5 6 7 4 4 3 5 5 5 6 7 6 7 6 7 6 7
Course T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-8 T-L-9 T-L-9 T-L-10 T-W-1	human aspects content divided into Radical polymeriza Condensation polymeriza Hydrogels from physicochemical progration of was physicochemical progration of plass Glycolysis of polymerization of plass Bigration of substate Polymerization of Polymerization of Polymerization of polymerization of polymerization of polymerization (Chain and step-grown) Chain and step-grown)	variou tion of mers fi otocura te plas roperti stic rec her ma f polyn noces f PVAC u e from ymers wth po reactiv	us forms of styrene in su rom renewab able monome tics for recyc es. cyclates terials (PET, p ner materials rom polymer sing emulsion plant raw ma science: nom olymerization vity ratios, the	instruction uspension le resources ers ling. Separation of polyurethane etc.) ic food packaging n technque aterial henclature, types c i: monomers, meth eir effect on copol	f polym materia	er mater Ils ierization roductio impositio	ials based on the n and depolymer n to kinetic aspe on, Q-e scheme)	eir ization ects.	Number of hours 5 5 4 4 4 4 3 5 5 5 5 1
Course T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-7 T-L-8 T-L-9 T-L-10 T-W-1 T-W-2	human aspects content divided into Radical polymeriza Condensation polymeriza Hydrogels from photomerical polymerication of was physicochemical polymerication of plass Glycolysis of polymerization of substate Polymerization of substate Obtaining limonemerications. Chain and step-group	variou tion of mers fi otocura te plas roperti stic rec mer ma f polyn mces f PVAC u e from ymers wth po reactiv n (anic	us forms of styrene in su rom renewab able monome tics for recyc es. cyclates terials (PET, p ner materials rom polymer sing emulsion plant raw ma science: nom olymerization vity ratios, the onic, cationic,	instruction uspension le resources ers ling. Separation of polyurethane etc.) ic food packaging n technque aterial henclature, types c i: monomers, meth eir effect on copoly , catalyst, living po	f polym materia	er mater ils erization roductio mpositic), coordin	ials based on the n and depolymer n to kinetic aspe on, Q-e scheme) nation polymeriz	eir ization ects.	Number of hours 5 5 6 7 4 4 3 5 5 5 6 7 7 8 9 10 11 4 4 4 5 5 5 1 4
Course T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-7 T-L-8 T-L-9 T-L-10 T-W-1 T-W-1 T-W-2 T-W-3	human aspects content divided into Radical polymeriza Condensation polymeriza Hydrogels from photometry Hydrogels from photometry Preparation of was physicochemical protection Glycolysis of polymetry Energy recycling of Migration of substate Polymerization of F Obtaining limonence Introduction to polymetry Chain and step-group Copolymerization (variou tion of mers fi otocura te plas roperti stic rec ner ma f polyn mces f PVAC u e from ymers wth po reactiv n (anic gler-Ni	us forms of styrene in su rom renewab able monome tics for recyc es. cyclates terials (PET, p ner materials rom polymer sing emulsion plant raw ma science: nom olymerization vity ratios, the ponic, cationic, atta catalysts	instruction uspension le resources ers ling. Separation of polyurethane etc.) ic food packaging n technque aterial henclature, types c i: monomers, meth eir effect on copoly , catalyst, living po s, catalysts genera	f polym materia ods, inf ymer co olymers tions, n	er mater lls roductio mpositic), coordin nechanis	ials based on the n and depolymer n to kinetic aspe on, Q-e scheme) nation polymeriz m)	eir ization ects.	Number of hours 5 5 4 4 4 3 5 5 1 4 2 5 5 5 5 5 5 5 5 5 2
Course T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-7 T-L-8 T-L-9 T-L-10 T-W-1 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5	human aspects content divided into Radical polymeriza Condensation polymeriza Hydrogels from phy Preparation of wass physicochemical prisitor Modification of plass Glycolysis of polymerization Polymerization of substation Obtaining limonence Introduction to polymerizations. Copolymerization (Ionic polymerization, Zier	variou tion of mers fi otocura te plas roperti stic rec ner ma f polyn nces f vVAC u e from ymers wth po reactiv n (anic gler-Na obase	us forms of styrene in su rom renewab able monome tics for recyc es. cyclates terials (PET, p ner materials rom polymer sing emulsion plant raw ma science: nom plant raw ma science: nom plymerization vity ratios, the ponic, cationic, atta catalysts d polymers):	<i>instruction</i> uspension le resources ers ling. Separation of polyurethane etc.) ic food packaging n technque aterial henclature, types co i: monomers, meth eir effect on copoly , catalyst, living po s, catalysts genera bio-polyolefins, bio	f polym materia of polym nods, ini ymer cc olymers tions, n p-PET, r	er mater Is roductio mpositic), coordin nechanis ec-PET, F	ials based on the n and depolymer n to kinetic aspe on, Q-e scheme) nation polymeriz m) PEF etc.).	eir ization ects.	Number of hours 5 5 6 7 4 4 3 5 5 5 6 7
Course T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-7 T-L-7 T-L-7 T-L-9 T-L-10 T-W-1 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-6 Student	human aspects content divided into Radical polymeriza Condensation polymeriza Hydrogels from phe Preparation of wass physicochemical program Glycolysis of polymerization of substation Polymerization of F Obtaining limonent Introduction to polymerizations. Chain and step-groot Copolymerization (autoinhibition, Zie Bio-alternatives (biotection)	variou tion of mers fi otocura te plas roperti stic rec ner ma f polyn mces f vVAC u e from ymers wth po reactiv n (anic gler-Na obased ymer re	us forms of styrene in su rom renewab able monome tics for recyc es. cyclates terials (PET, p ner materials rom polymer sing emulsion plant raw ma science: nom olymerization vity ratios, the onic, cationic, atta catalysts d polymers): ecycling; met	<i>instruction</i> uspension le resources ers ling. Separation of polyurethane etc.) ic food packaging n technque aterial henclature, types co i: monomers, meth eir effect on copoly , catalyst, living po s, catalysts genera bio-polyolefins, bio	f polym materia of polym nods, ini ymer cc olymers tions, n p-PET, r	er mater Is roductio mpositic), coordin nechanis ec-PET, F	ials based on the n and depolymer n to kinetic aspe on, Q-e scheme) nation polymeriz m) PEF etc.).	eir eir ization ects. ation ecycling	Number of hours 5 5 5 4 4 4 3 5 5 5 1 4 2 3 2 3 2 3 2 3 2 3 2 3 2
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Course T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-7 T-L-7 T-L-7 T-L-7 T-L-9 T-L-10 T-W-1 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-5 T-W-6 Student	human aspects content divided into Radical polymeriza Condensation polymeriza Hydrogels from phy Preparation of was physicochemical phy Modification of plass Glycolysis of polymerization of substate Polymerization of F Obtaining limoneme Introduction to polymerization (Copolymerization (Ionic polymerization (Bio-alternatives (bi) Introduction to polymerization Kworkload - forms of	variou tion of mers fi otocura te plas roperti stic rec ner ma f polyn mces f PVAC u e from ymers wth po reactiv n (anic gler-Na obased ymer re <i>activ</i> , oratory	us forms of styrene in su rom renewab able monome tics for recyc es. cyclates terials (PET, p ner materials rom polymer sing emulsion plant raw ma science: nom olymerization vity ratios, the onic, cationic, atta catalysts d polymers): ecycling; met	<i>instruction</i> uspension le resources ers ling. Separation of polyurethane etc.) ic food packaging n technque aterial henclature, types co i: monomers, meth eir effect on copoly , catalyst, living po s, catalysts genera bio-polyolefins, bio	f polym materia of polym nods, ini ymer cc olymers tions, n p-PET, r	er mater Is roductio mpositic), coordin nechanis ec-PET, F	ials based on the n and depolymer n to kinetic aspe on, Q-e scheme) nation polymeriz m) PEF etc.).	eir eir ization ects. ation ecycling	Number of hours 5 5 4 4 4 4 4 4 3 5 5 5 5 5 1 1 4 2 3 3 2 3 3 Number of hours

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			racary or chemi		ology all			9			
Student w	orkloa	d - form	s of activity						Nur	nber o	f hours
A-L-4	prepa	ration of	written reports								30
A-W-1	partic	ipation in	lectures								15
A-W-2	indivio	dual stud	y of a literature								10
A-W-3	consu	Itations									2
A-W-4	prepa	ration for	r exam								3
Teaching r											
M-1		-	resentation								
M-2	Labor	atory exe	ercises								
Evaluation	n meth	ods (F -	progressive, P - final)								
S-1	F	Continu	ious assessment: laboratory r	reports and activ	ity						
5-2	F	Exam									
S-3	F	Final te	st								
	Desig	ned leai	rning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course	e content	Teaching methods	Evaluatior methods
Knowledge											
MSE_1A_C15_ The student h recycling and	has the k	nowledge of polymer	of common aspect of synthesis, ric materials	MSE_1A_W02 MSE_1A_W07	P6S_WG	P6S_WG	C-1	T-W-1 T-W-2 T-W-3	T-W-4 T-W-5 T-W-6	M-1 M-2	S-1 S-2 S-3
Skills											
polymeric ma	as skills iterials		sis, recycling and safety of	MSE_1A_U03 MSE_1A_U08	P6S_UK P6S_UW	P6S_UW	C-1	T-L-1 T-L-2 T-L-3 T-L-4 T-L-5	T-L-6 T-L-7 T-L-8 T-L-9 T-L-10	M-1 M-2	S-1 S-2 S-3
Social com	npeten	ces		1		1	1	T 1 1	T 1 0	1	
MSE_1A_C15_ The student h polymeric ma	nas skills	in synthe	sis, recycling and safety of	MSE_1A_K02	P6S_KK	P6S_WK	C-1	T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-8	T-L-9 T-L-10 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6	M-1 M-2	S-1 S-2 S-3
Outcon	nes	Grade		E	valuation cri	iterion					
Knowledge	9										
MSE_1A_C15_	_W01	2,0 3,0 3,5 4,0 4,5 5,0	Positive grade of the final test (m	nore than 55% corr	ect answers)						
Skills											
MSE_1A_C15_	_U01	2,0 3,0 3,5 4,0 4,5 5,0	Positive grade of the final test (m	nore than 55% corr	ect answers)						
Other soci	al com		es								
MSE_1A_C15_		2,0	Positive grade of the final test (m	nore than 55% corr	ect answers)						
Required r	readin	g									
		-	lichael Maskos, Oskar Nuyker	n, Berlin, Polyme	r chemistry, S	pringer-Verla	g, Heide	elberg,	2017		

1. Sebastian Koltzenburg, Michael Maskos, Oskar Nuyken, Berlin, Polymer chemistry, Springer-Verlag, Heidelberg, 2017



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Required reading

2. A. Dieter Schlüter, Craig J. Hawker, and Junji Sakamoto, Synthesis of polymers : new structures and methods, Wiley-VCH Verlag, Weinheim, 2012

3. A. Ravve, Principles of polymer chemistry, Plenum Press, New York, 1995

4. La Mantia F., Handbook of Plastic Recycling: Sience, Technology and Applications, John Wiley and Sons, Chichester, 1998

5. Charles A. Harper, Modern Plastics Handbook, McGraw-Hill Companies, Inc., Lutherville, Maryland, 2000, doi:10.1036/0070267146

Field of st									
	tudy	Mate	erials Scienc	e and Engineeri	ng				
Mode of s	study	stati	onary	Level		first o	cycle	14/7014	~1
Graduate	's qualification	inżyı	nier	1		1		WTil(Lh
Fields of s	•			technology					
Discipline	es of science			eering (100%)					
Educatior		-	eral academ	-					
Module	1								
Course ur	nit	Intre	o to Bioma	terials: Implan	ts and	d Devic	es		
Code		-	1A_S_C16a	-					C
	pecialisation								
•	ering faculty	Den	artment of N	lanomaterials Pl	nysicor	chemict	rv.		
ECTS		6,0		ECTS (forms)	rysicol	6,0	y		
	ourse credit	cred	ite					-	
			11.5	Language		english		-	
Electives		5		Elective group		<u> </u>			
	nstruction	Cod		Hours		CTS	Weight	Realization	Credit
laborator	y course	L	5	45		,0	0,50	К	credits
lecture		W	5	30	2	2,0	0,50	К	credits
Leading t	eacher	Cher	n Xuecheng	(Xuecheng.Cher	n@zut.	.edu.pl)			
<i>Other tea</i>	ochers	(Xue	cheng.Chen	nna (Anna.Biedu @zut.edu.pl), O (psobolewski@:	ssowic	z-Rupni	ewska Paula (I	Paula.Ossowicz(@zut.edu.pl),
Prerequis	ites	1		<u> </u>		<u> </u>			
W-1	Knowledge of the b	basic c	ourse in phys	ics and chemistry	at the	elementa	ary level		
			ourse in phys	ics and chemistry	at the	elementa	ary level		
Module/co	ourse unit objective	es					-	rization for impla	nts and medical
Module/co C-1	ourse unit objective To make student to devices	es o unde	erstand the ba	asic principles in b			-	rization for impla	1
Module/co C-1 Course co	ourse unit objective To make student to devices ontent divided into	es o unde vario	erstand the ba	asic principles in bi			-	rization for impla	Number of hours
Module/co C-1 Course co T-L-1	ourse unit objective To make student to devices ontent divided into Preparation patche	es o unde <i>vario</i> es cont	erstand the ba us forms of caining terpen	asic principles in bi instruction ne compounds	iomater	rials desi	gn and characte		Number of hours 5
Module/co C-1 Course co T-L-1 T-L-2	ourse unit objective To make student to devices ontent divided into Preparation patche Determination of fa	es o unde <i>vario</i> es cont actors	erstand the ba us forms of caining terpen influencing th	asic principles in bi <i>instruction</i> ne compounds ne permeability of	iomater	rials desi	gn and characte		Number of hours 5 5
Module/co C-1 Course co T-L-1 T-L-2 T-L-3	ourse unit objective To make student to devices ontent divided into Preparation patche Determination of fa Controlled release	es o unde <i>vario</i> es cont actors of prot	erstand the ba us forms of aining terpen influencing th teins: Materia	asic principles in bi <i>instruction</i> ne compounds ne permeability of al preparation	iomater	rials desi	gn and characte		Number of hours 5 5 4
Module/co C-1 Course co T-L-1 T-L-2 T-L-3 T-L-4	ourse unit objective To make student to devices ontent divided into Preparation patche Determination of fa Controlled release Controlled release	es o unde vario es cont actors of prot	erstand the ba us forms of aining terpen influencing th teins: Materia teins: Materia	asic principles in bi instruction le compounds ne permeability of Il preparation Il characterization	iomater	rials desi	gn and characte		Number of hours 5 5 4 4
Module/co C-1 Course co T-L-1 T-L-2 T-L-3 T-L-4 T-L-5	ourse unit objective To make student to devices ontent divided into Preparation patche Determination of fa Controlled release Controlled release	es o unde vario es cont actors of proi of proi	erstand the ba us forms of aining terpen influencing th teins: Materia teins: Materia teins: Assessr	asic principles in bi instruction the compounds the permeability of al preparation al characterization ment of release	omater drugs t	rials desi	gn and characte		Number of hours 5 5 4
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Module/co C-1 Course co T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6	ourse unit objective To make student to devices ontent divided into Preparation patche Determination of fa Controlled release Controlled release Metal-organic fram	es vario es cont actors of prot of prot of prot ework f the p	erstand the ba us forms of aining terpen influencing th teins: Materia teins: Materia teins: Assessr s derived fror roduced meta	asic principles in bi instruction the compounds the permeability of al preparation al characterization thent of release the biomass and wa al-organic framewo	drugs t ste poly	rials desid through t ymers XRD	gn and characte	ranes	Number of hours 5 5 4 4 2 7
Module/cd C-1 Course cd T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-5 T-L-6 T-L-7	ourse unit objective To make student to devices ontent divided into Preparation patche Determination of fa Controlled release Controlled release Controlled release Metal-organic fram Characterization of	es vario es cont actors of prof of prof ework f the p f the p	erstand the ba us forms of caining terpen influencing th teins: Materia teins: Materia teins: Assess teins: Assess s derived fror roduced meta roduced meta	asic principles in bi instruction the compounds the permeability of al preparation al characterization ment of release m biomass and wa al-organic framewo	drugs t ste poly prks by prks by	rials desid through t ymers XRD nitrogen	gn and characte	ranes	Number of hours 5 4 4 2 7 4
Module/co C-1 Course co T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6 T-L-6 T-L-7 T-L-8	ourse unit objective To make student to devices ontent divided into Preparation patche Determination of fa Controlled release Controlled release Metal-organic fram Characterization of Characterization of	es vario es cont actors of prot of prot ework f the p f the p nce of	erstand the ba us forms of aining terpen influencing th teins: Materia teins: Materia teins: Assess teins: assess	asic principles in bi instruction le compounds le permeability of al preparation al characterization ment of release m biomass and wa al-organic framewo al-organic framewo erials in the enviro	drugs t ste poly orks by orks by	rials desi through k ymers XRD nitrogen of Ringe	gn and characte piological membro sorption/desorp r's solution.	ranes	Number of hours 5 5 4 4 2 7 7 4 4 4
Module/cd C-1 Course cd T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-5 T-L-6 T-L-7 T-L-8 T-L-9	ourse unit objective To make student to devices ontent divided into Preparation patche Determination of fa Controlled release Controlled release Controlled release Metal-organic fram Characterization of Characterization of Testing the resistant	es o unde vario es cont actors of prof of prof of prof ework f the p f the p nce of forma	erstand the ba us forms of aining terpen influencing th teins: Materia teins: Materia teins: Assessr s derived fror roduced meta roduced meta metallic mate tion of apatite	asic principles in bi instruction the compounds the permeability of al preparation al characterization ment of release m biomass and wa al-organic framewo al-organic framewo erials in the enviro e-like structures o	drugs t ste poly prks by prks by nment n the su	rials desid through t ymers XRD nitrogen of Ringe urface of	gn and characte piological membro sorption/desorp r's solution.	ranes	Number of hours 5 4 4 2 7 7 4 4 4 3
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			l'acury of chemi		ologyall		cern	ig			
Course co	ontent a	livided ir	nto various forms of instru	uction					Nur	nber o	f hours
T-W-12		tages, di dical mat	sadvantages and examples o erials.	ceramics, metals	, composites	used for the f	abricat	ion of			1
Student v	vorkload	d - forms	of activity						Nur	nber o	f hours
A-L-1	partici	pation in	laboratory exercises								45
A-L-2	prepar	ing for la	boratory exercises								30
A-L-3	prepar	ation of r	eports								20
A-L-4	Prepar	ing for te	sts								20
A-L-5	Consu	tations									5
A-W-1	partici	pation in	lectures								30
A-W-2	Individ	ual litera	ture studies								13
A-W-3	Prepar	ing for te	sts								15
A-W-4	Cosult	ations									2
Teaching	method	ls / tools	;								
M-1	lecture	es with pr	esentation								
M-2	labora										
M-3	subjec	t discussi	on during laboratories								
M-4	self stu										
Evaluatio	n metho	ods (F - 1	progressive, P - final)								
S-1	Р		bassing test								
5-2	F	-	ry reports								
5-3	F	student									
		ned leari	ning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Cours	e content	Teaching methods	Evaluation methods
Knowledg	le					1	1			1	
MSE_1A_C16 basic knowle application c	edge in th	e area of s erials	ynthesis, characterization and	MSE_1A_W02 MSE_1A_W03 MSE_1A_W04	P6S_WG P6S_WK	P6S_WG	C-1	T-W-1 T-W-2 T-W-3 T-W-4	T-W-5 T-W-6 T-W-7 T-W-8	M-1	S-1
Skills											
application of other device	basic sco of selecteo s	biomater	hesize, characterization and ials in the area of implants and	MSE_1A_U03 MSE_1A_U07 MSE_1A_U08	P6S_UK P6S_UW	P6S_UW	C-1	T-L-1 T-L-2 T-L-3 T-L-4	T-L-5 T-L-6 T-L-7 T-L-8	M-2 M-3 M-4	S-1 S-2 S-3
Social cor	mpeten	ces		1							
MSE_1A_C16 competence selected bior devices	s in synth	esis, chara in the area	cterization and application of of implants and medical	MSE_1A_K02	P65_KK	P6S_WK	C-1	T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-8 T-L-9 T-L-10 T-L-10 T-L-11 T-W-1	T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 T-W-8 T-W-9 T-W-10 T-W-11 T-W-12	M-1 M-2 M-3	S-1 S-2
Outco	mes	Grade		E	valuation cr	iterion					
Knowledg	je										
MSE_1A_C16		3,5 4,0 4,5	rom 50 to 55% of percentage po	pints							

Faculty of Chemical Technology and Engineering

Skills		
MSE_1A_C16a_U01	2,0	
	3,0	from 50 to 55% of percentage points
	3,5	
	4,0	
	4,5	
	5,0	

Other social competences

2,0	
3,0	from 50 to 55% of percentage points
3,5	
4,0	
4,5	
5,0	
	3,0 3,5 4,0 4,5

Required reading

1. C. Mauli Agrawal, Joo L. Ong, Mark R. Appleford, Gopinath Mani , Introduction to Biomaterials: Basic Theory with Engineering Applications, Cambridge University, 2013, ISBN-13: 978-0521116909

2. Joon Park, R. S. Lakes , Biomaterials: An Introduction, Springer, 2007, ISBN-13: 978-0387378794

3. William R Wagner, Shelly E. Sakiyama-Elbert, Guigen Zhang , Michael J. Yaszemski , Biomaterials Science: An Introduction to Materials in Medicine, Academic Press, 2020, ISBN-13: 978-0128161371

4. James Sangster, Octanol-Water Partition Coefficients: Fundamentals and Physical Chemistry, WILEY, 1997, 1

5. Yihong Qiu, Yisheng Chen, Geoff G.Z. Zhang, Lirong Liu, William Porter, Developing Solid Oral Dosage Forms: Pharmaceutical Theory and Practice, Academic Press, 2016, 1

6. Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons, An Introduction to Materials in Medicine, Academic Press (Elsevier), USA, 2013, 3, ISBN: 978-0-12-374626-9

7. J. Y. Wong, J. D. Bronzino, D.R. Peterson, Biomaterials Principles and Practices, CRC Press, 2013, ISBN 9781439872512

8. R. Hudak, M. Penhaker, J. Majernik, Biomedical engineering-technical applications in medicine, InTech, 2012

9. A. Serra, Advances in Bioengineering, InTechOpen, 2015, ISBN: 978-953-51-2141-1

Field of si Mode of s		-							
Mode of	tudy	Mate	erials Scienc	e and Engineeri	ng				
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laborator	ry course	L	5	45	4,	0	0,50	К	credits
lecture		W	5	30	2,	0	0,50	К	credits
Leading t	teacher	Cher	n Xuecheng	(Xuecheng.Cher	n@zut.e	edu.pl)			
				nna (Anna.Biedu			.edu.pl), Chen	Xuecheng	
Other tea	achers							Paula.Ossowicz@	zut.edu.pl),
	-:+	13000		(psobolewski@:	zut.euu	.pi), wi	ODIEWSKA AGI	lleszka	
Prerequis W-1	Knowledge of the k		ourco in nhươ	ice and chamistry	at the e	lomonto			
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Module/c	ourse unit objectiv				£	- 12			
C-1	To make student to biomaterials	5 unde	rstand the ba	isic mechanisms o	n arug a	envery a	and biosensing	with the use of var	lous classes of
Course co	ontent divided into	vario	us forms of	instruction					Number of hours
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T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-5 T-L-6 T-L-7 T-L-7 T-L-8 T-L-9 T-L-9 T-L-10 T-L-11	Preparation patched Isolation of raw mail Microparticles for p Microparticles for p Microparticles for p Preparation of port Characterization of Characterization of sur Investigation of sur Investigation of the Assessment of bioad	es cont aterials protein protein pous ma f the pr f the pr f the pr f active materi	aining terper for use in m delivery: Ma delivery: Ma delivery: Ass delivery: Ass terials from t roduced poro roduced poro vettability and omenon of in properties by als & biocom	e compounds edical polymers terial preparation terial characteriza sessment of releas piomass and waste us materials by XF us materials by ni d evaluation of the plant degradation the surfaces after patibility	e derived RD trogen s e influen n in aque	orption/ ce on th eous env	desorption tech e functional prc	nique.	5 5 4 4 2 7 7 4 4 3 3 3 4
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T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-7 T-L-8 T-L-9 T-L-10 T-L-10 T-L-11 T-W-1 T-W-1 T-W-2 T-W-3 T-W-4	Preparation patched Isolation of raw mail Microparticles for p Microparticles for p Microparticles for p Preparation of porce Characterization of Investigation of sum Investigation of the Assessment of biological Introduction to biol Biocompatibility ar Introduction to com Targeted drug delity	es cont aterials protein protein pous ma f the pr f the pr f the pr f the pr f the pr f active materi active materi ad the trolled very	aining terper for use in m delivery: Ma delivery: Ma delivery: Ass iterials from t roduced poro roduced poro roduced poro roduced poro vettability and omenon of in properties by als & biocom host response drug deliver	e compounds edical polymers terial preparation terial characteriza sessment of releas biomass and waste us materials by XF us materials by ni d evaluation of the plant degradation the surfaces after patibility e to materials	e derived RD trogen s e influen n in aque	orption/ ce on th eous env	desorption tech e functional prc	nique.	5 5 4 4 2 7 7 4 4 3 3 3 3 4 1 1 4 1 2
T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-7 T-L-8 T-L-9 T-L-10 T-L-10 T-L-11 T-W-1 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5	Preparation patchedIsolation of raw mathMicroparticles for pMicroparticles for pMicroparticles for pPreparation of porceCharacterization ofCharacterization of sumInvestigation of sumInvestigation of theAssessment of bioadIntroduction to bioadBiocompatibility arIntroduction to comTargeted drug delimNanoparticles for d	es cont aterials protein protein protein pous ma f the pr f the pr f the pr f the pr f ace w e phen active materi nd the atrolled very lrug de	aining terper for use in me delivery: Ma delivery: Ma delivery: Ass terials from b roduced poro roduced poro vettability and omenon of in properties by als & biocom host response l drug deliver	e compounds edical polymers terial preparation terial characteriza sessment of releas biomass and waste us materials by XF us materials by Ni d evaluation of the plant degradation the surfaces after patibility e to materials y	e derived RD trogen s e influen n in aque r modific	orption/ ce on th eous env	desorption tech e functional prc	nique.	5 5 4 4 2 7 4 4 4 3 3 3 4 1 1 4 1 2 2 2
T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-8 T-L-9 T-L-10 T-L-10 T-L-11 T-W-1 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-6	Preparation patched Isolation of raw mail Microparticles for p Microparticles for p Microparticles for p Preparation of port Characterization of Characterization of surimplants. Investigation of the Assessment of biod Introduction to biod Targeted drug delin Nanoparticles for d	es cont aterials protein protein porotein pous ma f the p f f f the p f f f the p f f f f f f f f f f f f f f f f f f f	aining terper for use in me delivery: Ma delivery: Ma delivery: Ass iterials from b roduced poro roduced poro vettability and omenon of in properties by als & biocom host response l drug deliver	e compounds edical polymers terial preparation terial characteriza sessment of releas biomass and waste us materials by XF us materials by ni d evaluation of the nplant degradation the surfaces after patibility e to materials y lled delivery of dru	e derived RD trogen s e influen n in aque r modific	orption/ ce on th cous env ation	desorption tech e functional pro vironments.	nique.	5 5 4 4 2 7 7 4 4 3 3 3 4 1 1 4 1 1 2 2 2 3
T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-7 T-L-8 T-L-9 T-L-10 T-L-10 T-L-11 T-W-1 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7	Preparation patched Isolation of raw mail Microparticles for p Microparticles for p Microparticles for p Preparation of porce Characterization of Investigation of sum implants. Introduction to biom Biocompatibility ar Introduction to com Targeted drug delim Nanoparticles for d Mesoporous silica mail	es cont aterials protein protein pous ma f the pr f the pr f the pr f the pr f active materi ad the atrolled very Irug de materi ipy Sys	aining terper for use in me delivery: Ma delivery: Ma delivery: Ass iterials from b roduced poro roduced poro	e compounds edical polymers terial preparation terial characteriza sessment of releas biomass and waste us materials by XF us materials by ni d evaluation of the palant degradation the surfaces after patibility e to materials y lled delivery of dru nd therapeutic na	e derived RD trogen s e influen n in aque r modifie ugs il polishe	orption/ ce on th eous env ation	desorption tech e functional pro rironments.	nique.	5 5 4 4 2 7 4 4 3 3 3 4 1 1 4 1 1 2 2 2 3 3 2
T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-7 T-L-8 T-L-9 T-L-10 T-L-10 T-L-11 T-W-1 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 T-W-8	Preparation patched Isolation of raw mail Microparticles for p Microparticles for p Microparticles for p Preparation of porce Characterization of Characterization of sur- Investigation of sur- Investigation of the Assessment of bioad Introduction to bioad Targeted drug delime Nanoparticles for d Mesoporous silicand Transdermal Therad Biomass derived p	es cont aterials protein protein portein pous ma f the pi f the pi	aining terper for use in me delivery: Ma delivery: Ma delivery: Ass iterials from b roduced poro roduced poro vettability and omenon of in properties by als & biocom host response drug deliver elivery als for contro stems (TTS) a rs as high val	e compounds edical polymers terial preparation terial characteriza sessment of releas biomass and waste us materials by XF us materials by ni d evaluation of the palant degradation the surfaces after patibility e to materials y lled delivery of dru nd therapeutic na ue added products	e derived RD trogen s e influen n in aque r modific ugs il polishe s for hea	orption/ ce on th eous env ation es and p lthcare	desorption tech e functional pro rironments.	nique.	5 5 4 4 2 7 4 4 4 3 3 3 4 4 1 1 4 1 1 2 2 2 2 3 3 2 5
T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-7 T-L-8 T-L-9 T-L-10 T-L-10 T-L-11 T-W-1 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7	Preparation patched Isolation of raw mail Microparticles for p Microparticles for p Microparticles for p Preparation of porce Characterization of Investigation of sum implants. Introduction to biom Biocompatibility ar Introduction to com Targeted drug delim Nanoparticles for d Mesoporous silica mail	es cont aterials protein protein porotein pus ma f the pi f the pi	aining terper for use in me delivery: Ma delivery: Ma delivery: Ass iterials from h roduced poro roduced poro vettability and omenon of in properties by als & biocom host response l drug deliver elivery als for contro stems (TTS) a rs as high val ano)composi	e compounds edical polymers terial preparation terial characteriza sessment of releas biomass and waste us materials by XF us materials by ni d evaluation of the nplant degradation the surfaces after patibility e to materials y lled delivery of dru nd therapeutic na ue added products tes for biosensing	e derived RD trogen s e influen n in aque r modifie r modifie il polishe s for hea applica	orption/ ce on th eous env ation ation es and p lthcare : cions	desorption tech e functional pro vironments. atches sector	nique.	5 5 4 4 2 7 4 4 4 3 3 3 4 1 1 4 1 1 2 2 2 3 3 2

			Faculty of chemi		ology all		cern	ig				
Course co	ontent d	divided i	nto various forms of instr	uction					Nur	nber o	f hours	
T-W-12			n on the surface of implants d topography on the induced				f surfac	e			1	
T-W-13	Functi	onalizatio	on of the surface of biomedic l properties dental ceramics	al materials. Infl			n the st	ructural			1	
T-W-14	The ef Acinet	fect of Er obacter B	,Cr:YSGG and Diode Laser A Baumannii and Pseudomona	pplications on de s Aeruginosa.	ntal implant s	urfaces conta	minateo	d with			1	
Student v	vorkloa	d - form	s of activity						Nur	nber o	f hours	
A-L-1			laboratory exercises								45	
A-L-2	prepa	ration for	laboratory exercises							20		
A-L-3	preparation of reports										30	
A-L-4	Prepa	ring for te	ests								20	
A-L-5	Consu	ltations									5	
A-W-1	partici	pation in	lectures								30	
A-W-2	Individ	lual litera	ture studies								13	
A-W-3	Preparing for tests										15	
A-W-4	Consultations										2	
Teaching	metho	ds / tools	5									
M-1	lecture	es with p	esentation									
M-2	labola	roty										
M-3	subject discussion during laboratories											
M-4	self studies											
Evaluatio	n meth	ods (F -	progressive, P - final)									
S-1	Р		passing test									
5-2	F		bry reports									
5-3	F	student										
	Desig	ned lear	ning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course co	ntent	Teaching methods	Evaluatio methods	
Knowledg	<i>je</i>			·								
MSE_1A_C16 basic knowle application o	edge in th	e area of s erials	synthesis, characterization and	MSE_1A_W02 MSE_1A_W03 MSE_1A_W04	P6S_WG P6S_WK	P6S_WG	C-1	T-W-2 T T-W-3 T	-W-6 -W-7 -W-8 -W-9	M-1	S-1	
Skills												
	e basic sco of selecte		hesize, characterization and ials in the area of drug delivery	MSE_1A_U03 MSE_1A_U07 MSE_1A_U08	P6S_UK P6S_UW	P6S_UW	C-1	T-L-2 T T-L-3 T	-L-5 -L-6 -L-7 -L-8	M-2 M-3 M-4	S-1 S-2 S-3	
Social col	mpeten	ces										
MSE_1A_C16 competence selected bio biosensing	es in synth	nesis, chara in the are	acterization and application of a of drug delivery and	MSE_1A_K02	P6S_KK	P6S_WK	C-1			M-1 M-2 M-3	S-1 S-2	
Outco	mes	Grade		E	valuation cri	iterion		J			1	
Knowledg	<i>je</i>	1]										
MSE_1A_C16	ōb_W01	2,0 3,0 3,5 4,0 4,5 5,0	from 50 to 55% of percentage p	oints								

Faculty of Chemical Technology and Engineering

Skills		
MSE_1A_C16b_U01	2,0	
	3,0	from 50 to 55% of percentage points
	3,5	
	4,0	
	4,5	
	5,0	
Other cocial com	notonc	

Other social competences

1A_C16b_K01	2,0	
	3,0	from 50 to 55% of percentage points
	3,5	
	4,0	
	4,5	
	5,0	

Required reading

1. William R Wagner, Shelly E. Sakiyama-Elbert, Guigen Zhang, Michael J. Yaszemski, Biomaterials Science: An Introduction to Materials in Medicine, Academic Press, 2020, ISBN-13: 978-0128161371

2. Joon Park, R. S. Lakes , Biomaterials: An Introduction, Springer, 2007, ISBN-13: 978-0387378794

3. C. Mauli Agrawal, Joo L. Ong, Mark R. Appleford, Gopinath Mani, Introduction to Biomaterials: Basic Theory with Engineering Applications, Cambridge University, 2017, ISBN-13: 978-0521116909

4. Thomas Nogrady, Donald F., Weaver Medicinal Chemistry: A Molecular and Biochemical Approach, Oxford University Press, 2005, 3 5. Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons, An Introduction to Materials in Medicine, Academic Press (Elsevier), USA, 2013, 3, ISBN: 978-0-12-374626-9

6. 3. A. Serra, Advances in Bioengineering, InTechOpen, 2015, ISBN: 978-953-51-2141-1

7. R. Hudak, M. Penhaker, J. Majernik, Biomedical engineering-technical applications in medicine, InTech, 2012

8. J. Y. Wong, J. D. Bronzino, D.R. Peterson,, Biomaterials Principles and Practices, CRC Press ISBN 9781439872512, 2013, ISBN 9781439872512

Field of Mode of	atudu							1	
Mode of	study	Mate	erials Scienc	e and Engineerii	ng				
	f study	stati	onary	Level		first o	cycle		
Graduat	te's qualification	inży	nier	I			-	WTil	Ch
	f science	-	neering and	technology					
	nes of science	-		eering (100%)					
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Module		<u> </u>				_			
Course (unit			ormation in Ma	ateria	S			
Code		MSE	_1A_S_C17a						\mathbf{O}
	specialisation								
	stering faculty	-	artment of P	olymer and Bior	nateria	ls Scier	nce		
ECTS		5,0		ECTS (forms)		5,0			
Form of course credit		cred	lits	Language		english	l		
Elective.	S	6		Elective group					
Form of	instruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
laborato	ory course	L	5	45	3	,0	0,50	к	credits
lecture		w	5	30		,0	0,50	K	credits
	teacher			a (Miroslawa.ElF				K	creates
Other te	eachers	Wojo (Agr	ciech (Wojcie nieszka.Koch	y@zut.edu.pl), F ech.lgnaczak@zu manska@zut.ed ztof (Krzysztof.k	ut.edu. lu.pl), I	pl), Koc Kochma	hmańska Agni ński Paweł (Pa	eszka wel.Kochmansl	
Prerequ	isites								
W-1	Fundamentals of n	nathen	natics and phy	ysics. Fundamenta	als of m	echanics	5.		
Module/	course unit objectiv	es							
C-1	To gain the knowle	edge, s	kills and com	petences in the fie	Id of st	ructural			
Course				•			deformations of	engineering mat	erials
COUISE	content divided into	vario	ous forms of				deformations of	engineering mat	1
T-L-1				instruction				engineering mat	1
	content divided into Influence of the stu Evaluation of teme	ructura	al defects on r	<i>instruction</i> mechanical profile	of poly			engineering mat	Number of hours
T-L-1	Influence of the str	ructura	al defects on r e effect on cre	<i>instruction</i> mechanical profile ep and stress rela	of poly			engineering mat	Number of hours 5
T-L-1 T-L-2	Influence of the str Evaluation of teme	ructura erature stome	al defects on r e effect on cre r fatique testi	<i>instruction</i> nechanical profile ep and stress rela ng	of poly xation	mers		engineering mat	Number of hours 5 5
T-L-1 T-L-2 T-L-3	Influence of the str Evaluation of teme Introduction to ela Determination of d Preparation and m	ructura erature stome leform echan	al defects on r e effect on cre r fatique testi ation parame ical character	<i>instruction</i> mechanical profile ep and stress rela ng ters of organic bin ization of steel rei	of poly xation der-bas	mers ed layer concret	's e elements		Number of hours 5 5 5
T-L-1 T-L-2 T-L-3 T-L-4	Influence of the str Evaluation of teme Introduction to ela Determination of d Preparation and m Studies on stress l	ructura erature stome leform echan	al defects on r e effect on cre r fatique testi ation parame ical character	<i>instruction</i> mechanical profile ep and stress rela ng ters of organic bin ization of steel rei	of poly xation der-bas	mers ed layer concret	's e elements		Number of hours 5 5 5 5 5
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T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6	Influence of the str Evaluation of teme Introduction to ela Determination of d Preparation and m Studies on stress l	ructura erature stome leform echan evel in I recov	al defects on r e effect on cre r fatique testi ation parame ical character fluence on mo very of metals	<i>instruction</i> mechanical profile ep and stress rela ng ters of organic bin ization of steel rei etals microstructure microstructure a	of poly xation der-bas nforced re and prop	mers ed layer concret propertie	's e elements		Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 5
T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7	Influence of the str Evaluation of teme Introduction to ela Determination of d Preparation and m Studies on stress l deformability Studies on therma	ructura erature stome leform echan evel in I recov icture	al defects on r e effect on cre r fatique testi ation parame ical character fluence on m very of metals and the prope	instruction mechanical profile ep and stress rela ng ters of organic bin ization of steel rei etals microstructur microstructure a erties of silica mat	of poly xation der-bas nforced re and p nd prop erials	mers ed layer concret propertie	's e elements		Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5
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T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-8 T-L-9 T-W-1 T-W-1 T-W-2	Influence of the str Evaluation of teme Introduction to ela Determination of d Preparation and m Studies on stress la deformability Studies on therma Study on microstru Study on microstru Stress corrosion ar Reinforcing metho reinforcement corr	ructura erature stome leform echan evel in l recov icture icture nd othe ds of b osion	al defects on r e effect on cre r fatique testi ation parame ical character fluence on m very of metals and the prope and the prope er corrosion ty puilding mater phenomenon	instruction mechanical profile ep and stress rela ng ters of organic bin ization of steel rei etals microstructure microstructure a erties of silica mat erties of silica mat ypes of metallic mat ials. Steel reinforc	of poly xation der-bas nforced re and re and nd prop erials erials aterials aterials	mers ed layer concret oropertie erties . Corrosi prestres	e elements es; Evaluation of on protection me sed concrete ma	metals	Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 5 6 2
T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-8 T-L-9 T-W-1 T-W-1 T-W-2 T-W-3	Influence of the str Evaluation of teme Introduction to ela Determination of d Preparation and m Studies on stress la deformability Studies on therma Study on microstru Study on microstru Stress corrosion ar Reinforcing metho reinforcement corr Deformation abiliti	erature stome leform echan evel in l recov icture icture ds of b osion es, me	al defects on r e effect on cre r fatique testi ation parame ical character fluence on me very of metals and the prope and the prope er corrosion ty puilding mater phenomenon echanical and	instruction mechanical profile ep and stress rela ng ters of organic bin ization of steel rei etals microstructure microstructure a erties of silica mat erties of silica mat ypes of metallic mat ials. Steel reinforc	of poly xation der-bas nforced re and re and nd prop erials erials aterials aterials	mers ed layer concret oropertie erties . Corrosi prestres	e elements es; Evaluation of on protection me sed concrete ma	metals	Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 5 6 2 2
T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-8 T-L-9 T-W-1 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4	Influence of the str Evaluation of teme Introduction to ela Determination of d Preparation and m Studies on stress l deformability Studies on therma Study on microstru Study on microstru Stress corrosion ar Reinforcing metho reinforcement corr Deformation abiliti Basics of fracture r	ructura erature stome leform echan evel in l recov icture icture ds of b osion es, me mecha	al defects on r e effect on cre r fatique testi ation parame ical character fluence on me very of metals and the prope and the prope er corrosion ty puilding mater phenomenon echanical and nics	instruction mechanical profile ep and stress rela ng ters of organic bin ization of steel rei etals microstructure microstructure a erties of silica mat erties of silica mat ypes of metallic mat rials. Steel reinforce barrier features of	of poly xation der-bas nforced re and p erials erials aterials ied and f filled p	ed layer concret propertie erties . Corrosi prestres	s e elements es; Evaluation of on protection mo ssed concrete ma layers	metals	Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 5 6 2 2 2 2 2 2 2 2
T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-7 T-L-8 T-L-9 T-W-1 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5	Influence of the str Evaluation of teme Introduction to ela Determination of d Preparation and m Studies on stress la deformability Studies on therma Study on microstru Study on microstru Stress corrosion ar Reinforcing metho reinforcement corr Deformation abiliti Basics of fracture r Creep and relaxati	ructura stome leform echan evel in l recov ucture ds of k osion es, me mecha on in s	al defects on r e effect on cre r fatique testi ation parame ical character fluence on m very of metals and the prope and the prope er corrosion ty puilding mater phenomenon echanical and nics soft polymers,	instruction mechanical profile ep and stress rela ng ters of organic bin ization of steel rei etals microstructure microstructure a erties of silica mat erties of silica mat ypes of metallic mat rials. Steel reinforce barrier features of	of poly xation der-bas nforced re and p erials erials aterials ied and f filled p	ed layer concret propertie erties . Corrosi prestres	s e elements es; Evaluation of on protection mo ssed concrete ma layers	metals	Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 5 6 2 2 2 2 2 2 2 2 2 2 2 2 2
T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-8 T-L-7 T-L-8 T-L-9 T-W-1 T-W-2 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-5	Influence of the str Evaluation of teme Introduction to ela Determination of d Preparation and m Studies on stress la deformability Studies on therma Study on microstru Study on microstru Stress corrosion ar Reinforcing metho reinforcement corr Deformation abiliti Basics of fracture r Creep and relaxati	ructura stome leform echan evel in l recov icture icture ds of b osion es, me mecha on in s mecha	al defects on re e effect on cre r fatique testi ation parame ical character fluence on me very of metals and the prope and the prope er corrosion ty phenomenon echanical and nics soft polymers, nics	instruction mechanical profile ep and stress rela ng ters of organic bin ization of steel rei etals microstructure microstructure a erties of silica mat rites of silica mat ypes of metallic mat ials. Steel reinforce barrier features of elastic recovery a	of poly xation der-bas nforced re and p erials erials aterials ied and f filled p	ed layer concret propertie erties . Corrosi prestres	s e elements es; Evaluation of on protection mo ssed concrete ma layers	metals	Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 6 2
T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-8 T-L-9 T-W-1 T-W-2 T-W-2 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7	Influence of the str Evaluation of teme Introduction to ela Determination of of Preparation and m Studies on stress la deformability Studies on therma Study on microstru Study on microstru Stress corrosion ar Reinforcing metho reinforcement corr Deformation abiliti Basics of fracture of Creep and relaxati Interface fracture of Fatigue crack grow	ructura stome leform echan evel in l recov icture icture ds of b osion es, me mecha on in s mecha or in s	al defects on re e effect on cre r fatique testi ation parame ical character ifluence on me very of metals and the prope and the prope and the prope er corrosion ty puilding mater phenomenon echanical and nics soft polymers, nics idels and mec	instruction mechanical profile ep and stress rela ng ters of organic bin ization of steel rei etals microstructure microstructure a erties of silica mat ypes of metallic mat ials. Steel reinforc barrier features of elastic recovery a hanisms	of poly xation der-bas nforced re and prop erials erials aterials ied and f filled p	ed layer concret propertie erties . Corrosi prestres	s e elements es; Evaluation of on protection mo ssed concrete ma layers	metals	Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 6 2
T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-7 T-L-8 T-L-9 T-W-1 T-W-2 T-W-2 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 T-W-8	Influence of the str Evaluation of teme Introduction to ela Determination of d Preparation and m Studies on stress la deformability Studies on therma Study on microstru Study on microstru Stress corrosion ar Reinforcing metho reinforcement corr Deformation abiliti Basics of fracture of Creep and relaxati Interface fracture of Fatigue crack grow	ructura stome leform echan evel in l recov icture icture ds of to osion es, me mecha on in s mecha or in s mecha	al defects on re e effect on cre r fatique testi ation parame ical character ifluence on me very of metals and the prope and the prope and the prope er corrosion ty puilding mater phenomenon echanical and nics soft polymers, nics dels and mec nanocomposi	instruction mechanical profile ep and stress rela ng ters of organic bin ization of steel rei etals microstructure microstructure a erties of silica mat ypes of metallic mat ials. Steel reinforc barrier features of elastic recovery a hanisms tes	of poly xation der-bas nforced re and prop erials aterials aterials aterials aterials f filled p	mers ed layer concret oropertie erties . Corrosi prestres polymer manent s	s e elements es; Evaluation of on protection mo sed concrete ma layers set	metals ethods aterials. Steel	Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 6 2
T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-8 T-L-9 T-W-1 T-W-2 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 T-W-8 T-W-9	Influence of the str Evaluation of teme Introduction to ela Determination of d Preparation and m Studies on stress la deformability Studies on therma Study on microstru Study on microstru Study on microstru Stress corrosion ar Reinforcing metho reinforcement corr Deformation abiliti Basics of fracture of Creep and relaxati Interface fracture of Fatigue crack grow Wear of composite Deformation mech recovery mechanis	ructura stome leform echan evel in l recov icture icture ind othe ds of k osion es, me mecha on in s mecha on in s mecha anism sms af	al defects on r e effect on cre r fatique testi ation parame ical character fluence on me very of metals and the prope and the prope er corrosion ty puilding mater phenomenon echanical and nics soft polymers, nics dels and mec nanocomposi s in metals; in ter stress indu	instruction mechanical profile ep and stress rela ng ters of organic bin ization of steel rei etals microstructure microstructure a erties of silica mat crties of silica mat pes of metallic mat ials. Steel reinforc barrier features of elastic recovery a hanisms tes ifluence of stress of uced deformation	of poly xation der-bas nforced re and prop erials erials aterials aterials aterials aterials and peri-	mers eed layer concret oropertie erties . Corrosi prestres polymer manent s	e elements es; Evaluation of on protection me sed concrete ma layers set re and metals pr	metals ethods aterials. Steel	Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 6 2 3 4
T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-7 T-L-8 T-L-9 T-W-1 T-W-2 T-W-2 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 T-W-8	Influence of the str Evaluation of teme Introduction to ela Determination of d Preparation and m Studies on stress la deformability Studies on therma Study on microstru Study on microstru Stress corrosion ar Reinforcing metho reinforcement corr Deformation abiliti Basics of fracture n Creep and relaxati Interface fracture n Fatigue crack grow Wear of composite Deformation mech	ructura stome leform echan evel in l recov icture icture ind othe ds of k osion es, me mecha on in s mecha on in s mecha anism sms af	al defects on r e effect on cre r fatique testi ation parame ical character fluence on me very of metals and the prope and the prope er corrosion ty puilding mater phenomenon echanical and nics soft polymers, nics dels and mec nanocomposi s in metals; in ter stress indu	instruction mechanical profile ep and stress rela ng ters of organic bin ization of steel rei etals microstructure microstructure a erties of silica mat crties of silica mat pes of metallic mat ials. Steel reinforc barrier features of elastic recovery a hanisms tes ifluence of stress of uced deformation	of poly xation der-bas nforced re and prop erials erials aterials aterials aterials aterials and peri-	mers eed layer concret oropertie erties . Corrosi prestres polymer manent s	e elements es; Evaluation of on protection me sed concrete ma layers set re and metals pr	metals ethods aterials. Steel	Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 5 6 2
T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-7 T-L-8 T-L-9 T-W-1 T-W-2 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5 T-W-5 T-W-6 T-W-7 T-W-8 T-W-9 T-W-10	Influence of the str Evaluation of teme Introduction to ela Determination of d Preparation and m Studies on stress la deformability Studies on therma Study on microstru Study on microstru Study on microstru Stress corrosion ar Reinforcing metho reinforcement corr Deformation abiliti Basics of fracture of Creep and relaxati Interface fracture of Fatigue crack grow Wear of composite Deformation mech recovery mechanis	ructura stome leform echan evel in l recov icture icture ind othe ds of b cosion es, me mecha on in s mecha on in s mecha anism sand anism saf	al defects on r e effect on cre r fatique testi ation parame ical character fluence on me very of metals and the prope and the prope er corrosion ty puilding mater phenomenon echanical and nics soft polymers, nics dels and mec nanocomposi s in metals; ir ter stress indu ical deformat	instruction mechanical profile ep and stress rela ng ters of organic bin ization of steel rei etals microstructure microstructure a erties of silica mat crties of silica mat pes of metallic mat ials. Steel reinforc barrier features of elastic recovery a hanisms tes ifluence of stress of uced deformation	of poly xation der-bas nforced re and prop erials erials aterials aterials aterials aterials and peri-	mers eed layer concret oropertie erties . Corrosi prestres polymer manent s	e elements es; Evaluation of on protection me sed concrete ma layers set re and metals pr	metals ethods aterials. Steel	Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 6 2 3 4 5

			Faculty of Chemi		ology an		eenn	ig			
Student wor									Nun	nber o	fhours
			y of literature								25
			written reports								20
			lectures								30
			y of literature								20
A-W-3 0	consult	ations									10
Teaching m	ethod	s / tool	s								
	Lecture										
<i>M-2</i>	Labora	tory exe	rcises								
	metho	ods (F -	progressive, P - final)								
S-1	F	Reports	3								
S-2	Р	Exam									
	Design	ied lear	ning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Cours	e content	Teaching methods	Evaluatio methods
Knowledge				1	1	1	1	T-W-1	T-W-6	1	
MSE_1A_C17a_W01 The student has the knowledge of common aspect of structural deformation in different engineering materials			MSE_1A_W03	P6S_WG P6S_WK	P6S_WG	C-1	T-W-1 T-W-2 T-W-3 T-W-4 T-W-5	T-W-6 T-W-7 T-W-8 T-W-9 T-W-10	M-1 M-2	S-1 S-2	
Skills											
MSE_1A_C17a_U01 The student has skills of identification, description and prevention of different materials from structural deformations			MSE_1A_U07	P6S_UW	P6S_UW	C-1	T-L-1 T-L-2 T-L-3 T-L-4	T-L-5 T-L-6 T-L-7	M-1 M-2	S-1 S-2	
Social comp	petenc	ces									
MSE_1A_C17a_K01 The student understands the importance of structural deformations of engineering materials in practical applications			MSE_1A_K02	P65_KK	P6S_WK	C-1	T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-W-1 T-W-1 T-W-2	T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 T-W-8 T-W-9 T-W-10	M-1 M-2	S-1 S-2	
Outcome	es	Grade		E	valuation cr	iterion	1				1
Knowledge											
MSE_1A_C17a_V	W01	2,0 3,0 3,5 4,0 4,5 5,0	Positive grade of the final test (n	nore than 55% corr	ect answers)						
Skills											
MSE_1A_C17a_I	U01	2,0 3,0 3,5 4,0 4,5 5,0	Positive grade of the final test (n	nore than 55% corr	ect answers)						
Other social	l comi		25								
MSE_1A_C17a_I		2,0	Positive grade of the final test (n	nore than 55% corr	ect answers)						
Required re	ading	4,5 5,0									

Faculty of Chemical Technology and Engineering

Required reading

1. M. DeGraef and M. E. McHenry, Structure of Materials: An Introduction to Crystallography, Diffraction, and Symmetry, Cambridge University Press, New York, 2007

2. Gibson R.F., Principles of Composite Material Mechanics, 1994

			<u> </u>						
Field of st	udy	Mate	erials Scienc	e and Engineeri	ng				
Mode of s	tudy	stati	onary	Level		first o	cycle		
Graduate	s qualification	inży	nier					WTil(Ch
Fields of s	science	engi	neering and	technology					
Discipline	s of science	-	-	ering (100%)					
Education			eral academ	-					
Module		90							
Course ur	nit	Fati	que. Fracti	ure and Wear					
Code			1A_S_C17b						Ci
	pecialisation		_1/(_0_01/0						
	ering faculty			Organic Chemica	al Techi	lology a	and Polymer		
ECTS		5,0	erials	ECTS (forms)		5,0		-	
	ourse credit	cred	itc	Language		english		-	
Electives		6		Elective group		crigiisi		-	
			<u> </u>				14/2/2/14		Caralit
Form of ir		Cod	Semester	Hours		TS	Weight	Realization	Credit
laboratory	/ course	L	5	45		,0	0,50	K	credits
lecture		W	5	30	2	,0	0,50	К	credits
Leading to	eacher			ztof (Krzysztof.) nta (Jolanta.Bar			-		
Prerequis	ites	(Paw	el.Kochman	nieszka (Agnies Iski@zut.edu.pl) na (Karolina.Wil	, Kowa	lczyk Kr	rzysztof (Krzysz		
W-1	Fundamentals of m	athon	natics and nhy	usics Eundament	als of m				
Moaule/co C-1	Durse unit objective		kills and com	notoncos in tho fi	old of fr	tiquo f	racture and wear	asports of ongin	ooring materials
		-							-
Course co T-L-1	ntent divided into Preparation and ch				raanic c	oatings			Number of hours 5
T-L-1 T-L-2	Determination of a			21	-		wers		5
T-L-3	Influence of the str			•	-				5
T-L-4	Fatique resistance			F					5
T-L-5	Intrerfacial adhesio			osites					5
T-L-6	Evaluation of corro	sion p	roperties of m	naterials					5
T-L-7	Evaluation of tribol	ogical	properties of	materials; Analys	is of fai	ures in I	metallic material	S	5
T-L-8	Fatigue of polymer	suppo	orted nanoma	terials thin films					5
T-L-9	Microstructural effe								5
T-W-1	Steel and alloys con anticorrosion prote	ction	-				rrosion types. Fu	ndamentals of	6
T-W-2	PVC and CPVC para			•	-				2
T-W-3	Fundamentals of tr and coatings for tri	bologi	ical applicatio						8
T-W-4	Introduction to frac								2
T-W-5	Fatigue of polymer		-		/stheres	is metho	ods		2
T-W-6	Fatigue crack grow			hanisms					2
T-W-7	Interface fracture n	necha	nics						2
T-W-8 T-W-9	Wear of polymers Failure mechanism	c in m	otallic materi	alc					2
Student и A-L-1	vorkload - forms of Participation in the		-						Number of hours
	rearrightion in the	apor	alory exercise	- 、					45

Faculty of Chemical Technology and Engineering

Student wo	orkload	d - form	s of activity						Nur	nber of	f hours
A-L-2	Instruc	tions rea	ading, literature review								35
A-L-3	Report	s prepar	ation								5
A-L-4	Consu	tations									5
A-W-1	Partici	pation in	the lectures								30
			ent work. Literature review.								28
A-W-3	Consu	tations									2
Teaching n	nethod	ls / tool	S								
M-1	Lectur										
М-2	Labora	itory exe	rcises								
Evaluation	meth	ods (F -	progressive, P - final)								
S-1	F	Reports									
S-2	Р	Exam									
						Reference to		T			
	Desigi	ned lear	ning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course	content	Teaching methods	Evaluation methods
Knowledge	I						-			-	-
MSE_1A_C17b_W01 The student has the knowledge of common aspect of fatigue, fracture and wear of engineering materials Skills			MSE_1A_W02 MSE_1A_W03	P6S_WG P6S_WK	P6S_WG	C-1	T-W-1 T-W-2 T-W-4 T-W-5	T-W-6 T-W-7 T-W-8	M-1	S-2	
Skills											
MSE_1A_C17b_U01 The student has skills of identification, description and prevention of fatigue, fracture and wear of engineering materials			MSE_1A_U02 MSE_1A_U07	P6S_UW	P6S_UW	C-1	T-L-1 T-L-2 T-L-3 T-L-4 T-L-5	T-L-6 T-L-7 T-L-8 T-L-9	M-2	S-1 S-2	
Social com	peten	ces			•						
	nderstar		portance of fatigue, fracture and n practical applications	MSE_1A_K01 MSE_1A_K02	P65_KK	P6S_WK	C-1	T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-8	T-L-9 T-W-1 T-W-2 T-W-4 T-W-5 T-W-6 T-W-7 T-W-8	M-1 M-2	S-1 S-2
Outcom	les	Grade		E	Evaluation cri	iterion					
Knowledge	1										
MSE_1A_C17b		2,0									
			The student knows the fundamen	tals aspects of fat	igue, fracture ar	nd wear of engin	neering r	naterials			
		3,5									
		4,0									
		4,5									
Chille		5,0									
Skills	1101										
MSE_1A_C17b	_001	2,0 3,0	The student can identify,describe	and provent fatio	up fracture and	wear of onging	oring m	toriale			
		3,5	The student can identify, describe								
		4,0									
		4,5									
		5,0									
Other socia	al com	petence	25								
MSE_1A_C17b	_K01	2,0									
		3,0	Student understands the importa	nce of fatigue, frac	cture and wear a	aspects of engir	eering n	naterials			
		3,5									
		4,0									
		4,5									
		5,0									
Required re	eading	1									

Faculty of Chemical Technology and Engineering

Required reading

1. Wranglen G., An Introduction to Corrosion and Protection of Metals, Springer Netherlands, 1985

2. Uhling H.H., Corrosion and Corrosion Control: An Introduction to Corrosion Science and Engineering, John Wiley & Sons, Inc., 2008

3. J. Kolesce, Paint and coating testing manual, ASTM, Ann Arbor, 1995

Field of s								7	
	tudy	Mate	erials Scienc	e and Engineeri	ng				
Mode of s	study	stati	onary	Level		first c	ycle	VA/T:L	
Graduate	e's qualification	inżyr	nier					WTil(Ln
Fields of :	science	engii	neering and	technology					
Discipline	es of science	mate	erials engine	ering (100%)				1 I _	_
Educatio	nal profile	gene	eral academ	ic					
Module									
Course ui	nit	Micr	o- and Nar	nofabrication o	of Mate	erials			
Code		MSE	_1A_S_C18a						C
Field of s	pecialisation								
Administe	ering faculty	Depa	artment of N	lanomaterials Pl	hysicocł	nemistr	ſу		
ECTS		8,0		ECTS (forms)	8	8,0			
Form of c	course credit	exan	nination	Language	e	english		_	
Electives		7		Elective group					
Form of i	Instruction	Cod	Semester	Hours	ECT	TS	Weight	Realization	Credit
lecturing	course	Α	5	30	2,0		0,25	К	credits
laborator	y course	L	5	60	4,(0	0,50	К	credits
lecture	<u> </u>	w	5	30	2,0		0,25	К	examination
Leading t	teacher	Zielir	nska Beata (Beata.Zielinska	@zut er	du nl)	-		
I		(Dari		ski@zut.edu.pl),			zyński Dariusz olina (Karolina		edu.pl), Wróbel
Prerequis W-1 Module/c	Knowledge of the b	Rafa	iusz.Moszyn ł (Rafal.Wro ourse in phys	ski@zut.edu.pl), bel@zut.edu.pl) ics and chemistry	, Wenels , Zielins at the e	ska Kar ska Bea lementa	rolina (Karolina ta (Beata.Ziel ary level	a.Wilgosz@zut.e inska@zut.edu.	pl), Żwir Marek
W-1 Module/co C-1	Knowledge of the b course unit objective The aim of the cou nanomaterials synt	Rafa Dasic co es rse is t thesis.	iusz.Moszyn ł (Rafal.Wro ourse in phys to develop stu	ski@zut.edu.pl), bel@zut.edu.pl) ics and chemistry udent's knowledge	, Wenels , Zielins at the e	ska Kar ska Bea lementa	rolina (Karolina ta (Beata.Ziel ary level	a.Wilgosz@zut.e inska@zut.edu.	pl), Żwir Marek d for materials and
W-1 Module/cc C-1 Course co	Knowledge of the b course unit objective The aim of the cou nanomaterials synt ontent divided into	Rafa Dasic co es rse is t thesis. <i>vario</i>	iusz.Moszyn ł (Rafal.Wro ourse in phys to develop stu us forms of	ski@zut.edu.pl), bel@zut.edu.pl) ics and chemistry udent's knowledge	, Wenels , Zielins at the e	ska Kar ska Bea lementa	rolina (Karolina ta (Beata.Ziel ary level	a.Wilgosz@zut.e inska@zut.edu.	pl), Żwir Marek d for materials and Number of hours
W-1 Module/cd C-1 Course cd T-A-1	Knowledge of the b course unit objective The aim of the cou nanomaterials synt ontent divided into Kinetic theory of ga	Rafa pasic co es rse is t thesis. variou ases -	iusz.Moszyn ł (Rafal.Wro ourse in phys to develop stu us forms of exercises	ski@zut.edu.pl), bel@zut.edu.pl) ics and chemistry udent's knowledge instruction	, Wenels , Zielins at the e	ska Kar ska Bea lementa	rolina (Karolina ta (Beata.Ziel ary level	a.Wilgosz@zut.e inska@zut.edu.	pl), Żwir Marek d for materials and Number of hours 9
W-1 Module/cc C-1 Course cc T-A-1 T-A-2	Knowledge of the b course unit objective The aim of the cou nanomaterials synt ontent divided into Kinetic theory of ga Model design and s	Rafa pasic co es rse is t thesis. variou ases –	iusz.Moszyn ł (Rafal.Wro ourse in phys to develop stu us forms of exercises for FDM print	ski@zut.edu.pl), bel@zut.edu.pl) ics and chemistry udent's knowledge instruction	, Wenels , Zielins at the el	ska Kar ka Bea lementa	rolina (Karolina ta (Beata.Ziel ary level	a.Wilgosz@zut.edu. inska@zut.edu. nt techniques use	pl), Żwir Marek d for materials and Number of hours 9 9
W-1 Module/c C-1 Course co T-A-1 T-A-2 T-A-3	Knowledge of the b course unit objective The aim of the cou nanomaterials synt ontent divided into Kinetic theory of ga Model design and s Chemical vapor de assisted CVD) – eff	Rafa pasic co es rse is t thesis. variou ases – slicing positio ect of	iusz.Moszyn ł (Rafal.Wro ourse in phys to develop stu <i>us forms of</i> exercises for FDM print on techniques synthesis par	ski@zut.edu.pl), bel@zut.edu.pl) ics and chemistry udent's knowledge instruction ing (CVD, plasma enf	, Wenels , Zielins at the el e and skil	ska Kar ka Bea lementa	rolina (Karolina ta (Beata.Ziel ary level e area of differe ohol CVD, gel C	a.Wilgosz@zut.edu. inska@zut.edu. nt techniques use	pl), Żwir Marek d for materials and <i>Number of hours</i> 9 9 9
W-1 Module/cc C-1 Course cc T-A-1 T-A-2	Knowledge of the b course unit objective The aim of the counanomaterials synt ontent divided into Kinetic theory of ga Model design and s Chemical vapor de assisted CVD) – eff Participation in pas	Rafa pasic co es rse is t thesis. variou ases - slicing positio sect of ssing te	iusz.Moszyn ł (Rafal.Wro ourse in phys to develop stu <i>us forms of</i> exercises for FDM print on techniques synthesis par est	ski@zut.edu.pl), bel@zut.edu.pl) ics and chemistry udent's knowledge instruction ing (CVD, plasma enh ameters on the pr	, Wenels , Zielins at the el e and skil	ska Kar ika Bea lementa Ils in the CVD, alco nanostro	rolina (Karolina ta (Beata.Ziel ary level e area of differe ohol CVD, gel C uctures properti	a.Wilgosz@zut.edu. inska@zut.edu. nt techniques use vD, laser es.	pl), Żwir Marek d for materials and Number of hours 9 9
W-1 Module/c C-1 Course co T-A-1 T-A-2 T-A-3	Knowledge of the b course unit objective The aim of the counanomaterials synt ontent divided into Kinetic theory of ga Model design and s Chemical vapor de assisted CVD) – eff Participation in pas 1a. Studies on met 1b. Studies on com 1c. Studies on poly	Rafa pasic co es rse is t thesis. variou ases - slicing positio ect of ssing te asing te asing te asing te tallic ar	iusz.Moszyn ł (Rafal.Wro ourse in phys to develop stu <i>us forms of</i> exercises for FDM print on techniques synthesis par est nd ceramic co thin films depo	ski@zut.edu.pl), bel@zut.edu.pl) ics and chemistry udent's knowledge instruction ing (CVD, plasma enh ameters on the pr patings deposited eposited by high energy	, Wenels , Zielins at the el e and skil	ska Kar ska Bea lementa lls in the CVD, alco nanostro beams.	rolina (Karolina ta (Beata.Ziel ary level e area of differe ohol CVD, gel C uctures properti	a.Wilgosz@zut.edu. inska@zut.edu. nt techniques use vD, laser es.	pl), Żwir Marek d for materials and <i>Number of hours</i> 9 9 9
W-1 Module/c C-1 Course co T-A-1 T-A-2 T-A-3 T-A-3 T-A-4 T-L-1 T-L-2	Knowledge of the b course unit objective The aim of the counanomaterials synt ontent divided into Kinetic theory of ga Model design and s Chemical vapor de assisted CVD) – eff Participation in pass 1a. Studies on met 1b. Studies on com 1c. Studies on poly 2a. Thin films obtai 2b. Thin films chara 2c. Application of x	Rafa pasic co es rse is t thesis. variou ases - slicing positio fect of ssing te salic an posite mer th ined by acteris (-ray di	iusz.Moszyn ł (Rafal.Wro ourse in phys to develop stu <i>us forms of</i> exercises for FDM print on techniques synthesis par est nd ceramic co e thin films depo y magnetron sation – attenu iffraction for t	ski@zut.edu.pl), bel@zut.edu.pl) ics and chemistry udent's knowledge instruction ing (CVD, plasma enhameters on the pr patings deposited eposited by high ener sputtering. uation effect of ov chin film character	, Wenels , Zielins at the el e and skil e and skil by magn energetic rgetic be erlayer f ization.	ska Kar ska Bea lementa lls in the CVD, alco nanostro beams. ams ilms.	olina (Karolina ta (Beata.Ziel ary level e area of differe ohol CVD, gel C uctures properti outtering depos	a.Wilgosz@zut.edu. inska@zut.edu. nt techniques use vD, laser es.	pl), Żwir Marek d for materials and Number of hours 9 9 9 3
W-1 Module/c C-1 Course cc T-A-1 T-A-2 T-A-3 T-A-4 T-L-1	Knowledge of the b course unit objective The aim of the counanomaterials synt ontent divided into Kinetic theory of ga Model design and s Chemical vapor de assisted CVD) – eff Participation in pass 1a. Studies on met 1b. Studies on com 1c. Studies on poly 2a. Thin films obtainab 2b. Thin films chara 2c. Application of x Influence of proces	Rafa pasic co es rse is t thesis. variou ases - slicing positio ect of ssing te callic an posite mer th ined by acteris c-ray di ss para	iusz.Moszyn ł (Rafal.Wro ourse in phys to develop stu <i>us forms of</i> exercises for FDM print on techniques synthesis par est nd ceramic co thin films den in films depo y magnetron iation – attenu iffraction for t	ski@zut.edu.pl), bel@zut.edu.pl) ics and chemistry udent's knowledge instruction ing (CVD, plasma enhameters on the pr batings deposited eposited by high ener sputtering. uation effect of ov chin film character e surface composi	, Wenels , Zielins at the el e and skil e and skil by magn nergetic rgetic be rerlayer f rization.	ska Kar ska Bea lementa lis in the CVD, alco nanostro beams. ams ilms. eposited	rolina (Karolina ta (Beata.Ziel ary level e area of differe ohol CVD, gel C uctures properti outtering depos	a.Wilgosz@zut.edu. inska@zut.edu. nt techniques use vD, laser es. ition.	pl), Żwir Marek d for materials and Number of hours 9 9 9 9 3 15
W-1 Module/cu C-1 Course cu T-A-1 T-A-2 T-A-3 T-A-4 T-L-1 T-L-2 T-L-2 T-L-3 T-L-4	Knowledge of the b course unit objective The aim of the counanomaterials synth ontent divided into Kinetic theory of gate Model design and s Chemical vapor de assisted CVD) – eff Participation in pass 1a. Studies on met 1b. Studies on com 1c. Studies on poly 2a. Thin films obtain 2b. Thin films chara 2c. Application of x Influence of process Preparation of RTV of strength).	Rafa pasic co es rse is t thesis. variou ases - slicing positio fect of ssing te allic an posite mer th ined by acteris c-ray di s para silicor	iusz.Moszyn ł (Rafal.Wro ourse in phys to develop stu <i>us forms of</i> exercises for FDM print on techniques synthesis par est nd ceramic co thin films den in films depo y magnetron iation – attenu iffraction for tu meters on tho ne mold for ra	ski@zut.edu.pl), bel@zut.edu.pl) ics and chemistry udent's knowledge instruction ing (CVD, plasma enhameters on the pr batings deposited eposited by high ener sputtering. uation effect of ov chin film character e surface composi pid tooling resin c	, Wenels , Zielins at the el e and skil e and skil by magn energetic rgetic be erlayer f rization. ition of d casts (pai	ska Kar ska Bea lementa lis in the CVD, alco nanostro beams. ams ilms. epositeo rt I – pre	rolina (Karolina ta (Beata.Ziel ary level e area of differe ohol CVD, gel C uctures properti outtering depos	a.Wilgosz@zut.edu. inska@zut.edu. nt techniques use vD, laser es. ition.	pl), Żwir Marek d for materials and Number of hours 9 9 9 9 3 15 15 15 8 4
W-1 Module/C C-1 Course co T-A-1 T-A-2 T-A-3 T-A-3 T-L-1 T-L-2 T-L-2 T-L-3 T-L-4 T-L-5	Knowledge of the b course unit objective The aim of the counanomaterials synt ontent divided into Kinetic theory of ga Model design and s Chemical vapor de assisted CVD) - eff Participation in pas 1a. Studies on met 1b. Studies on com 1c. Studies on poly 2a. Thin films obtai 2b. Thin films chara 2c. Application of x Influence of proces Preparation of RTV of strength). Chemical vapar de on physicochemica	Rafa pasic co es rse is t thesis. variou ases - slicing positio actor is construction asing te asing t	iusz.Moszyn ł (Rafal.Wro ourse in phys to develop stu <i>us forms of</i> exercises for FDM print on techniques synthesis par est nd ceramic co thin films depo y magnetron sation – attenu iffraction for t meters on the ne mold for ra on as technique	ski@zut.edu.pl), bel@zut.edu.pl) ics and chemistry udent's knowledge instruction ing (CVD, plasma enhameters on the pr patings deposited eposited by high ener sputtering. uation effect of ov chin film character e surface composi upid tooling resin co use of carbon nanoto	, Wenels , Zielins at the el e and skil e and skil by magn nergetic roduced f by magn nergetic reclayer f rization. ition of d casts (particular) tubes syn thesis a	ska Kar ska Bea lementa lis in the CVD, alco nanostro beams. ams ilms. epositeo rt I – pre nthesis – nd prod	rolina (Karolina ta (Beata.Ziel ary level e area of differe ohol CVD, gel C uctures properti outtering depos d polymer films eparation, part I - study of synth	a.Wilgosz@zut.edu. inska@zut.edu. nt techniques use vD, laser es. ition. I -determination esis parameters	pl), Żwir Marek d for materials and Number of hours 9 9 9 3 15 15 15 8 4 4
W-1 Module/cd C-1 Course cd T-A-1 T-A-2 T-A-3 T-A-3 T-A-4 T-L-1 T-L-2 T-L-2 T-L-3 T-L-4	Knowledge of the b course unit objective The aim of the counanomaterials synt ontent divided into Kinetic theory of ga Model design and s Chemical vapor de assisted CVD) - eff Participation in pas 1a. Studies on met 1b. Studies on poly 2a. Thin films obtai 2b. Thin films obtai 2c. Application of x Influence of proces Preparation of RTV of strength). Chemical vapar de on physicochemica	Rafa pasic co es rse is t thesis. vario ases - slicing positio asing te asing te asi	iusz.Moszyn ł (Rafal.Wro ourse in phys to develop stu <i>us forms of</i> exercises for FDM print on techniques synthesis par est nd ceramic co e thin films depo y magnetron sation – attenu iffraction for tu meters on the ne mold for ra on as technique ration generation on as technique in as technique	ski@zut.edu.pl), bel@zut.edu.pl) ics and chemistry udent's knowledge instruction ing (CVD, plasma enf ameters on the pr patings deposited eposited by high en- sisted by high en- sisted by high en- sputtering. Jation effect of ov chin film character e surface composi ipid tooling resin con anotubes (syr n, printing and pos	, Wenels , Zielins at the el e and skil e and skil e and skil by magn energetic roduced of by magn energetic be erlayer f ization. ition of d casts (par tubes syn thesis a st-proces	ska Kar ska Bea lementa lis in the CVD, alco nanostru beams. beams. ilms. eposited rt I – pre nthesis - nd prod ising	rolina (Karolina ta (Beata.Ziel ary level e area of differe ohol CVD, gel C uctures properti outtering depos d polymer films eparation, part I - study of synth- uct characteriza	a.Wilgosz@zut.edu. inska@zut.edu. nt techniques use VD, laser es. ition. I -determination esis parameters ition)	pl), Żwir Marek d for materials and Number of hours 9 9 9 9 3 15 15 15 8 4
W-1 Module/C C-1 Course co T-A-1 T-A-2 T-A-3 T-A-3 T-L-1 T-L-2 T-L-2 T-L-3 T-L-4 T-L-5	Knowledge of the b course unit objective The aim of the counanomaterials synt ontent divided into Kinetic theory of ga Model design and s Chemical vapor de assisted CVD) - eff Participation in pas 1a. Studies on met 1b. Studies on com 1c. Studies on poly 2a. Thin films obtai 2b. Thin films chara 2c. Application of x Influence of proces Preparation of RTV of strength). Chemical vapar de on physicochemica	Rafa pasic co es rse is t thesis. variou ases - slicing positio ect of ssing te aslicing te aslicing te aslicing te aslicing te aslicing te ssing te ssing te ssing te aslicing te aslicing te ssing te ssing te ssing te techn ostruct	iusz.Moszyn ł (Rafal.Wro ourse in phys to develop stu <i>us forms of</i> exercises for FDM print on techniques synthesis par est nd ceramic co thin films depo y magnetron sation – attenu iffraction for t meters on the ne mold for ra on as technique erties of carb- iology. Design ture formatio	ski@zut.edu.pl), bel@zut.edu.pl) ics and chemistry udent's knowledge instruction ing (CVD, plasma enhater ameters on the pro- patings deposited eposited by high ener sputtering. uation effect of ov chin film character e surface composi pid tooling resin co use of carbon nanoto on nanotubes (syr n, printing and position of the surface , Wenels , Zielins at the el e and skil e and skil e and skil by magn nergetic roduced f by magn nergetic rerlayer f rization. ition of d casts (par tubes syn thesis a st-proces thin films	ska Kar ska Bea lementa lis in the CVD, alco nanostro beams. ams ilms. eposited rt I – pre nthesis – nthesis – nthesis – nthesis – sing s deposi	rolina (Karolina ta (Beata.Ziel ary level e area of differe ohol CVD, gel C uctures properti outtering depos d polymer films eparation, part I - study of synth- uct characteriza	a.Wilgosz@zut.edu. inska@zut.edu. nt techniques use VD, laser es. ition. I -determination esis parameters ition)	pl), Żwir Marek d for materials and Number of hours 9 9 9 3 15 15 15 8 4 4	
W-1 Module/cu C-1 Course co T-A-1 T-A-2 T-A-3 T-A-3 T-A-4 T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-5 T-L-6	Knowledge of the b course unit objective The aim of the counanomaterials synt ontent divided into Kinetic theory of ga Model design and s Chemical vapor de assisted CVD) - eff Participation in pass 1a. Studies on met 1b. Studies on com 1c. Studies on poly 2a. Thin films obtainab 2b. Thin films charra 2c. Application of x Influence of process Preparation of RTV of strength). Chemical vapar de on physicochemica SLA manufacturing 1a. Micro- and nam 1b. Influence of hig Chemical vapor de assisted CVD) as m	Rafa pasic co es rse is t thesis. variou ases - slicing positio ect of ssing te allic ar posite mer th ined by acteris callic ar posite mer th ined by acteris s para silicor positio al prope techn ostruct gh ener positio nethod	iusz.Moszyn ł (Rafal.Wro ourse in phys to develop stu <i>us forms of</i> exercises for FDM print on techniques synthesis par est nd ceramic co thin films depo y magnetron sation – attenu iffraction for t meters on the ne mold for ra on as techniques ture formation rgetic beams on techniques s of nanostru	ski@zut.edu.pl), bel@zut.edu.pl) ics and chemistry udent's knowledge instruction ing (CVD, plasma enf ameters on the pr batings deposited eposited by high ener sputtering. uation effect of ov chin film character e surface composi upid tooling resin co in nanotubes (syr n, printing and pos n in coatings and on film growth an (CVD, plasma enf ctures synthesis.	, Wenels , Zielins at the el e and skil e and skil e and skil by magn nergetic roduced of by magn nergetic be rerlayer f rization. ition of d casts (particular tubes syn thesis a st-proces thin films d proper	ska Kar ska Bea lementa lis in the CVD, alco nanostru beams. ams ilms. eposited rt I – pre nthesis – nthesis – nthesis – nthesis – sing s deposi ties	colina (Karolina ta (Beata.Ziel ary level e area of differe ohol CVD, gel C uctures properti outtering depos d polymer films eparation, part I - study of synth- uct characteriza ted by physical	a.Wilgosz@zut.edu. inska@zut.edu. nt techniques use VD, laser es. ition. I -determination esis parameters ation) methods	pl), Żwir Marek d for materials and Number of hours 9 9 9 9 9 3 15 15 15 8 4 4 15 3
W-1 Module/cu C-1 Course co T-A-1 T-A-2 T-A-3 T-A-3 T-A-4 T-L-1 T-L-2 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-W-1	Knowledge of the b course unit objective The aim of the counanomaterials synt ontent divided into Kinetic theory of ga Model design and s Chemical vapor de assisted CVD) - eff Participation in pass 1a. Studies on met 1b. Studies on com 1c. Studies on poly 2a. Thin films obtainab 2b. Thin films chara 2c. Application of x Influence of process Preparation of RTV of strength). Chemical vapar de on physicochemica SLA manufacturing 1a. Micro- and nam 1b. Influence of hig Chemical vapor de	Rafa pasic co es rse is t thesis. variou ases - slicing positio ect of ssing te allic ar posite mer th ined by acteris callic ar posite spara silicor positio al propo techn ostruct gh ener positio et hod e kinet	iusz.Moszyn ł (Rafal.Wro ourse in phys to develop stu <i>us forms of</i> exercises for FDM print on techniques synthesis par est nd ceramic co thin films depo y magnetron sation – attenu iffraction for t meters on the ne mold for ra on as techniques sof nanostru- ture formation rgetic beams on techniques s of nanostru- cic theory of g	ski@zut.edu.pl), bel@zut.edu.pl) ics and chemistry udent's knowledge instruction ing (CVD, plasma enf ameters on the pr batings deposited eposited by high ener sputtering. uation effect of ov chin film character e surface composi upid tooling resin co in nanotubes (syr n, printing and pos n in coatings and on film growth an (CVD, plasma enf ctures synthesis.	, Wenels , Zielins at the el e and skil e and skil e and skil by magn nergetic roduced of by magn nergetic be rerlayer f rization. ition of d casts (particular tubes syn thesis a st-proces thin films d proper	ska Kar ska Bea lementa lis in the CVD, alco nanostru beams. ams ilms. eposited rt I – pre nthesis – nthesis – nthesis – nthesis – sing s deposi ties	colina (Karolina ta (Beata.Ziel ary level e area of differe ohol CVD, gel C uctures properti outtering depos d polymer films eparation, part I - study of synth- uct characteriza ted by physical	a.Wilgosz@zut.edu. inska@zut.edu. nt techniques use VD, laser es. ition. I -determination esis parameters ation) methods	pl), Żwir Marek d for materials and Number of hours 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9
W-1 Module/C C-1 Course co T-A-1 T-A-2 T-A-3 T-A-3 T-A-4 T-L-1 T-L-2 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-W-1 T-W-2	Knowledge of the b course unit objective The aim of the counanomaterials synt ontent divided into Kinetic theory of gat Model design and s Chemical vapor de assisted CVD) – eff Participation in pass 1a. Studies on met 1b. Studies on poly 2a. Thin films obtainable. Thin films obtainable. Thin films character 2c. Application of X Influence of process Preparation of RTV of strength). Chemical vapar de on physicochemicater SLA manufacturing 1a. Micro- and namulable. Influence of hig Chemical vapor de on physicochemicater SLA manufacturing 1a. Micro- and namulable. Influence of hig Chemical vapor de on physicochemicater SLA manufacturing 1a. Micro- and namulable. Influence of hig Chemical vapor de assisted CVD) as m 3a. Principles of the assisted CVD as m 3b. Magnetron sput	Rafa pasic co es rse is t thesis. variou ases - slicing positio ect of asing te allic ar posite mer th ined by acteris cray di s para silicor positio al propo techn ostruct gh ener positio techn ostruct gh ener positio techn techn techn	iusz.Moszyn ł (Rafal.Wro ourse in phys to develop stu <i>us forms of</i> exercises for FDM print on techniques synthesis par est nd ceramic co thin films depo y magnetron sation – attenu iffraction for t meters on the ne mold for ra on as techniques on techniques s of nanostru- cic theory of g	ski@zut.edu.pl), bel@zut.edu.pl) ics and chemistry udent's knowledge instruction ing (CVD, plasma enh ameters on the pr patings deposited eposited by high ener sputering. Jation effect of ov chin film character e surface composi pid tooling resin co ipid tooling resin co ipid tooling resin co on nanotubes (syr n, printing and pos n in coatings and fo on film growth an (CVD, plasma enh ctures synthesis. Jasses.	, Wenels , Zielins at the el e and skil e and skil e and skil by magn nergetic roduced of by magn nergetic be rerlayer f rization. ition of d casts (particular tubes syn thesis a st-proces thin films d proper nanced C	ska Kar ska Bea lementa lis in the CVD, alco nanostro beams. ams ilms. eposited rt I – pre nthesis – nthesis – nthesis – nthesis – sing s deposi ties CVD, alco	rolina (Karolina ta (Beata.Ziel ary level e area of differe ohol CVD, gel C uctures properti outtering depos d polymer films eparation, part I - study of synth- uct characteriza ted by physical ohol CVD, gel C	a.Wilgosz@zut.edu. inska@zut.edu. nt techniques use VD, laser es. ition. I -determination esis parameters ation) methods	pl), Żwir Marek d for materials and Number of hours 9 9 9 9 3 15 15 15 15 15 15 3 7 7 7

			racarcy or enem					9					
			nto various forms of instr	ruction					Nur	mber o			
T-W-6	Electro	spinning	g of polymeric nanofibres								2		
Student w	vorkload	d - form	s of activity						Nur	mber o	f hours		
A-A-1	Partici	pation in	recitations								30		
A-A-2	prepar	ing for te	ests								13		
A-A-3	Prepar	ing for re	ecitations								15		
A-A-4	Consu	Consultations											
A-L-1	participation in laboratory exercises										60		
A-L-2	preparing for laboratory exercises										20		
A-L-3	prepar	preparation of reports											
A-L-4	prepar	ing for te	ests								10		
A-L-5	Cosult	ations									10		
A-W-1	partici	pation in	lectures								30		
A-W-2	Individ	ual litera	ature studies								13		
A-W-3	Prepar	ing for th	ne exam								15		
A-W-4	The ex	The exam									1		
A-W-5	Consu	tations									2		
Teaching	method	ls / tool	S						I				
M-1	lecture	s with p	resentation										
М-2	subjec	t disscus	ion during lectures, auditori	um excercises an	d laboratories								
М-3	self stu	udies											
Evaluatio	n metho	ods (F -	progressive, P - final)										
S-1	P	written											
5-2	F		completion of exercises										
5-3	F		ory reports										
S-4	F		activity during auditory exc	ercise									
	Desigi	ned lear	ning outcomes	Reference to the learning outcomes designed for the fields or study	Reference to Learning Outcomes f for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	S Course content		Teaching methods			
Knowledg	je												
MSE_1A_C18 knowledge ir synthesis	Ba_W01 n the area	of differe	ent methods of materials	MSE_1A_W03	P6S_WG P6S_WK	P6S_WG	C-1	T-W-1 T-W-2 T-W-3	T-W-4 T-W-5	M-1	S-1		
Skills				·						_			
MSE_1A_C18 ability to pla materials		olement sy	ynthesis processes of selected	MSE_1A_U08	P6S_UK	P6S_UW	C-1	T-A-1 T-A-2 T-A-3 T-A-4 T-L-1	T-L-2 T-L-3 T-L-4 T-L-5 T-L-6	M-2 M-3	S-2 S-3 S-4		
Social cor	mpeten	ces		I	1	I	1	I 					
MSE_1A_C18 Competence materials	3a_K01 s in micro	- and nan	ofabrication of engineering	MSE_1A_K02	P65_KK	P6S_WK	C-1	T-A-1 T-A-2 T-A-3 T-A-4 T-L-1 T-L-2 T-L-3 T-L-3 T-L-4	T-L-5 T-L-6 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6	M-1 M-2	S-1 S-3		
Outco	mes	Grade		E	Evaluation cr	iterion							
Knowledg													
MSE_1A_C18	3a_W01	2,0											
			from 50 to 55% of percentage p	points									
		3,5											
		4,0											
		4,5											

Faculty of Chemical Technology and Engineering

Skills		
MSE_1A_C18a_U01	2,0	
	3,0	from 50 to 55% of percentage points
	3,5	
	4,0	
	4,5	
	5,0	
Other social com	petence	es
MSE_1A_C18a_K01	2,0	
	3,0	Student describes selected issues at a basic level (score => 50%)
	3,5	
	4,0	
	4,5	
	5,0	
Required reading)	

1. Jiwang Yan, Micro and Nano Fabrication Technology (Micro/Nano Technologies), Springer, 2020, ISBN-13: 978-9811300998 2. Kwang-Leong Choy, Chemical Vapour Deposition (CVD) Advances, Technology and Applications, CRC Press, 2019, ISBN 9781466597761

3. Eiichi Kondoh, Micro- and Nanofabrication for Beginners, CRC Press, 2020, ISBN 9789814877091

Course unit Advanced Manufacturing Processes Code MSE_1A_5_C18b Field of specialisation Administering faculty Department of Materials Technology ECTS 8,0 ECTS (forms) 8,0 Form of course credit examination Language english Electives 7 Elective group ECTS K credits Form of instruction Cod Semester Hours ECTS Weight Realization Credit lecturing course A 5 30 2,0 0,25 K credits laboratory course L 5 60 4,0 0,50 K credits lecture W 5 30 2,0 0,25 K examination Leading teacher Baranowska Jolanta (Jolanta, Baranowska@zut.edu.pl) Elective group Elective group (Xuecheng, Chen@zut.edu.pl), Kirsyska@zut.edu.pl) Elective group Elective group E		-		<u> </u>						
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<i>I-W-5</i> I nin polymer films formation by LBL and sping coating techniques; thin biological layers formation 3		vapor deposition (F	VP) ai	nd their modi	fication					
	T-W-5	Thin polymer films	forma	tion by LBL a	nd sping coating t	echniqu	ies; thin	biological layers	formation	3

		racuity of chem					.9			
Course co	ontent d	ivided into various forms of inst	ruction					Nur	nber o	f hours
T-W-6		nergetic beams used for thin films d ties; process parameters selections;			coating struc	ture an	d			7
T-W-7	Rapid	protopyping of polymers using photo	ocuring and therm	oforming pros	sessing (FDM,	SLA)				3
T-W-8	Electro	spinning of polymer nanofibres								2
Student v	vorkload	l - forms of activity						Nur	nber o	f hours
A-A-1		pation in recitations								30
A-A-2	Prepar	ing for recitations								23
A-A-3	Prepar	ing for tests								5
A-A-4	Consul	tations								2
A-L-1	partici	pation in laboratory exercises								60
A-L-2	prepar	ing for laboratory exercises								30
A-L-3	Prepar	ation of reports								20
A-L-4	Consul	tations								10
A-W-1	partici	pation in lectures								30
A-W-2	self-stu	udy of the literature								17
A-W-3	prepar	ing for the exam								10
A-W-4	The ex	am								1
A-W-5	Consul	tations								2
Teaching	method	ls / tools						1		
M-1		tive lectures, use of presentation (e	.g. Powerpoint), fi	lms						
М-2		rium Exercises								
М-3	Labora	tory exercises								
Evaluatio	n meth	ods (F - progressive, P - final)								
S-1	P	written exam								
5-1 5-2	F	questions								
S-2 S-3	F	reports								
5-5										
	Desigr	ned learning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes f or qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Cours	e content	Teaching methods	Evaluation methods
Knowledg	<i>je</i>									
MSE_1A_C18 Student dese processes		es concerning advanced manufacturing	MSE_1A_W07	P6S_WG	P6S_WG	C-1	T-W-1 T-W-2 T-W-3 T-W-4	T-W-5 T-W-6 T-W-7 T-W-8	M-1	S-1
Skills										
MSE_1A_C18 Student has		dvanced manufacturing processes	MSE_1A_U08	P65_UK	P6S_UW	C-2	T-A-1 T-A-2 T-A-3 T-L-1 T-L-2 T-L-3 T-L-3 T-L-4	T-L-5 T-L-6 T-L-7 T-L-8 T-L-9 T-L-10	M-2	S-2 S-3
Social cor	mpeten	ces	-	1	1	1	1		1	1
MSE_1A_C18	3b_K01	nced manufacturing of engineering	MSE_1A_K02	P65_KK	P6S_WK	C-1	T-A-1 T-A-2 T-A-3 T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-8	T-L-9 T-L-10 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 T-W-8	M-1 M-3	S-1 S-3

Faculty of Chemical Technology and Engineering

Outcomes	Grade	Evaluation criterion
Knowledge		
MSE_1A_C18b_W01	2,0	
	3,0	Student describes selected issues at a basic level (score => 50%)
	3,5	
	4,0	
	4,5	
	5,0	
Skills		
MSE_1A_C18b_U01	2,0	
	3,0	Student describes selected issues at a basic level (score => 50%)
	3,5	
	4,0	
	4,5	
	5,0	
Other social con	npetenc	es
MSE_1A_C18b_K01	2,0	
	3,0	Student describes selected issues at a basic level (score => 50%)
	3,5	
	4,0	
	4,5	
	5,0	
Required reading	g	
1. Mikell Groover,	Introduct	ion to Manufacturing Processes, Wiley, 2011
2. Prof. DrIng. Fri	edrich-W	ilhelm Bach Dr. Andreas Laarmann DiplIng. Thomas Wenz, Modern Surface Technology, Springer, 2006
2 Jan CibconDavid	W Doc	an Brent Stucker, Additive Manufacturing Technologies, Springer, 2010

3. Ian GibsonDavid W. RosenBrent Stucker, Additive Manufacturing Technologies, Springer, 2010

Field of s	study	Mate	erials Scienc	e and Engineeri	ng]	
Mode of s	study	stati	onary	Level		first c	cycle	14/7014	~1
Graduate	e's qualification	inży	nier	I				WTil	_h
Fields of	science	-		technology					
Discipline	es of science	mat	erials engine	eering (100%)					
	nal profile	-	eral academ	-					
Module		gen							
	init	E	ational Mai	torials and Da	viena				C
Course u	Innt	_		terials and De	vices				
Code		MSE	_1A_S_C19						
	specialisation	_							
	tering faculty		artment of N	lanomaterials P	hysicoc		ſy		
ECTS		3,0		ECTS (forms)		3,0		_	
Form of c	course credit	cred	its	Language		english			
Electives	5			Elective group					
Form of i	instruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
laborator	ry course	L	6	30	1	,5	0,50	К	credits
lecture		w	6	30		, <u>5</u>	0,50	K	credits
Leading t				wa.Borowiak-Pa					creates
		Bart		r (Artur-Bartkow			ech (Wojciech	.Ignaczak@zut.e	edu.pl), Mijowska
Other tea		(Mir		viak-Palen@zut.e			ska Karolina (K	arolina.Wilgosz	@zut.edu.pl)
Prerequis	sites	(Miro Ewa	(Ewa.Borow	viak-Palen@zut.e	edu.pl),	Wenels			@zut.edu.pl)
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Prerequis W-1 Module/c C-1 Course co T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-W-1 T-W-2 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 T-W-8	sites Knowledge of the Course unit objectiv The students will h for example super Content divided into Preparation of sup Electrochemical da Preparation of poly Nanoprecipitation Smart pH-indicato Antimicrobial and Functional materia Electrode compon Electrode material Functional materia Functional materia Smart packaging r Modification of bar Bioactive surfaces	(Mine Ewa basic co res have kn capaci o vario ercapa ata col ymeric of prof rs and rs and antivir als for s ents in s for e als bas ing ma materia rrier pr and m ssing t	(Ewa.Borow course in mathemowlegge and tors. <i>Pus forms of</i> acitors and its ection and an porous struct cein nanoparti humidity regu al surfaces ba supercapacito lithium-ion ba lectrochemcia ed on polyeled terials als operties of pon haterials est	iak-Palen@zut.e nematics, physics skills in device fa <i>instruction</i> measurements (F alysis (part II) tures by porogen i icles for drug deliv ulators in food pac ased on functional ors. atteries. al water decomposi ctrolytes	edu.pl), and che bricatio Part I). removal rery and coating	wenels emistry a n compo method l release	t the elementary sed of functiona	y level l materials for de	fined applications Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5
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Prerequis W-1 Module/c C-1 Course co T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-W-1 T-W-2 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7 T-W-5 T-W-6 T-W-7 T-W-8 T-W-9 T-W-10 T-W-10 T-W-10 T-W-11 T-W-12 Student v A-L-1 A-L-2	sites Knowledge of the Course unit objectiv The students will h for example super Content divided into Preparation of sup Electrochemical da Preparation of poly Nanoprecipitation Smart pH-indicato Antimicrobial and Functional materia Electrode compon Electrode material Functional materia Functional materia Functional packag Smart packaging r Modification of bar Bioactive surfaces participation in pa Wet adhesion surf Micro- and nanopa workload - forms o participation in lat preparing for labor	(Mind Ewa basic of es nave ki capaci of vario ercapa ata col ymeric of prof rs and antivir als for e als bas ing ma materia rier pr and m ssing t as sca aces rticles f activ porator ratory	(Ewa.Borow course in mathemowlegge and tors. <i>Pus forms of</i> acitors and its ection and an porous struct cein nanoparti humidity regu al surfaces bas supercapacito lithium-ion bo lectrochemcia ed on polyeled terials als operties of pon haterials est folding system for drug delive <i>rity</i> y exercises	iak-Palen@zut.e	edu.pl), and che bricatio Part I). removal rery and coating	wenels emistry a n compo method l release	t the elementary sed of functiona	y level l materials for de	fined applications Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 6 7 8 9 10 2 2 2 2 2 1 4 2 4 2 4 2 4 2 4 2 4 2 4 Number of hours
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Faculty of Chemical Technology and Engineering

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Student wor	rkload	- forms	of activity						Nun	nber o	f hours
A-L-5 C	Consult	ations									2
<i>А-W-1</i> р	articip	ation in l	lectures								30
A-W-2 Ir	ndividu	ual literat	cure studies								5
<i>А-W-3</i> р	orepari	ng for te	sts								8
A-W-4 C	Consult	ations									2
Teaching me	ethod:	s / tools									
-			esentation								
М-2 р	ractica	al									
<i>M-3</i> s	ubject	discussi	on during lectures and labor	atories							
<i>M-4</i> s	elf stu	dies									
Evaluation n	netho	ds (F - r.	progressive, P - final)								
S-1			completion of lectures and la	boratories							
5-2			ry reports								
5-3			activity during lectures and	laboratories							
D			ning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Cours	e content	Teaching methods	Evaluation methods
Knowledge											
MSE_1A_C19_W knowlegge of de materials for de	evice fa		composed of functional s	MSE_1A_W03	P6S_WG P6S_WK	P6S_WG	C-1	T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6	T-W-7 T-W-8 T-W-9 T-W-10 T-W-11 T-W-12	M-1	S-1
Skills											
MSE_1A_C19_U0 ability to device defined applicat	e fabrica	ition comp	posed of functional materials for	MSE_1A_U07	P6S_UW	P6S_UW	C-1	T-L-1 T-L-2 T-L-3	T-L-4 T-L-5 T-L-6	M-2 M-3 M-4	S-1 S-2 S-3
Social comp	etenc	es									
MSE_1A_C19_K0 understanding c devices in pract	of the in		of functional materials and	MSE_1A_K02	P6S_KK	P65_WK	C-1	T-W-2	T-W-4 T-W-5 T-W-6 T-W-7 T-W-8 T-W-9 T-W-10 T-W-11 T-W-12	M-1 M-2 M-3	S-1 S-2
Outcome	es	Grade		E	valuation cr	iterion	1	1		1	1
Knowledge		-									
MSE_1A_C19_W	/01	2,0 3,0 f 3,5 4,0 4,5 5,0	rom 50 to 55% of percentage po	ints							
Skills		, -									
MSE_1A_C19_U	01	2,0 3,0 f 3,5 4,0 4,5 5,0	rom 50 to 55% of percentage po	ints							

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Other social com	petence	es
MSE_1A_C19_K01	2,0	
	3,0	from 50 to 55% of percentage points
	3,5	
	4,0	
	4,5	
	5,0	

Required reading

1. Deborah D. L. Chung, Functional Materials: Electrical, Dielectric, Electromagnetic, Optical and Magnetic Applications, World Scientific Publishing Company, 2010, ISBN-13: 978-9814287159

2. A. K. Arof, S. A. Hashim Ali, Functional Materials and Devices, Trans Tech Publications, 2006, ISBN-13: 978-0878494040

3. Donald R. Askeland, Wendelin J. Wright , Essentials of Materials Science and Engineering, Cengage Learning, 2018, ISBN-13: 978-1337385497

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Field of s	tudy	Mate	rials Scienc	e and Engi	ineering				
Mode of s	study	stati	onary	Leve	el	first	cycle		C 1
Graduate	's qualification	inżyr	nier					WTil	Lh
Fields of :	science	engii	neering and	ltechnolog	У				
Discipline	es of science	mate	erials engine	eering (100)%)				
Educatior	nal profile	gene	eral academ	ic					
Module									
Course u	nit	Adh	esives and	Coatings	;				
Code		-	1A_S_C20	j _					
Field of s	pecialisation								C
	ering faculty			Drganic Che	emical Tecl	nnology	and Polymer		
		Mate	erials	FCTC /for		5.0		_	
ECTS		5,0	1	ECTS (fori		5,0		_	
	course credit	credi	its	Language		englisł	1	_	
Electives				Elective g	roup		1		
Form of i	nstruction	Cod	Semester	Hours	5 E	CTS	Weight	Realization	Credit
laborator	y course	L	6	45		3,0	0,75	К	credits
lecture		W	6	15		2,0	0,25	К	credits
Leading t	teacher	Czec	h Zbigniew	(psa_czecł	n@wp.pl)				
Other tea	achers		kowiak Artu alczyk Krzys					niew (psa_czecł	n@wp.pl),
						-	· · · · · · · · · · · · · · · · · · ·		
Prerequis	sites								
Prerequis W-1	<i>sites</i> Fundamentals of c	hemist	ry and mater	ials science,	, presented i	n previou	s courses in this	field of study.	
W-1	Fundamentals of c		ry and mater	ials science,	, presented i	n previou	s courses in this	s field of study.	
W-1	Fundamentals of c	es			-				used in present-day
W-1 Module/c C-1	Fundamentals of c ourse unit objectiv The aim of the cou industry.	es rse is t	o get knowle	edge and skil	lls in the fiel				
W-1 Module/c C-1	Fundamentals of c ourse unit objectiv The aim of the cou	es rse is t vario	to get knowle	dge and skil	lls in the field	d of techr			used in present-day Number of hours 5
W-1 Module/cc C-1 Course co	Fundamentals of c ourse unit objectiv The aim of the cou industry.	es rse is t <i>vario</i> i oplicati	to get knowle us forms of on of a solve	dge and skil <i>instruction</i> nt-borne pol	lls in the field	d of techr			Number of hours
W-1 Module/c C-1 Course co T-L-1	Fundamentals of c ourse unit objectiv The aim of the cou industry. ontent divided into Preparation and ap	es rse is t <i>vario</i> plication	to get knowle us forms of on of a solver on of a water	dge and skil instruction nt-borne pol rborne paint	lls in the field	d of techr aint.	nology of adhesin		Number of hours 5
W-1 Module/C C-1 Course co T-L-1 T-L-2	Fundamentals of c ourse unit objectiv The aim of the cou industry. ontent divided into Preparation and ap Preparation and ap	es rse is t variou oplicati oplicati wder c	to get knowle us forms of on of a solver on of a water oating. Testir	instruction instruction nt-borne pol borne paint ng of the pre	lls in the fiel yurethane p	d of techr aint. sh and pa	nology of adhesin		Number of hours 5 5
W-1 Module/cd C-1 Course cd T-L-1 T-L-2 T-L-3	Fundamentals of c ourse unit objectiv The aim of the cou industry. ontent divided into Preparation and ap Preparation and ap Application of a po	es rse is t vario plicati pplicati wder c pplicati	to get knowle us forms of on of a solver on of a water oating. Testin on of inks an	instruction instruction nt-borne pol borne paint ng of the pre d coatings fo	lls in the field yurethane p epared varni or modificati	d of techr aint. sh and pa on of poly	nology of adhesin int coatings. rmer films.	ves and coatings (Number of hours 5 5 5
W-1 Module/cd C-1 Course cd T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6	Fundamentals of c ourse unit objectiv The aim of the cou industry. ontent divided into Preparation and ap Preparation of a po Preparation and ap Application of a po Preparation and ap Preparation of a po Characteristion of a	es rse is t oplicati oplicati wder c oplicati oplicati	to get knowle us forms of on of a solver on of a water oating. Testin on of inks and on of inks and polymer film	instruction instruction nt-borne pol borne paint ng of the pre d coatings fo d coatings fo ns and cellulo	lls in the fiel yurethane p epared varni or modificati or modificati osic materia	d of techr aint. sh and pa on of poly on of cell s for mod	nology of adhesin int coatings. ymer films. ulosic material c lified packaging	ves and coatings of the second s	Number of hours 5 5 5 5 5
W-1 Module/C C-1 Course co T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7	Fundamentals of c ourse unit objectiv The aim of the cou industry. ontent divided into Preparation and ap Preparation and ap Application of a po Preparation and ap Characteristion of solution	es rse is t variou pplicati pplicati wder c pplicati oplicati coated vent-ba	to get knowle us forms of on of a solver on of a water oating. Testin on of inks and on of inks and polymer film ased pressure	instruction instruction nt-borne pol borne paint ng of the pre d coatings fo d coatings fo d coatings fo s and cellulo e-sensitive a	lls in the fiel yurethane p epared varni or modificati or modificati osic materia dhesive acry	d of techr aint. sh and pa on of poly on of cell s for moo rlics using	nology of adhesin int coatings. ymer films. ulosic material c lified packaging g UV-C lamp.	ves and coatings of a second s	Number of hours 5 5 5 5 5 5 5 5 5 5 5
W-1 Module/C C-1 Course co T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-8	Fundamentals of c ourse unit objectiv The aim of the coulindustry. ontent divided into Preparation and ap Preparation and ap Application of a po Preparation and ap Characteristion of apo Characteristion of solv Manufacturing of o	es rse is t vario oplicati oplicati oplicati oplicati coated vent-ba ne-side	to get knowle us forms of on of a solver on of a water oating. Testin on of inks and on of inks and polymer film ased pressure ed and doubl	instruction instruction nt-borne pol borne paint ng of the pre d coatings fo d coatings fo d coatings fo e-sensitive a e-sensitive a	lls in the fiel yurethane p epared varni or modificati osic materia dhesive acry es based on s	d of techr aint. sh and pa on of poly on of cell s for moo rlics using	nology of adhesin int coatings. ymer films. ulosic material c lified packaging g UV-C lamp.	ves and coatings of a second s	Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5
W-1 Module/C C-1 Course cc T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-7 T-L-8 T-L-9	Fundamentals of c ourse unit objectiv The aim of the cou industry. ontent divided into Preparation and ap Preparation and ap Application of a po Preparation and ap Characteristion of Crosslinking of solv Manufacturing of o UV-initiated polym	es rse is t vario oplicati oplicati oplicati oplicati coated vent-ba ne-sido erizatio	to get knowle us forms of on of a solver on of a water oating. Testin on of inks and on of inks and polymer film ased pressure ed and doubl	instruction instruction nt-borne pol borne paint ng of the pre d coatings fo d coatings fo d coatings fo e-sensitive a e-sided tape adhesive mo	lls in the fiel yurethane p epared varni or modificati osic materia dhesive acry es based on s	d of techr aint. sh and pa on of poly on of cell s for moo rlics using solvent-fr	nology of adhesin nint coatings. mer films. ulosic material c lified packaging g UV-C lamp. ee low viscosity	ves and coatings of oating. materials. adhesives.	Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 5
W-1 Module/C C-1 Course co T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-5 T-L-6 T-L-7 T-L-8 T-L-9 T-W-1	Fundamentals of c ourse unit objectiv The aim of the coulindustry. ontent divided into Preparation and ap Preparation and ap Application of a po Preparation and ap Characteristion of Crosslinking of solv Manufacturing of o UV-initiated polym Definitions of a varisolvent, diluent.	es rse is t vario oplicati oplicati oplicati oplicati coated vent-ba ne-sido erizatio nish, p	to get knowle us forms of on of a solver on of a water oating. Testin on of inks and polymer film ased pressure ed and doubl on of typical a paint, adhesiv	instruction instruction nt-borne pol borne paint ng of the pre d coatings fo d coatings fo d coatings fo as and cellulo e-sensitive a e-sided tape adhesive mo re, binder, fil	lls in the fiel yurethane p epared varni or modificati osic materia dhesive acry es based on pnomers. Im forming s	d of techr aint. sh and pa on of poly on of cell s for moo clics using solvent-fr ubstance	nology of adhesin nint coatings. wer films. ulosic material c lified packaging y UV-C lamp. ee low viscosity , pigment, micro	oating. materials. adhesives.	Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 1
W-1 Module/cc C-1 Course cc T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-7 T-L-8 T-L-9 T-W-1 T-W-2	Fundamentals of c ourse unit objectiv The aim of the cou industry. ontent divided into Preparation and ap Preparation and ap Application of a po Preparation and ap Characteristion of a Crosslinking of solv Manufacturing of o UV-initiated polym Definitions of a var solvent, diluent. Characterization or	es rse is t variou oplicati oplicati oplicati oplicati coated vent-ba ne-sidu erizatio nish, p f the m rents a	to get knowle us forms of on of a solver on of a water oating. Testin on of inks and on of inks and polymer film ased pressure ed and doubl on of typical a baint, adhesiv	instruction instruction nt-borne pol borne paint ng of the pre d coatings fo d coatings fo as and cellule e-sensitive a e-sided tape adhesive mo ve, binder, fil binders, mice dditives.	lls in the field yurethane p epared varni or modificati or modificati osic materia dhesive acry es based on s onomers. Im forming s ro- and nanc	d of techr aint. sh and pa on of poly on of cell s for moo clics using solvent-fr ubstance	nology of adhesin nint coatings. wer films. ulosic material c lified packaging y UV-C lamp. ee low viscosity , pigment, micro	oating. materials. adhesives.	Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 1 4
W-1 Module/C C-1 Course co T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-5 T-L-6 T-L-7 T-L-8 T-L-9 T-W-1	Fundamentals of c ourse unit objectiv The aim of the cou industry. ontent divided into Preparation and ap Preparation and ap Application of a po Preparation and ap Characteristion of a UV-initiated polym Definitions of a var solvent, diluent. Characterization of anticorrosive), solv Preparation and ap	es rse is t variou oplicati oplicati oplicati oplicati oplicati coated rent-ba ne-sidu erizatio rnish, p f the m rents a oplicati nent of	to get knowle us forms of on of a solver on of a solver on of a water on of inks and on of inks and polymer film ased pressure ed and doubl on of typical a baint, adhesive nost popular k nd coating ac on methods of f adhesives a	instruction nt-borne pol borne paint ng of the pre d coatings fo d coatings fo d coatings fo e-sensitive a e-sided tape adhesive mo ve, binder, fil binders, mice dditives. of coating co	Ils in the field yurethane p epared varni or modificati or modificati osic materia dhesive acry es based on s onomers. Im forming s ro- and nano	d of techr aint. sh and pa on of poly on of cell ls for moo lics using solvent-fr ubstance fillers, pig	nology of adhesin int coatings. mer films. ulosic material c dified packaging g UV-C lamp. ee low viscosity , pigment, micro gments (decorat	ves and coatings of oating. materials. adhesives. and nanofiller, ive,	Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 1
W-1 Module/C C-1 Course co T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-7 T-L-8 T-L-9 T-W-1 T-W-2 T-W-2 T-W-3	Fundamentals of c ourse unit objectiv The aim of the cou industry. ontent divided into Preparation and ap Preparation and ap Application of a po Preparation and ap Preparation and ap Characteristion of Crosslinking of solv Manufacturing of o UV-initiated polym Definitions of a var solvent, diluent. Characterization of Application and ap Preparation and ap Preparation and ap Initiated polym Definitions of a var solvent, diluent. Characterization of Application and ap Historical developr and mechanisms o Types of commonity	es rse is t variou oplicati oplicati oplicati oplicati oplicati coated vent-ba ne-sidu erizatio nersidu erizatio ners a oplicati nent of f adhe y used	to get knowle us forms of on of a solver on of a solver on of a water on of inks and on of inks and polymer film ased pressure ed and double on of typical a baint, adhesive nd coating ac on methods of f adhesives a sion. adhesives ba	instruction instruction nt-borne pol borne paint ng of the pre d coatings fo d coatings fo d coatings fo e-sided tape adhesive mo ve, binder, fil binders, mice ditives. of coating co nd sealants, ased on poly	Ils in the field yurethane p epared varni or modificati or modificati osic materia dhesive acry es based on s onomers. Im forming s ro- and nanc ompositions. , from ancier	d of techr aint. sh and pa on of poly on of cell s for moo flics using solvent-fr ubstance fillers, pig at times to	nology of adhesin int coatings. mer films. ulosic material c lified packaging g UV-C lamp. ee low viscosity , pigment, micro gments (decorat	ves and coatings of oating. materials. adhesives. b- and nanofiller, ive, blogy. Theories dhesives, solvent	Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 1 4 2
W-1 Module/C C-1 Course co T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-6 T-L-7 T-L-8 T-L-9 T-W-1 T-W-2 T-W-3 T-W-4	Fundamentals of c ourse unit objectiv The aim of the cou industry. ontent divided into Preparation and ap Preparation and ap Application of a po Preparation and ap Characteristion of a Crosslinking of solv Manufacturing of o UV-initiated polym Definitions of a var solvent, diluent. Characterization of Definitions of a var solvent, diluent. Characterization of Types of commonity type adhesives, dis Adhesives for spector	es rse is t variou oplicati oplicati oplicati oplicati oplicati coated vent-ba ne-sidu erizatio ner.sidu erizatio nish, p f the m rents a oplicati nent of f adhe y used sperseo ial app	to get knowle us forms of on of a solver on of a solver on of a water on of inks and on of inks and polymer film ased pressure ed and double on of typical a baint, adhesive on methods of f adhesives a sion. adhesives ba d adhesives, p	instruction instruction nt-borne pol borne paint ng of the pre d coatings fo d coatings fo d coatings fo e-sided tape adhesive mo ve, binder, fil binders, mice ditives. of coating co nd sealants, ased on poly pressure-ser	Ils in the field yurethane p epared varni or modificati or modificati osic materia dhesive acry es based on s onomers. Im forming s ro- and nanc ompositions. , from ancier	d of techr aint. sh and pa on of poly on of cell s for moo flics using solvent-fr ubstance fillers, pig at times to nelt adhe sives) an	nology of adhesin int coatings. mer films. ulosic material c lified packaging g UV-C lamp. ee low viscosity , pigment, micro gments (decorat o modern techno sives, contact ad d their applicatio	ves and coatings of oating. materials. adhesives. b- and nanofiller, ive, blogy. Theories dhesives, solvent on.	Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 6 2 2 2
W-1 Module/C C-1 Course co T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-6 T-L-7 T-L-8 T-L-7 T-L-8 T-L-9 T-W-1 T-W-1 T-W-2 T-W-3 T-W-3 T-W-4 T-W-5	Fundamentals of c ourse unit objectiv The aim of the cou industry. ontent divided into Preparation and ap Preparation and ap Application of a po Preparation and ap Characteristion of a Crosslinking of solv Manufacturing of o UV-initiated polym Definitions of a var solvent, diluent. Characterization of The aim of the course UV-initiated polym Definitions of a var Solvent, diluent. Characterization of Types of commonity type adhesives, dis	es rse is t variou oplicati oplicati oplicati oplicati oplicati coated vent-ba ne-sidu erizatio rnish, p f the m rents a oplicati nent of f adhe y used spersed ial app moder	to get knowle us forms of on of a solver on of a solver on of a water on of inks and on of inks and polymer film ased pressure ed and doubl on of typical a baint, adhesive d coating ac on methods of f adhesives a sion. adhesives ba d adhesives, lications. Pre n industry	instruction instruction nt-borne pol borne paint ng of the pre d coatings fo d coatings fo as and cellulo e-sensitive a e-sided tape adhesive mo ve, binder, fil binders, mice dditives. of coating co nd sealants, ased on poly pressure-sensit	Ils in the field yurethane p epared varni or modificati or modificati osic materia dhesive acry es based on s onomers. Im forming s ro- and nand ompositions. , from ancier mers ((hot-r nsitive adhesive	d of techr aint. sh and pa on of poly on of cell s for moo flics using solvent-fr ubstance fillers, pig at times to nelt adhe sives) an	nology of adhesin int coatings. mer films. ulosic material c dified packaging g UV-C lamp. ee low viscosity , pigment, micro gments (decorat o modern techno sives, contact ad d their applicatio logy and their ap	ves and coatings of oating. materials. adhesives. b- and nanofiller, ive, blogy. Theories dhesives, solvent on.	Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 1 4 2 2 2 2 2 2 2 2 2 2 2 2
W-1 Module/C C-1 Course co T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-7 T-L-7 T-L-8 T-L-9 T-W-1 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7	Fundamentals of c ourse unit objectiv The aim of the cou industry. ontent divided into Preparation and ap Preparation and ap Application of a po Preparation and ap Preparation and ap Characteristion of Crosslinking of solv Manufacturing of o UV-initiated polym Definitions of a var solvent, diluent. Characterization of Apreparation and ap Definitions of a var solvent, diluent. Characterization of Anticorrosive), solv Preparation and ap Historical developr and mechanisms o Types of commonity type adhesives for spect many branches of Physical and chem	es rse is t variou oplicati oplicati oplicati oplicati oplicati coated vent-ba ne-sidu erizatio nesidu erizatio nish, p the m vents a oplicati nent of f adhe y used spersed ial app moder ical tes	to get knowle us forms of on of a solver on of a solver on of a water on of inks and on of inks and polymer film ased pressure ed and double on of typical a baint, adhesive nost popular b nd coating ac on methods of f adhesives a sion. adhesives ba d adhesives, lications. Pre n industry sting and ana	instruction instruction nt-borne pol borne paint ng of the pre d coatings fo d coatings fo as and cellulo e-sensitive a e-sided tape adhesive mo ve, binder, fil binders, mice dditives. of coating co nd sealants, ased on poly pressure-sensit	Ils in the field yurethane p epared varni or modificati or modificati osic materia dhesive acry es based on s onomers. Im forming s ro- and nand ompositions. , from ancier mers ((hot-r nsitive adhesive	d of techr aint. sh and pa on of poly on of cell s for moo flics using solvent-fr ubstance fillers, pig at times to nelt adhe sives) an	nology of adhesin int coatings. mer films. ulosic material c dified packaging g UV-C lamp. ee low viscosity , pigment, micro gments (decorat o modern techno sives, contact ad d their applicatio logy and their ap	ves and coatings of oating. materials. adhesives. b- and nanofiller, ive, blogy. Theories dhesives, solvent on.	Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 6 7 1 4 2 3
W-1 Module/C C-1 Course co T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-7 T-L-7 T-L-8 T-L-9 T-W-1 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7	Fundamentals of c ourse unit objectiv The aim of the cou industry. ontent divided into Preparation and ap Preparation and ap Application of a po Preparation and ap Preparation and ap Preparation and ap Characteristion of Crosslinking of solv Manufacturing of o UV-initiated polym Definitions of a var solvent, diluent. Characterization oi Anticorrosive), solv Preparation and ap Historical developr and mechanisms o Types of commonistive, dis Adhesives for spec many branches of Physical and chem	es rse is t variou oplicati oplicati oplicati oplicati oplicati coated vent-ba ne-sidu erization ne-sidu erization f the m rents a oplicati nent of f adhe y used spersed ial app moder ical tes	to get knowle us forms of on of a solver on of a solver on of a water on of inks and polymer film ased pressure ed and double on of typical a baint, adhesive con methods of f adhesives a sion. adhesives bad d adhesives bad	instruction instruction nt-borne pol borne paint ng of the pre d coatings fo d coatings fo as and cellulo e-sensitive a e-sided tape adhesive mo ve, binder, fil binders, mice dditives. of coating co nd sealants, ased on poly pressure-sensit	Ils in the field yurethane p epared varni or modificati or modificati osic materia dhesive acry es based on s onomers. Im forming s ro- and nand ompositions. , from ancier mers ((hot-r nsitive adhesive	d of techr aint. sh and pa on of poly on of cell s for moo flics using solvent-fr ubstance fillers, pig at times to nelt adhe sives) an	nology of adhesin int coatings. mer films. ulosic material c dified packaging g UV-C lamp. ee low viscosity , pigment, micro gments (decorat o modern techno sives, contact ad d their applicatio logy and their ap	ves and coatings of oating. materials. adhesives. b- and nanofiller, ive, blogy. Theories dhesives, solvent on.	Number of hours 5 6 7 7 7 7 7 7 7 7 7 7 7 7
W-1 Module/C C-1 Course co T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-7 T-L-7 T-L-8 T-L-7 T-L-7 T-L-8 T-L-7 T-L-7 T-L-8 T-L-7 T-L-8 T-L-7 T-L-8 T-L-7 T-L-8 T-L-7 T-L-8 T-L-7 T-L-8 T-L-7 T-L-8 T-L-7 T-L-8 T-L-7 T-L-8 T-L-7 T-L-8 T-L-7 T-L-8 T-L-7 T-L-8 T-L-9 T-W-1 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-5 T-W-5 T-W-5 T-W-5 T-W-5 T-W-5 T-W-7 Student v	Fundamentals of c ourse unit objectiv The aim of the cou industry. ontent divided into Preparation and ap Preparation and ap Application of a po Preparation and ap Preparation and ap Characteristion of Crosslinking of solv Manufacturing of o UV-initiated polym Definitions of a var solvent, diluent. Characterization of Apreparation and ap Definitions of a var solvent, diluent. Characterization of Anticorrosive), solv Preparation and ap Historical developr and mechanisms o Types of commonity type adhesives for spect many branches of Physical and chem	es rse is t variou oplicati oplicati oplicati oplicati oplicati coated vent-ba residu erizatio ne-sidu erizatio nish, p f the m rents a oplicati nent of f adhe y used spersed ial app moder ical tes	to get knowle us forms of on of a solver on of a solver oating. Testin on of inks and polymer film ased pressure ed and double on of typical a paint, adhesive to of typical a paint, adhesive on methods of f adhesives a sion. adhesives ba d adhesives ba d adhesives ba d adhesives ba d adhesives ba d adhesives ba d adhesives, lications. Pre n industry asting and ana <i>ity</i> y exercises.	instruction instruction nt-borne pol borne paint ng of the pre d coatings fo d coatings fo as and cellulo e-sensitive a e-sided tape adhesive mo ve, binder, fil binders, mice dditives. of coating co nd sealants, ased on poly pressure-sensit	Ils in the field yurethane p epared varni or modificati or modificati osic materia dhesive acry es based on s onomers. Im forming s ro- and nand ompositions. , from ancier mers ((hot-r nsitive adhesive	d of techr aint. sh and pa on of poly on of cell s for moo flics using solvent-fr ubstance fillers, pig at times to nelt adhe sives) an	nology of adhesin int coatings. mer films. ulosic material c dified packaging g UV-C lamp. ee low viscosity , pigment, micro gments (decorat o modern techno sives, contact ad d their applicatio logy and their ap	ves and coatings of oating. materials. adhesives. b- and nanofiller, ive, blogy. Theories dhesives, solvent on.	Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 5 6 7 1 4 2 3 4 5 5 5 5 5 5 5 5 5 5
W-1 Module/C C-1 Course co T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-L-6 T-L-7 T-L-8 T-L-7 T-L-8 T-L-9 T-W-1 T-W-1 T-W-2 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-5 T-W-6 T-W-7 Student v A-L-1	Fundamentals of c ourse unit objectiv The aim of the cou industry. ontent divided into Preparation and ap Preparation and ap Application of a po Preparation and ap Preparation and ap Characteristion of Crosslinking of solv Manufacturing of o UV-initiated polym Definitions of a var solvent, diluent. Characterization of Anticorrosive), solv Preparation and ap Historical developm Definitions of a var solvent, diluent. Characterization of Anticorrosive), solv Preparation and ap Historical developm and mechanisms o Types of commonity type adhesives, dis Adhesives for spector many branches of Physical and chem workload - forms of Participation in lab	es rse is t variou oplicati oplicati oplicati oplicati oplicati coated vent-ba residu erizatio ne-sidu erizatio nish, p f the m rents a oplicati nent of f adhe y used spersed ial app moder ical tes	to get knowle us forms of on of a solver on of a solver oating. Testin on of inks and polymer film ased pressure ed and double on of typical a paint, adhesive to of typical a paint, adhesive on methods of f adhesives a sion. adhesives ba d adhesives ba d adhesives ba d adhesives ba d adhesives ba d adhesives ba d adhesives, lications. Pre n industry asting and ana <i>ity</i> y exercises.	instruction instruction nt-borne pol borne paint ng of the pre d coatings fo d coatings fo as and cellulo e-sensitive a e-sided tape adhesive mo ve, binder, fil binders, mice dditives. of coating co nd sealants, ased on poly pressure-sensit	Ils in the field yurethane p epared varni or modificati or modificati osic materia dhesive acry es based on s onomers. Im forming s ro- and nand ompositions. , from ancier mers ((hot-r nsitive adhesive	d of techr aint. sh and pa on of poly on of cell s for moo flics using solvent-fr ubstance fillers, pig at times to nelt adhe sives) an	nology of adhesin int coatings. mer films. ulosic material c dified packaging g UV-C lamp. ee low viscosity , pigment, micro gments (decorat o modern techno sives, contact ad d their applicatio logy and their ap	ves and coatings of oating. materials. adhesives. b- and nanofiller, ive, blogy. Theories dhesives, solvent on.	Number of hours 5 5 5 5 5 5 5 5 5 5 5 5 5 6 5 6 7 6 7

Student wo	orkload	- form	s of activity						Nun	nber of	hours
A-W-2	Self-stu	dy of th	e literature								30
A-W-3	Consulta	ations									15
Teaching m	nethods	s / tools	S								
_	Lecture										
М-2	Laborat	ory exe	rcises								
Evaluation	method	ds (F -	progressive, P - final)								
S-1	P١	Written	test								
	Designe	ed lear	ning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course o	ontent	Teaching methods	Evaluation methods
Knowledge											
and self adhes	as a know live mater olymers a	rials, coa is well as	bout technology of adhesives atings, and fillers, solvents and s modern auxiliary agents for	MSE_1A_W03 MSE_1A_W04	P6S_WG P6S_WK	P6S_WG	C-1	T-W-2	T-W-5 T-W-6 T-W-7	M-1	S-1
MSE_1A_C20_L The student ha adhesives, incl	as skills ir luding pre	eparation	d of modern coatings and n, purification, application testing of their properties.	MSE_1A_U01 MSE_1A_U08	P6S_UK P6S_UW	P6S_UW	C-1	T-L-2 T-L-3	T-L-6 T-L-7 T-L-8 T-L-9	M-2	5-1
Social com	petence	e <i>s</i>									
	nderstand plogies in		le of modern, environmentally l of adhesives, self-adhesive	MSE_1A_K01 MSE_1A_K02	P6S_KK	P6S_WK	C-1	T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7	T-L-9 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6 T-W-7	M-1 M-2	S-1
Outcom	ies (Grade		E	valuation cri	iterion					
Knowledge											
MSE_1A_C20_V	W01	2,0 3,0 3,5 4,0 4,5 5,0	Student describes selected issue	s at a basic level (:	score => 50%)						
Skills		5,0									
MSE_1A_C20_U	101	2,0									
			Student describes selected issue	s at a basic level (:	score => 50%)						
Other socia	al comp		25								
MSE_1A_C20_k	-	2,0	Student describes selected issue	s at a basic level (:	score => 50%)						
Required re	adina	-,-									
-		nd coat	ing testing manual, ASTM, Ph	iladelphia. 1995							
-			mposites, The McGraw-Hill Co								
-	-		ic coatings, John Wiley&Sons,								
	-	-	rs), Handbook of Adhesive Te		l Dekker Inc.,	New York - Ba	sel, 200)3, 2nd	Ed.		
5 Benedek	Pressi	ire-Sen	sitive Adhesives and Applicat	ion Marcel Dekk	erinc New Y	ork - Basel 2	004 2n	d Ed			



Faculty of Chemical Technology and Engineering

Required reading

6. Z. Czech, D. Sowa, Adhesion of Pressure-Sensitive Adhesives, Especially of Solvent-Based PSA, WPUT Szczecin Publishing House, Szczecin, 2016

Field of st				-				1	
	tudy	Mate	rials Scienc	e and Enginee	ring				
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lecture		W	6	30	2	,0	0,30	к	examination
Leading t	eacher	Micha	alkiewicz Be	eata (Beata.M	chalkiev	/icz@zu	t.edu.pl)		
Other tea	chers	(Beat	a.Michalkie	wicz@zut.edu	.pl), Pell	ka Rafal	ol), Michalkiew (Rafal.Pelka@ arek (Marek.Zw	zut.edu.pl), Sre	ńscek-Nazzal
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Student wo	rkload	d - form	s of activity						Nun	nber o	f hours
<i>A-L-4</i> i	ndivid	ual cons	ultations								6
		ing Class									30
	Prepar	ing for th	ne exam								26
	ndivid	ual cons	ultations								2
A-W-4	The ex	am									2
Teaching m	ethoc	ls / tool	S								
	Lecture	-									
M-2	Labora	itory									
	metho	ods (F -	progressive, P - final)								
S-1	Р	Exam									
5-2	F	written	test								
ſ	Desigr	ned lear	ning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course	e content	Teaching methods	Evaluation methods
Knowledge					•					•	
MSE_1A_C21_V Student descril porous materia	oes sele		es concerning the structure of d synthesis	MSE_1A_W03	P6S_WG P6S_WK	P6S_WG	C-1	T-W-1 T-W-2 T-W-3 T-W-4 T-W-5	T-W-6 T-W-7 T-W-8 T-W-9 T-W-10	M-1	S-1
Skills											
properties of p	terizes prous m		ture and determines the basic	MSE_1A_U07	P6S_UW	P6S_UW	C-2	T-L-1 T-L-3	T-L-5 T-L-6	M-2	S-2
MSE_1A_C21_U Student synthe		elected po	rous materials	MSE_1A_U08	P6S_UK	P6S_UW	C-2	T-L-2	T-L-4	M-2	S-2
Social comp										1	
MSE_1A_C21_K Student unders foams in practi	stands t		ance of porous structures and	MSE_1A_K02	P65_KK	P6S_WK	C-1 C-2	T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-W-1 T-W-2 T-W-3	T-W-4 T-W-5 T-W-6 T-W-7 T-W-8 T-W-9 T-W-10 T-W-10 T-W-11 T-W-12	M-1 M-2	S-1 S-2
Outcom	es	Grade		E	valuation cr	iterion					
Knowledge											
MSE_1A_C21_V	V01	2,0 3,0 3,5	Student describes selected issue (exam score => 50%)	es concerning the st	tructure of porou	us materials, pro	operties	and synt	thesis at a	a basic le	evel
		4,0									
		4,5									
		5,0									
Skills											
MSE_1A_C21_U	01		Student characterizes properties	s of porous material	s at a basic leve	el (exam score =	=> 50%)				
		3,5 4,0 4,5									
		5,0									
MSE_1A_C21_U	02		Student synthetises selected po	rous materials at a	basic level (exa	m score => 50%	%)				
		3,5 4,0 4,5									
		4,5 5,0									

Faculty of Chemical Technology and Engineering

Other social com	petenc	es
MSE_1A_C21_K01	2,0	
	3,0	Student understands the structure-property relationship in porous materials at a basic level (exam score => 50%)
	3,5	
	4,0	
	4,5	
	5,0	

Required reading

1. David Atwood, David Atwood, Gerd Meyer, Derek Woollins, Introduction to Porous Materials, A Wiley Series of Advanced Textbooks, 2019

2. Duncan W. Bruce, Dermot O'Hare, Richard I. Walton, Porous Materials, A John Wiley and Sons, Ltd, Publication, 2011

Field of st	-			e and Engineeri	ng				
Mode of st	-		onary	Level		first o	cycle	WTil	~h
Graduate'	s qualification	inży	nier					44111	
Fields of s	cience	engi	neering and	technology					
Disciplines	s of science	mate	erials engine	ering (100%)					<u> </u>
Education	al profile	gene	eral academ	ic					
Module									
Course un	it	Cas	e Studies i	n Biomaterials					
Code		MSE	_1A_S_C22a						
Field of sp	ecialisation								C
Administe	ring faculty	Dep	artment of P	olymer and Bior	nateria	als Scier	nce		
ECTS		4,0		ECTS (forms)		4,0			
Form of co	ourse credit	cred	its	Language		english	1		
Electives		8		Elective group				_	
Form of in	struction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
project co	urse	Р	6	15	1	,0	0,25	К	credits
seminars		S	6	45		,0	0,75	К	credits
Leading te	acher	-		a (Miroslawa.ElF				<u> </u>	
Other tead	chers	Bied (Xue	unkiewicz A cheng.Chen	nna (Anna.Biedu @zut.edu.pl), El ki@zut.edu.pl)	unkiew	icz@zut	.edu.pl), Chen		.pl), Sobolewski
Prerequisi			nor motol on	d eeroneie neeterie		ania ak			ution valationship
W-1	Basic knowledge in with the application			u ceramic materia	is synu	iesis, ch		a structure-prope	ercies relacionship
Module/co	ourse unit objectiv	es							
C-1	To gain the knowle medical application		kills and com	petences in the fie	eld of va	arious as	pects of biomate	erials synthesis, c	haracterization and
C-2	To carry out a basi		ature search b	ased on database	es and s	cientific	literature.		
Course co	ntent divided into								Number of hours
T-P-1	Design of biomater								5
T-P-2	Design of metal an								5
Т-Р-3	Nanomaterials for								5
T-S-1	Operating condition	ns and	l mechanisms	of dergadation/fa	ilure of	biomedi	cal materials		3
T-S-2	The most common	proble	ems with ensu	iring the quality o	f implaı	nts and e	endoprostheses		3
T-S-3	Methods of preven	ting bi	iomaterials fro	om destructive pho	enomer	na			3
T-S-4	The issue of biocor	•							3
T-S-5	Development direc	tions (es	of nano- and r	nicro-crystalline c	eramic,	metallio	and composite	biomaterials.	3
T-S-6	Production process	of TiC	02 - cause and	d effect relationshi	ips				6
T-S-7	Analysis and discus	ssion o	of current bior	materials literature	9				15
T-S-8	Analysis and discus	ssion o	of current nan	omaterials literatu	ure				9
Student w	orkload - forms of	activ	rity						Number of hours
A-P-1	participation in pro	-							15
A-P-2	individual study of	literat	ure						10
A-P-3	consultations								5
A-S-1	participation in ser								45
A-S-2	individual study of	literat	ure						30
A-S-3	consultations								15
	methods / tools								
M-1	Seminars								
M-2	Discussion								

T = = = {= { = = = =		-1- (11						9			
Teaching M-3	Case s		S								
M-3 M-4	Projec	-									
			progressive, P - final)								
S-1	F	-	nent based on evaluation of t		tation and act	ivity during di	scussio	ns (ser	minar).		
5-2	Р	Written	project and presentation (pro	oject)							
	Desig	ned lear	ning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Cours	e content	Teaching methods	Evaluatior methods
Knowledg	е										
field of biom	hās know	vledge in tl	he subject of case analysis in the	MSE_1A_W10	P6S_WK	P6S_WG	C-1 C-2	T-P-1 T-P-2 T-P-3 T-S-1 T-S-2 T-S-3	T-S-4 T-S-5 T-S-6 T-S-7 T-S-8	M-1 M-2 M-3 M-4	S-1 S-2
Skills				1	1	1				1	
MSE_1A_C22 Studdent car Engineering	n perform		udy for selected Biomaterials	MSE_1A_U09 MSE_1A_U12	P6S_UO P6S_UW		C-1 C-2	T-P-1 T-P-2 T-P-3 T-S-1 T-S-2 T-S-3	T-S-4 T-S-5 T-S-6 T-S-7 T-S-8	M-1 M-2 M-3 M-4	S-1 S-2
Social cor	npeten	ces		•							
MSE_1A_C22 Student und developmen	erstands		or continuous training and studies	MSE_1A_K05	P6S_KR	P6S_WK	C-1 C-2	T-P-1 T-P-2 T-P-3 T-S-1 T-S-2 T-S-3	T-S-4 T-S-5 T-S-6 T-S-7 T-S-8	M-1 M-2 M-3 M-4	S-1 S-2
Outco	mes	Grade		E	valuation cr	iterion					
Knowledg	е										
MSE_1A_C22		2,0									
			from 50 to 55% of percentage po	oints							
		3,5									
		4,0									
		4,5									
		5,0									
Skills											
MSE_1A_C22	a_U01	2,0									
			from 50 to 55% of percentage po	oints							
		3,5 4,0									
		4,0									
		5,0									
Other soc	ial com		25								
MSE_1A_C22		2,0									
	-		from 50 to 55% of percentage po	pints							
		3,5									
		4,0									
		4,5									
		5,0									
Required											
-			, D.R. Peterson, Biomaterials								
		-	Majernik, Biomedical engine	-	applications i	n medicine, Ir	Tech, 2	2012			
			Bioengineering, InTechOpen								
	Boccacc	ini. Peter	X. Ma, Tissue Engineering Us	ing Ceramics an	d Polymers, E	lsevier, 2014					

Field of s	tudy	Mate	erials Scienc	e and Engineeri	ng				
Mode of s	study	stati	onary	Level		first o	cycle		
Graduate	e's qualification	inży	nier	I				WTil	Ch
Fields of .		-		technology					
	es of science			eering (100%)					
	nal profile		eral academ	-					
	nai prome	gene							
Module	••	-	<u> </u>						
Course u	nit	_		n Medical Devi	ces				
Code		MSE	_1A_S_C22b	•					C
Field of s	pecialisation								
Administ	ering faculty	Dep	artment of M	laterials Techno	logy				
ECTS		4,0		ECTS (forms)		4,0			
Form of c	course credit	cred	its	Language		english	ı		
Electives		8		Elective group					
Form of i	nstruction	Cod	Semester	Hours	EC	CTS	Weight	Realization	Credit
project co		P	6	15		,0	0,30	K	credits
seminars		S	6	45		,0	0,70	K	credits
Leading t			-	nna (Anna.Biedu		-		K	creats
Other tea		(Xue	cheng.Chen	nna (Anna.Biedu n@zut.edu.pl), El ki@zut.edu.pl)					.pl), Sobolewski
		FIOLI	(hannena	Ki@Zut.cuu.pl)					
Prerequis	sites	FIOLI	(psobolews						
Prerequis W-1	Basic knowledge ir	n polyr	ner, metal an	d ceramic materia	ls synti	nesis, chi	aracterization a	nd structure-prop	erties relationship
W-1	Basic knowledge ir with the applicatio	n polyr n in m	ner, metal an	d ceramic materia	ls syntl	nesis, ch	aracterization a	nd structure-prop	erties relationship
W-1 Module/c	Basic knowledge ir with the applicatio ourse unit objectiv	n polyr n in m res	ner, metal an edical device	d ceramic materia s	-				
W-1 Module/c C-1	Basic knowledge ir with the applicatio ourse unit objectiv To gain the knowle medical devices ap	n polyr n in m es edge, s oplicat	ner, metal an edical devices kills and com ions	d ceramic materia s petences in the fie	eld of va	arious as	pects of biomat		
W-1 Module/c	Basic knowledge ir with the applicatio ourse unit objectiv To gain the knowle	n polyr n in m es edge, s oplicat	ner, metal an edical devices kills and com ions	d ceramic materia s petences in the fie	eld of va	arious as	pects of biomat		
W-1 Module/c C-1 C-2	Basic knowledge ir with the applicatio ourse unit objectiv To gain the knowle medical devices ap	n polyr n in m res edge, s oplicat ic litera	ner, metal an edical devices kills and com ions ature search b	d ceramic materia s petences in the fie pased on database	eld of va	arious as	pects of biomat		haracterization in
W-1 Module/c C-1 C-2	Basic knowledge ir with the applicatio ourse unit objectiv To gain the knowle medical devices ap To carry out a basi	n polyr n in m edge, s oplicat ic litera	ner, metal an edical devices kills and com ions ature search b ous forms of	d ceramic materia s petences in the fie pased on database instruction	eld of va	arious as	pects of biomat literature.	erials synthesis, o	haracterization in
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W-1 Module/c C-1 C-2 Course co T-P-1 T-P-2	Basic knowledge ir with the applicatio ourse unit objectiv To gain the knowle medical devices ap To carry out a basi ontent divided into Design criteria and Design criteria for Nanocomposites ir Issues with biocom	n polyr n in m 'es edge, s oplicat ic litera ic litera d mate metals n medi npatibi	ner, metal an edical devices kills and com ions ature search t <i>rus forms of</i> rials for blood s and ceramic cal devices lity of implant	d ceramic materia s petences in the fie pased on database <i>instruction</i> I contacting medic used in medical d	eld of va es and s al devices levices eses. In	arious as scientific ces (hear npact of	pects of biomat literature. rt assist devices implants on life	erials synthesis, o	Number of hours
W-1 Module/c C-1 C-2 Course co T-P-1 T-P-2 T-P-3	Basic knowledge ir with the applicatio ourse unit objectiv To gain the knowle medical devices ap To carry out a basi ontent divided into Design criteria and Design criteria for Nanocomposites ir	n polyr n in m edge, s oplicat ic litera vario d mate metals n medi npatibi	ner, metal an edical devices kills and com ions ature search b <i>rus forms of</i> rials for blood s and ceramic cal devices lity of implant cure of the hu	d ceramic materia s petences in the fie pased on database <i>instruction</i> I contacting medic used in medical d as and endoprosthe man body. Probler	al devides and set of values a	arious as scientific ces (hear npact of ensuring	pects of biomat literature. rt assist devices implants on life g the durability	erials synthesis, o) processes. of the quality of	Number of hours
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W-1 Module/c C-1 C-2 Course co T-P-1 T-P-2 T-P-3 T-S-1 T-S-1 T-S-2 T-S-3 T-S-4 T-S-5	Basic knowledge ir with the applicatio ourse unit objectiv To gain the knowle medical devices ap To carry out a basi ontent divided into Design criteria and Design criteria for Nanocomposites ir Issues with biocom Introduction to the ceramic, metallic a human tissue. Improving oseointe Titanium nanotube Reconstruction of Problems of joining	n polyr n in m es edge, s oplicat ic litera o vario d mate metals n medi n patibi e struct and con egratices in bi biologi g meta s of TiC	ner, metal an edical devices kills and com ions ature search t <i>us forms of</i> rials for blood s and ceramic cal devices lity of implant cure of the hu mposite biom on (ceramic bi omaterials su cal tissues. D llic and ceram D2 - cause an	d ceramic materia s petences in the fie pased on database <i>instruction</i> I contacting medic used in medical d aterials in the envious oactive layers). Mi inface engineering. esign of scaffoldin nic biomaterials. d effect relationshi	al devid al devid levices eses. In ns with ironme cropord g	arious as scientific ces (hear npact of ensuring nt of boo	pects of biomat literature. rt assist devices implants on life g the durability dy fluids and in c	erials synthesis, o) processes. of the quality of contact with	Number of hours
W-1 Module/c C-1 C-2 Course co T-P-1 T-P-2 T-P-3 T-S-1 T-S-1 T-S-2 T-S-3 T-S-4 T-S-5 T-S-6	Basic knowledge ir with the applicatio ourse unit objectiv To gain the knowle medical devices ap To carry out a basi ontent divided into Design criteria and Design criteria for Nanocomposites ir Issues with biocom Introduction to the ceramic, metallic a human tissue. Improving oseointo Titanium nanotube Reconstruction of Problems of joining Production process	n polyr n in m es edge, s oplicat ic litera vario d mate metals n medi npatibi estruct and co egratic es in bi biologi g meta s of TiC ssion c	mer, metal an edical devices kills and com ions ature search b <i>us forms of</i> rials for blood s and ceramic cal devices lity of implant cure of the hu mposite biom omaterials su cal tissues. D llic and ceram D2 - cause and	d ceramic materia s petences in the fie based on database <i>instruction</i> I contacting medic cused in medical d contacting medical d cused in medica	eld of va es and s al devices eses. In ns with ironme croporo g ips ure	arious as scientific ces (hear npact of ensuring nt of boo	pects of biomat literature. rt assist devices implants on life g the durability dy fluids and in c	erials synthesis, o) processes. of the quality of contact with	haracterization in Number of hours 5 5 5 3 3 3 3 3 3 3 6
W-1 Module/c C-1 C-2 Course co T-P-1 T-P-2 T-P-3 T-S-1 T-S-1 T-S-2 T-S-3 T-S-4 T-S-5 T-S-6 T-S-7 T-S-8	Basic knowledge ir with the applicatio ourse unit objectiv To gain the knowle medical devices ap To carry out a basi ontent divided into Design criteria and Design criteria for Nanocomposites ir Issues with biocom Introduction to the ceramic, metallic a human tissue. Improving oseointe Titanium nanotube Reconstruction of Problems of joining Production process Analysis and discu	n polyr n in m res edge, s oplicat ic litera o vario d mate metals n medi npatibi e struct and col egratic es in bi biologi g meta s of TiC ssion c	ner, metal an edical devices skills and com ions ature search b <i>us forms of</i> rials for blood s and ceramic cal devices lity of implant ture of the hu mposite biom on (ceramic bi omaterials su cal tissues. D llic and ceram D2 - cause and of current meto of current meto	d ceramic materia s petences in the fie based on database <i>instruction</i> I contacting medic cused in medical d contacting medical d cused in medica	eld of va es and s al devices eses. In ns with ironme croporo g ips ure	arious as scientific ces (hear npact of ensuring nt of boo	pects of biomat literature. rt assist devices implants on life g the durability dy fluids and in c	erials synthesis, o) processes. of the quality of contact with	haracterization in Number of hours 5 5 5 5 3 3 3 3 3 3 6 1 5 9
W-1 Module/c C-1 C-2 Course co T-P-1 T-P-2 T-P-3 T-S-1 T-S-2 T-S-3 T-S-4 T-S-5 T-S-6 T-S-7 T-S-7 T-S-8	Basic knowledge ir with the applicatio ourse unit objectiv To gain the knowle medical devices ap To carry out a basi ontent divided into Design criteria and Design criteria for Nanocomposites ir Issues with biocom Introduction to the ceramic, metallic a human tissue. Improving oseointe Titanium nanotube Reconstruction of Problems of joining Production process	n polyr n in m es edge, s oplicat ic litera vario d mate metals n medi npatibi estruct and co egratic es in bi biologi g meta s of TiC ssion c ssion c	ner, metal an edical devices skills and com ions ature search b <i>us forms of</i> rials for blood s and ceramic cal devices lity of implant ture of the hu mposite biom on (ceramic bi omaterials su cal tissues. D llic and ceram D2 - cause and of current meto of current meto	d ceramic materia s petences in the fie based on database <i>instruction</i> I contacting medic cused in medical d contacting medical d cused in medica	eld of va es and s al devices eses. In ns with ironme croporo g ips ure	arious as scientific ces (hear npact of ensuring nt of boo	pects of biomat literature. rt assist devices implants on life g the durability dy fluids and in c	erials synthesis, o) processes. of the quality of contact with	haracterization in Number of hours 5 5 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
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W-1 Module/c C-1 C-2 Course co T-P-1 T-P-2 T-P-3 T-S-1 T-S-1 T-S-2 T-S-3 T-S-4 T-S-5 T-S-6 T-S-7 T-S-6 T-S-7 T-S-8 Student v A-P-1 A-P-2	Basic knowledge ir with the applicatio ourse unit objectiv To gain the knowle medical devices ap To carry out a basi ontent divided into Design criteria and Design criteria for Nanocomposites ir Issues with biocom Introduction to the ceramic, metallic a human tissue. Improving oseointe Titanium nanotube Reconstruction of Problems of joining Production process Analysis and discu workload - forms of participation in pro	n polyr n in m es edge, s oplicat ic litera ovario d mate metals n medi- npatibi estruct and col egratic es in bi biologi g meta s of TiC ssion c ssion c f activ ojects	mer, metal an edical devices kills and com ions ature search b <i>us forms of</i> rials for blood s and ceramic cal devices lity of implant cal devices lity of implant ure of the hu mposite biom on (ceramic bi omaterials su cal tissues. D llic and ceram of current meno of current man <i>rity</i>	d ceramic materia s petences in the fie based on database <i>instruction</i> I contacting medic cused in medical d contacting medical d cused in medica	eld of va es and s al devices eses. In ns with ironme croporo g ips ure	arious as scientific ces (hear npact of ensuring nt of boo	pects of biomat literature. rt assist devices implants on life g the durability dy fluids and in c	erials synthesis, o) processes. of the quality of contact with	haracterization in Number of hours 5 5 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
W-1 Module/c C-1 C-2 Course co T-P-1 T-P-2 T-P-3 T-S-1 T-S-1 T-S-2 T-S-3 T-S-4 T-S-5 T-S-6 T-S-7 T-S-6 T-S-7 T-S-8 Student v A-P-1 A-P-2 A-P-3	Basic knowledge in with the applicatio ourse unit objectiv To gain the knowle medical devices ap To carry out a basi ontent divided into Design criteria and Design criteria for Nanocomposites in Issues with biocom Introduction to the ceramic, metallic a human tissue. Improving oseointe Titanium nanotube Reconstruction of Problems of joining Production process Analysis and discu Morkload - forms of participation in pro- individual study of consultations	n polyr n in m es edge, s oplicat ic litera ovario d mate metals n medi- npatibi estruct and col egratic es in bi biologi g meta s of TiC ssion c ssion c f activ ojects	mer, metal an edical devices kills and com ions ature search b <i>us forms of</i> rials for blood s and ceramic cal devices lity of implant cal devices lity of implant ure of the hu mposite biom on (ceramic bi omaterials su cal tissues. D llic and ceram of current meno of current man <i>rity</i>	d ceramic materia s petences in the fie based on database <i>instruction</i> I contacting medic cused in medical d contacting medical d cused in medica	eld of va es and s al devices eses. In ns with ironme croporo g ips ure	arious as scientific ces (hear npact of ensuring nt of boo	pects of biomat literature. rt assist devices implants on life g the durability dy fluids and in c	erials synthesis, o) processes. of the quality of contact with	Number of hours
W-1 Module/c C-1 C-2 Course co T-P-1 T-P-2 T-P-3 T-S-1 T-S-3 T-S-4 T-S-5 T-S-6 T-S-7 T-S-6 T-S-7 T-S-8 Student v A-P-1 A-P-2 A-P-3 A-S-1	Basic knowledge in with the applicatio ourse unit objectiv To gain the knowle medical devices ap To carry out a basi ontent divided into Design criteria and Design criteria for Nanocomposites in Issues with biocom Introduction to the ceramic, metallic a human tissue. Improving oseointo Titanium nanotube Reconstruction of Problems of joining Production process Analysis and discu workload - forms of participation in pro individual study of consultations participation in ser	n polyr n in m es edge, s oplicat ic litera ovario d mate metals n medi- npatibi estruct and col egratic es in bi biologi g meta s of TiC ssion c ssion c f activ ojects	mer, metal an edical devices kills and com ions ature search b <i>us forms of</i> rials for blood s and ceramic cal devices lity of implant cal devices lity of implant ure of the hu mposite biom on (ceramic bi omaterials su cal tissues. D llic and ceram of current meno of current man <i>rity</i>	d ceramic materia s petences in the fie based on database <i>instruction</i> I contacting medic cused in medical d contacting medical d cused in medica	eld of va es and s al devices eses. In ns with ironme croporo g ips ure	arious as scientific ces (hear npact of ensuring nt of boo	pects of biomat literature. rt assist devices implants on life g the durability dy fluids and in c	erials synthesis, o) processes. of the quality of contact with	haracterization in Number of hours 5 5 5 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
W-1 Module/c C-1 C-2 Course co T-P-1 T-P-2 T-P-3 T-S-1 T-S-3 T-S-4 T-S-5 T-S-6 T-S-7 T-S-6 T-S-7 T-S-6 T-S-7 T-S-8 Student v A-P-1 A-P-2 A-P-3 A-S-1 A-S-2	Basic knowledge ir with the applicatio ourse unit objectiv To gain the knowle medical devices ap To carry out a basi ontent divided into Design criteria and Design criteria for Nanocomposites ir Issues with biocom Introduction to the ceramic, metallic a human tissue. Improving oseointe Titanium nanotube Reconstruction of Problems of joining Production process Analysis and discu Analysis and discu participation in pro individual study of consultations participation in ser study of literature	n polyr n in m es edge, s oplicat ic litera ovario d mate metals n medi- npatibi estruct and col egratic es in bi biologi g meta s of TiC ssion c ssion c f activ ojects	mer, metal an edical devices kills and com ions ature search b <i>us forms of</i> rials for blood s and ceramic cal devices lity of implant cal devices lity of implant ure of the hu mposite biom on (ceramic bi omaterials su cal tissues. D llic and ceram of current meno of current man <i>rity</i>	d ceramic materia s petences in the fie based on database <i>instruction</i> I contacting medic cused in medical d contacting medical d cused in medica	eld of va es and s al devices eses. In ns with ironme croporo g ips ure	arious as scientific ces (hear npact of ensuring nt of boo	pects of biomat literature. rt assist devices implants on life g the durability dy fluids and in c	erials synthesis, o) processes. of the quality of contact with	Number of hours 5 5 5 3

			Faculty of Chemi	cal rechn	ology an		eenn	ig			
Teaching m	nethod	ds / tool	ls								
M-1	Semin	ars									
М-2	Discus	sion									
М-3	Case s	tudies									
M-4	Project	ts									
Evaluation	meth	ods (F -	progressive, P - final)								
S-1	F		ment based on evaluation of	the given presen	tation and act	ivity during d	iscussio	ns (sei	minar).		
S-2	Р	Writter	project and presentation (pr	oject)							
	Desigi	ned lea	rning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes f or qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Cours	e content	Teaching methods	Evaluation methods
Knowledge											
MSE_1A_C22b The student ha field of medica	as know		the subject of case analysis in the	MSE_1A_W10	P6S_WK	P6S_WG	C-1 C-2	T-P-1 T-P-2 T-P-3 T-S-1 T-S-2 T-S-3	T-S-4 T-S-5 T-S-6 T-S-7 T-S-8	M-1 M-2 M-3 M-4	S-1 S-2
Skills											
MSE_1A_C22b_ Studdent can p problems.	_U01 perform	a case st	tudy for selected Medical Devices	MSE_1A_U09 MSE_1A_U12	P6S_UO P6S_UW		C-1 C-2	T-P-1 T-P-2 T-P-3 T-S-1 T-S-2 T-S-3	T-S-4 T-S-5 T-S-6 T-S-7 T-S-8	M-1 M-2 M-3 M-4	S-1 S-2
Social com	peten	ces								.!	
MSE_1A_C22b_ Student under development i	stands		for continuous training and e studies	MSE_1A_K04	P6S_KR		C-1 C-2	T-P-1 T-P-2 T-P-3 T-S-1 T-S-2 T-S-3	T-S-4 T-S-5 T-S-6 T-S-7 T-S-8	M-1 M-2 M-3 M-4	S-1 S-2
Outcom	nes	Grade		E	Evaluation cr	iterion					
Knowledge	•										
MSE_1A_C22b_	_W01	2,0 3,0 3,5 4,0 4,5 5,0	from 50 to 55% of percentage po	pints							
Skills		•									
MSE_1A_C22b	_U01	2,0 3,0 3,5 4,0 4,5 5,0	from 50 to 55% of percentage po	pints							
Other socia	al com	petenc	es				_			_	_
MSE_1A_C22b_		2,0 3,0 3,5 4,0 4,5 5,0	from 50 to 55% of percentage po	bints							
Poquirad	oodina										
Required re	-		D.P. Potorson Diamatoriala	Principles and P	racticos CPC	Droce 2012					
2. R. Hudak,	M. Per	nhaker, J	 b, D.R. Peterson, Biomaterials Majernik,, Biomedical engine Bioengineering, InTech Operation 	eering—technica			nTech,	2012			
J. A. Jena E	.u., Aut	ances II	i bioengineering, intech Oper	11, 2013							

Field of s	study	Mate	erials Scienc	e and Engineeri	ng				
Mode of	study	stati	onary	Level		first o	cycle	\A/T:1/	~ I
Graduat	e's qualification	inżyr	nier					WTil(_n
Fields of	^r science	engii	neering and	technology				_	_
Disciplin	es of science	mate	erials engine	eering (100%)					<u> </u>
Educatio	onal profile	gene	eral academ	ic					
Module									
Course u	unit	Com	posite and	Advanced Ma	aterial	s			
Code		MSE_	1A_S_C23						C
Field of s	specialisation								
Administ	tering faculty	Depa	artment of P	olymer and Bio	materia	als Scier	nce		_
ECTS		6,0		ECTS (forms)		6,0			
Form of	course credit	exan	nination	Language		english	1		
Electives	S			Elective group					
Form of	instruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
laborato	ry course	L	6	30		,0	0,50	К	credits
lecture	<u>,</u>	w	6	30		,0	0,50	К	examination
Leading	teacher	El Era	av Mirosław	a (Miroslawa.Elf					
Other te	achers	(Woj Kwia	ciech.Ignacz tkowska Ma	a (Miroslawa.Ell zak@zut.edu.pl) gdalena (Magda wicz@zut.edu.p	, Kowa alena.K	lczyk Kr wiatkov	zysztof (Krzysz vska@zut.edu.	tof.Kowalczyk@ pl), Paszkiewicz	
Prerequi	isites								
W-1	Fundamentals of cl	hemist	ry of polyme	rs, their synthesis	and pro	cessing.			
W-2	Fundamentals of m	nechan	ics of materia	als.					
Module/o	course unit objective	es							
C-1	To gain the knowle	dge, s	kills and com	petences in the fi	eld of co	omposite	and advanced n	naterials	
Course d	content divided into	vario	us forms of	instruction					Number of hours
T-L-1	Preparation of BMC			-					5
T-L-2	Determination of m								5
T-L-3	Preparation and de nanocomposites	lermin	nation of elec		nano-se	or based	d functional poly	mer	5
T-L-4	Preparation of poly		•		-				5
T-L-5	Processing techniq casting); Physicochemical pr					-		-	5
T-L-6	Physical (mechanic								5
T-W-1	Composite materia	ls: aer	neral principle	es and basic conce	epts				2
T-W-2	Materials for comp								4
T-W-3	Design examples: r	natura	l and man-ma	ade composites					3
T-W-4	Interfaces in compo	osites							2
T-W-5	Fracture physics of								2
T-W-6	Composites based								2
T-W-7	Introduction to poly Properties of polym		•		-		-		2
T-W-8	etc.)		-	_					5
T-W-9	Polymer nanocomp								2
T-W-10	Preparation metho				•				4
T-W-11	Destructive and no		ructive meth	ous for (nano)con	posites	properti	es assessment		2
Student A-L-1	workload - forms of		-						Number of hours 30

Student wo	orkload	l - form	s of activity						Nur	nber o	f hours
A-L-2	individ	ual stud	y of literature								40
A-L-3	prepar	ation of	written reports								30
A-L-4	consult	ations									20
			lectures								30
			y of the literature								20
	Consul										10
A-W-4	The ex	am									1
Teaching n			S								
	Lecture										
М-2	Labora	tory exe	ercises								
Evaluation	metho	ods (F -	progressive, P - final)								
S-1	Р	Exam									
5-2	F	written	test								
	Desigr	ied leai	rning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes f or qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course	e content	Teaching methods	Evaluation methods
Knowledge	;				•	1	1	1			1
MSE_1A_C23_V The student ha and advanced	as the kr		of common aspect of composite erials	MSE_1A_W02 MSE_1A_W06	P65_WG	P65_WG	C-1	T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6	T-W-7 T-W-8 T-W-9 T-W-10 T-W-11	M-1 M-2	S-1 S-2
Skills											
MSE_1A_C23_U The student ha and advanced	as the kr		of common aspect of composite erials	MSE_1A_U03 MSE_1A_U09	P6S_UW	P6S_UW	C-1	T-L-1 T-L-2 T-L-3	T-L-4 T-L-5 T-L-6	M-1 M-2	S-1 S-2
Social com					•						1
MSE_1A_C23_I The student u advanced eng	nderstar	ds the in material	nportance of composite and s in practical applications	MSE_1A_K02	P65_KK	P65_WK	C-1	T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-W-1 T-W-2 T-W-3	T-W-4 T-W-5 T-W-6 T-W-7 T-W-8 T-W-9 T-W-10 T-W-11	M-1 M-2	S-1 S-2
Outcom	nes	Grade		E	Evaluation cr	iterion					
Knowledge	,										
MSE_1A_C23_V		2,0									
			from 50 to 55% of percentage po	ints							
		3,5									
		4,0 4,5									
		5,0									
Skills			I								
MSE_1A_C23_U	U01	2,0									
			from 50 to 55% of percentage po	ints							
		3,5									
		4,0 4,5									
		5,0									
Other socia	al com	petence	es								
MSE_1A_C23_I	-	2,0									
			from 50 to 55% of percentage po	ints							
		3,5									
		4,0 4,5									
		5,0									



Faculty of Chemical Technology and Engineering

Required reading

1. Agarwal B.D., Broutman L.J., Analysis and Performance of Fiber Composites, Elsevier, 1990

2. Gibson R.F., Principles of Composite Material Mechanics, 1994

3. Chawla K.K ., Composite Materials - Science and Engineering, 1998

			-				_		
Field of s	tudy	Mate	erials Scienc	e and Engineeri	ing				
Mode of s	study	stati	onary	Level		first o	cycle	14/	~1
Graduate	e's qualification	inżyı	nier	L L		1		WTil(Lh
Fields of	science	engi	neering and	technology					_
Discipline	es of science	mate	erials engine	ering (100%)					
Educatio	nal profile	gene	eral academ	ic					
Module		-							
Course u	nit	Mec	hanics of N	Aaterials					
Code		MSE	1A S C24						
Field of s	pecialisation								C
	ering faculty	Depa	artment of N	laterials Techno	oloav				
ECTS		2,0		ECTS (forms)		2,0			
	course credit	cred	its	Language		english	1		
Electives				Elective group		J			
	nstruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
		L	3	15	-	,0	0,50	K	credits
laborator	y course	W	3	15			0,50	K K	credits
lecture		1 1		_		,0		ĸ	creats
Leading t	teacher		-	nta (Jolanta.Bar				Cabaatian	
Other tea	achers	(Seb	astian.Frysk		Ignacza	ak Wojc	iech (Wojciech	.lgnaczak@zut.	edu.pl), Kiełbasa nski@zut.edu.pl)
Prerequis	sites								
W-1	Approval in Mather	natics	, Physics of m	aterials, Intro to I	MatSci/lı	ntro to M	latEng		
Module/c	ourse unit objectiv	es							
C-1	to get the basic kn	owledg	ge about mec	hanics of materia	ls, main	mechar	nical parameters	of materials and	methods of their
C-2	evaluation, formation of the sk	ills in	mechanical p	roperties testing					
	ontent divided into		•						Number of hours
T-L-1	Tensile test of met				th test				5
T-L-2	Compressive test of								5
T-L-3	Tensile and flexura				materia	als.			5
T-W-1	Introduction to me					rains an	d displacements	Models used in	3
T-W-2	mechanics of mate Hooke's low in a ur	niaxial	tensile or cor	mpressive stress:	stress-s	trains cu	Irves for differen	t materials,	4
1-00-2	determination of p Multiaxial stress ar					aonoral	ized Heekels law	moments of	4
T-W-3	intertia	iu stia		elationship, Mohi	s circle,	general	IZEU HOOKE'S IAW	, moments of	4
T-W-4	Mechanics of mate			-			iness		2
T-W-5	Stress concentration	on; intr	roduction to f	atigue strength of	f materia	als			2
Student v	workload - forms of	activ	ity						Number of hours
A-L-1	participation in lab		-						15
A-L-2	preparation for lab		y exercises						6
A-L-3	Preparation of repo	orts							7
A-L-4	Consultations								2
A-W-1 A-W-2	participation in lect individual studies of		subject						15
A-W-2 A-W-3	preparing for tests		SUDJELL						5
A-W-3 A-W-4	Consultations								2
Teacning M-1	interactive lectures	5 pres	entation (e.g.	power point)					
M-1 M-2	group discussion	, pies	entation (e.g.						
· · -									

Teaching n	nethoc	ls / tool	ls								
М-3	reports	s prepar	ation								
Evaluation	metho	ods (F -	progressive, P - final)								
S-1	Р	written	exam								
S-2	F	questio	ons								
5-3	F	raports	prepration								
	Desigr	ned leai	rning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course	content	Teaching methods	Evaluation methods
Knowledge	<u>į</u>										
MSE_1A_C24_ Student descri materials	W01 ibes sele	ected issu	les concerning the mechanics of	MSE_1A_W05	P6S_WG P6S_WK		C-1	T-W-1 T-W-2 T-W-3	T-W-4 T-W-5	M-1	S-1
Skills											
MSE_1A_C24_ has skills in pr	U01 actical u	isage of r	nechanics of materials	MSE_1A_U02	P6S_UW		C-2	T-L-1 T-L-2	T-L-3	M-2 M-3	S-2 S-3
Social com	peten	ces									
MSE_1A_C24_l Students is ab work in group.	le to pei	rform all t	task on time and cooperate and	MSE_1A_K02	P6S_KK	P6S_WK	C-1	T-L-1 T-L-2 T-L-3 T-W-1	T-W-2 T-W-3 T-W-4 T-W-5	M-1 M-3	S-1 S-3
Outcom	nes	Grade		E	valuation cri	iterion					
Knowledge	,										
MSE_1A_C24_1	W01	2,0 3,0 3,5 4,0 4,5 5,0	Student describes selected issue	s at a basic level (:	score => 50%)						
Skills		- , -									
MSE_1A_C24_I	U01	2,0 3,0 3,5 4,0 4,5 5,0	Student describes selected issue	s at a basic level (:	score => 50%)						
Other socia	al com		es								
MSE_1A_C24_I		2,0	Student describes selected issue	s at a basic level (!	score => 50%)						
		3,5 4,0 4,5 5,0									
Required re	eadino		1								
-	-		chanics of Materials, CRC Pre	ss, 2014							
			nics of Materials For Dummie								

Field of stu	ıdy	Mate	erials Scienc	e and Engine	ering							
Mode of st	udy	stati	onary	Level		first cy	cle	3.4	/			
Graduate's	s qualification	inży	nier	l		I			/Til	Ch)	
Fields of se	cience	engi	neering and	technology								
Disciplines	of science	mate	erials engine	eering (100%))				_		<u> </u>	
Educationa	al profile	gene	eral academ	ic								
Module												
Course un	it	Mar	nagement a	and Project	Plannin	g						
Code		MSE	_1A_S_C24a	а							Ĵ	
Field of sp	ecialisation											
Administer	ring faculty	RCli	Π									
ECTS		1,0		ECTS (forms)	1,0						
Form of co	urse credit	cred	its	Language		english		-				
Electives		9		Elective grou	др							
Form of in:	struction	Cod	Semester	Hours	E	CTS	Weight	Rea	alization)	Crea	lit
lecture		W	7	15		1,0	1,00		К		credi	ts
Leading te	acher	Żebi	rowski Pawe	ł (Pawel.Zebr	 owski@z	ut.edu.pl)						
Other teac				ł (Pawel.Zebr	-							
Prerequisit	tes					<u> </u>						
W-1	Basics of Mathema	tics										
W-2	Engineering											
Module/co	urse unit objective	es										
C-1	Consolidation of kn	owled	lge related to	the manageme	ent in enç	jineering.						
C-2	Developing studen	t's abi	lity to recogn	ize the basic co	oncepts o	f managem	ent in enginee	ring.				
С-3	Improving student'						•	•				
C-4	Project manageme Milestones. Risks a	nt of e nd ho	engineering p w to aviod the	rojects in pract em. Project plai	ice. Get to nning and	o know and I executing	forming team	s. Tearr	is manag	Jement	t. Workf	low.
	ntent divided into									Nun	nber of	[:] hours
T-W-1	Team Management		-		g							5
T-W-2	Workflow. Mileston Project planning ar											5
T-W-3	, , , ,		<u> </u>	t management		eering proje	ects in practice			<u> </u>		
	orkload - forms of		rity							Nun	nber of	
A-W-1 A-W-2	Classroom participa Self-study of the le		content and l	itoraturo						—		15 10
A-W-2 A-W-3	Consultations	cture								+		5
	nethods / tools											
M-1	Lecture											
Evaluation	methods (F - pro	aress	ive. P - final)								
S-1	F Written test	-		·								
	Designed learnin	g out	comes	Referenc learning o designed for stud	utcomes Le the fields of fo	Reference to earning Outcomes or qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course c	ontent	Teaching methods	Evaluation methods
Knowledge	2											
	_W01 heory-based knowledg in engineering.	e withi	n the scope of	MSE_14	4_W11	P65_WK		C-1 C-2 C-3 C-4	T-W-1 T-W-2	T-W-3	M-1	S-1
Skills												

		dniopomorski U Faculty of Chemi	cal Tacha		d Engine	orin	A			
		Faculty of Chemi		biogy an			19			1
		nowledge to solve and evaluate f management in engineering.	MSE_1A_U12	P6S_UO		C-1 C-2 C-3 C-4	T-W-1 T-W-2	T-W-3	M-1	S-1
Social competer	ices									1
		r continuous education and e field of management in	MSE_1A_K03	P6S_KO	P6S_WK		T-W-1 T-W-2	T-W-3		
Outcomes	Grade		E	valuation cr	iterion					
Knowledge										
MSE_1A_C24a_W01	2,0									
	3,0	Student demonstrates basic know	ledge of managen	nent in enginee	ring.					
	3,5									
	4,0									
	4,5									
	5,0									
Skills										
MSE_1A_C24a_U01	2,0									
	3,0	Student is able to use the acquire	d knowledge at a l	basic level to so	lve and evaluat	e select	ed probl	ems in the	e field of	
	-	management in engineering.								
	3,5									
	4,0									
	4,5 5,0									
011										
Other social con		2S								
MSE_1A_C24a_K01	2,0		d for continues	ducation	ining at a bar	laure 1.1	46 a 6 - 1	.		
	3,0	The student understands the nee engineering.	u for continuous eo	ucation and tra	aining at a basic	ievel in	the field	i or mana	gement i	L)
	3,5									
	4,0									
	4,5									

2. Garold D. Oberlender, Project Management for Engineering and Construction, McGraw-Hill International Editions, 2011

3. Karl Smith, P.K. Imbrie, Teamwork and Project Management (Basic Engineering Series and Tools), 2011

Field of													
	study		Mate	erials Scienc	e and Enginee	ering							
Mode of	f study		stati	ionary	Level		first cy	cle	1.4		Ch		
Graduat	te's qualit	fication	inży	nier					N	/Til	Ch		
Fields of	f science		engi	neering and	ltechnology								
Disciplin	nes of sci	ence	mate	erials engine	eering (100%)					_		<u> </u>	
Educatic	onal profi	ile	gene	eral academ	ic								
Module													
Course ι	unit		Inno	ovation Tea	ams								
Code			MSE	_1A_S_C24b)								
Field of s	specialisa	ation											
Adminis	tering fac	culty	RCI	Π								4	
ECTS			1,0		ECTS (forms)		1,0						
Form of	course c	redit	cred	lits	Language		english						
Electives	s		9		Elective grou	р							
Form of	instructio	on	Cod	Semester	Hours	E	CTS	Weight	Rea	alization		Crea	lit
lecture			w	7	15		1,0	1,00		К		credi	its
l eading	teacher		Żebi	rowski Pawe	ł (Pawel.Zebro	wski@z	ut.edu.pl)						
Other te					ł (Pawel.Zebro								
Prerequi													
W-1		nt knows the	basic	s of high scho	ol mathematics								
		nit objective											
C-1		-		lae related to	the innovation	manager	nent.						
C-2				-		-							
			c J ubi	muy to recogn		ncepts of	f innovation	management					
C-3	Improv				need for contin			management professional c		ment.			
C-3 C-4		ving student'	s awa	reness of the		uous edu	ication and	professional c	levelopi				
C-4	cquirin	ving student' ng knowledge	s awa e on fu	reness of the	need for contine of innovation tea	uous edu	ication and	professional c	levelopi		Nun	nber of	f hours
C-4	cquirin content a Produc	ving student' ng knowledge <i>livided into</i> ct, business p	s awa e on fu <i>vario</i> proces	reness of the undamentals of ous forms of	need for contine of innovation tea	uous edu am forma	ation and	professional c and delivering	levelopi outcon		Nun	nber of	f hours 5
C-4 Course c T-W-1	cquirin content o Produc manag	ving student' ng knowledge <i>livided into</i> ct, business p gement tools	s awa e on fu <i>vario</i> proces	reness of the undamentals of us forms of s, and organiz	need for continues of innovation tea	uous edu am forma ion. Inno	ation, work a	professional c and delivering agement. Inno	evelopi outcon	nes	Num	nber of	5
C-4 Course c	cquirin content a Produc manag Creatin roles. Manag	ving student' ng knowledge <i>livided into</i> ct, business p gement tools ng multi-func jing team into	s awa e on fu vario proces tional eracti	reness of the undamentals of us forms of s, and organia development ons; Design T	need for continues of innovation teases instruction zational innovation	uous edu am forma ion. Inno ship for i	ucation and ation, work wation man nnovation;	professional c and delivering agement. Inno Innovation tea	evelopr outcon ovation im desig	nes gn and	Nun	nber of	
C-4 Course c T-W-1 T-W-2 T-W-3	cquirin content a Produc manag Creatin roles. Manag Measu	ving student' ng knowledge <i>livided into</i> ct, business p gement tools ng multi-func ying team intu ring innovati	s awa e on fu vario proces ttional eractional	reness of the undamentals of us forms of s, and organi: development ons; Design T ccess	need for continue of innovation tea <i>instruction</i> zational innovat t teams. Leaders	uous edu am forma ion. Inno ship for i	ucation and ation, work wation man nnovation;	professional c and delivering agement. Inno Innovation tea	evelopr outcon ovation im desig	nes gn and			5 5 5
C-4 Course c T-W-1 T-W-2 T-W-3 Student	cquirin content of Produc manag Creatin roles. Manag Measu	ving student' ng knowledge <i>livided into</i> ct, business p gement tools ng multi-func ng multi-func ring innovati d - forms of	s awa e on fu vario proces ttional eraction on su	reness of the undamentals of us forms of s, and organi: development ons; Design T ccess	need for continue of innovation tea <i>instruction</i> zational innovat t teams. Leaders	uous edu am forma ion. Inno ship for i	ucation and ation, work wation man nnovation;	professional c and delivering agement. Inno Innovation tea	evelopr outcon ovation im desig	nes gn and		nber of	5 5 5
C-4 Course c T-W-1 T-W-2 T-W-3 Student A-W-1	cquirin content of Produc manag Creatin roles. Manag Measu r workload	ving student' ng knowledge <i>livided into</i> ct, business p gement tools ng multi-func ging team intur ring innovati d - forms of pation in lect	s awa e on fu vario proces tional eractio on su <i>activ</i> cures	reness of the undamentals of us forms of s, and organi: development ons; Design T ccess	need for continue of innovation tea <i>instruction</i> zational innovat t teams. Leaders	uous edu am forma ion. Inno ship for i	ucation and ation, work wation man nnovation;	professional c and delivering agement. Inno Innovation tea	evelopr outcon ovation im desig	nes gn and			5 5 5 f hours 15
C-4 Course c T-W-1 T-W-2 T-W-3 Student	cquirin content of Produc manag Creatin roles. Manag Measu workload Partici Self-st	ving student' ng knowledge <i>livided into</i> ct, business p gement tools ng multi-func ng multi-func ring innovati d - forms of	s awa e on fu vario proces tional eractio on su <i>activ</i> cures	reness of the undamentals of us forms of s, and organi: development ons; Design T ccess	need for continue of innovation tea <i>instruction</i> zational innovat t teams. Leaders	uous edu am forma ion. Inno ship for i	ucation and ation, work wation man nnovation;	professional c and delivering agement. Inno Innovation tea	evelopr outcon ovation im desig	nes gn and			5 5 5
C-4 Course c T-W-1 T-W-2 T-W-3 Student A-W-1 A-W-2 A-W-3	cquirin content of Produc manag Creatin roles. Manag Measu workload Partici Self-st Consul	ving student' ng knowledge <i>livided into</i> ct, business p gement tools ng multi-func ying team inte ring innovati d - forms of pation in lect udy of the lit ltations	s awa e on fu vario proces tional eractio on su <i>activ</i> cures	reness of the undamentals of us forms of s, and organi: development ons; Design T ccess	need for continue of innovation tea <i>instruction</i> zational innovat t teams. Leaders	uous edu am forma ion. Inno ship for i	ucation and ation, work wation man nnovation;	professional c and delivering agement. Inno Innovation tea	evelopr outcon ovation im desig	nes gn and			5 5 5 f hours 15 10
C-4 Course c T-W-1 T-W-2 T-W-3 Student A-W-1 A-W-2 A-W-3	cquirin content of Produc manag Creatin roles. Manag Measu workload Partici Self-st	ving student' ng knowledge <i>livided into</i> ct, business p gement tools ng multi-func ing team into ring innovati d - forms of pation in lect udy of the lit ltations ds / tools	s awa e on fu vario proces tional eractio on su <i>activ</i> cures	reness of the undamentals of us forms of s, and organi: development ons; Design T ccess	need for continue of innovation tea <i>instruction</i> zational innovat t teams. Leaders	uous edu am forma ion. Inno ship for i	ucation and ation, work wation man nnovation;	professional c and delivering agement. Inno Innovation tea	evelopr outcon ovation im desig	nes gn and			5 5 5 f hours 15 10
C-4 Course c T-W-1 T-W-2 T-W-3 Student A-W-1 A-W-2 A-W-3 Teaching M-1	cquirin content of Produc manag Creatin roles. Manag Measu <i>workload</i> Partici Self-st Consul g methoo	ving student' ng knowledge <i>livided into</i> ct, business p gement tools, ng multi-func ying team inte ring innovati d - forms of pation in lect udy of the lit ltations ds / tools e	s awa e on fu vario proces tional eractiv cures eratur	reness of the undamentals of us forms of is, and organi: development ons; Design T ccess rity	need for continent of innovation tead instruction zational innovat t teams. Leaders hinking to drive	uous edu am forma ion. Inno ship for i	ucation and ation, work wation man nnovation;	professional c and delivering agement. Inno Innovation tea	evelopr outcon ovation im desig	nes gn and			5 5 5 f hours 15 10
C-4 Course c T-W-1 T-W-2 T-W-3 Student A-W-1 A-W-2 A-W-3 Teaching M-1	cquirin content of Produc manag Creatin roles. Manag Measu <i>workload</i> Partici Self-st Consul g methoo	ving student' ng knowledge <i>livided into</i> ct, business p gement tools, ng multi-func ying team inte ring innovati d - forms of pation in lect udy of the lit ltations ds / tools e	s awa e on fu vario proces ttional eractiv cures eratur eratur	reness of the undamentals of us forms of s, and organi: development ons; Design T ccess	need for continent of innovation tead instruction zational innovat t teams. Leaders hinking to drive	uous edu am forma ion. Inno ship for i	ucation and ation, work wation man nnovation;	professional c and delivering agement. Inno Innovation tea	evelopr outcon ovation im desig	nes gn and			5 5 5 f hours 15 10
C-4 Course of T-W-1 T-W-2 T-W-3 Student A-W-1 A-W-2 A-W-3 Teaching M-1 Evaluatio	cquirin content of manag Creatin roles. Manag Measu rworkload Particin Self-st Consul g method Lectur ion metho	ving student' ng knowledge <i>livided into</i> ct, business p gement tools. ng multi-func ing team into ring innovati d - forms of pation in lect udy of the lit ltations e ods / tools e	s awa e on fu vario proces tional eractiv activ ures eratur gress	reness of the undamentals of ous forms of is, and organi: development ons; Design T ccess rity re	need for continent of innovation tead instruction zational innovat t teams. Leaders hinking to drive	to the for the for the for the fields of the	ucation and ation, work wation man nnovation;	professional c and delivering agement. Inno Innovation tea g innovation s	evelopr outcon ovation im desig	nes gn and	Nun		5 5 f hours 15 10 5
C-4 Course c T-W-1 T-W-2 T-W-3 Student A-W-1 A-W-2 A-W-3 Teaching M-1 Evaluation S-1	cquirin content of manag Creatin roles. Manag Measu workload Partici Self-st Consul g method Lectur ion metho F Design	ving student' ng knowledge <i>livided into</i> ct, business p gement tools ng multi-func ing team inte ring innovati d - forms of pation in lect udy of the lit ltations ds / tools e ods (F - prog	s awa e on fu vario proces tional eractiv activ ures eratur gress	reness of the undamentals of ous forms of is, and organi: development ons; Design T ccess rity re	need for continue of innovation tea <i>instruction</i> zational innovat t teams. Leader: hinking to drive	to the for the for the for the fields of the	Reference to Reference to requalifications at	professional c and delivering agement. Inno Innovation tea g innovation s g innovation s Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering	evelopri outcon ovation im desig trategy,	nes gn and ;	Nun	nber of	5 5 5 15 10 5 Evaluation
C-4 Course of T-W-1 T-W-2 T-W-3 Student A-W-1 A-W-2 A-W-3 Teaching M-1 Evaluation S-1 Knowled MSE_1A_CZ Student ha	cquirin content of Produc manag Creatin roles. Manag Measu Workload Partici Self-st Consul g method Lectur ion metho F Design	ving student' ng knowledge <i>livided into</i> ct, business p gement tools, ng multi-func ying team inte ring innovati d - forms of pation in lect udy of the lit ltations ds / tools e ods (F - prog Written test	s awa e on fu vario proces tional eractiv cures eratur gress t	reness of the undamentals of ous forms of is, and organi: development ons; Design T ccess rity re	need for continue of innovation tea <i>instruction</i> zational innovat t teams. Leader: hinking to drive	to the training of the fields	Reference to Reference to requalifications at	professional c and delivering agement. Inno Innovation tea g innovation s g innovation s Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering	evelopri outcon ovation im desig trategy,	nes gn and ; Course co	Nun	nber of	5 5 5 15 10 5

		dniopomorski U Faculty of Chemi	cal Tocha		d Engin	oori-	20			
				biogy an		1	ig		1	
		nowledge to solve and evaluate f innovation management.	MSE_1A_U11	P6S_UK P6S_UW		C-1 C-2 C-3 C-4	T-W-1 T-W-2	T-W-3	M-1	S-:
Social competer	ices									
MSE_1A_C24b_K01 Student is aware of tl professional developi management.	ne need fo ment in th	or continuous education and e field of innovation	MSE_1A_K03	P65_KO	P6S_WK	C-1 C-2 C-3 C-4	T-W-1 T-W-2	T-W-3	M-1	S -:
Outcomes	Grade		E	valuation cr	iterion					
Knowledge	1									
MSE_1A_C24b_W01	2,0									
	3,0	Student demonstrates basic knov	vledge of innovatio	n management						
	3,5									
	4,0									
	4,5									
	5,0									
Skills										
MSE_1A_C24b_U01	2,0									
	3,0	Student is able to use the acquire innovation management.	ed knowledge at a l	pasic level to so	lve and evalua	te select	ed proble	ems in th	e field of	
	3,5									
	4,0									
	4,5									
	5,0									
Other social con	petenc	es								
MSE_1A_C24b_K01	2,0									
	3,0	The student understands the nee management.	d for continuous eo	ducation and tra	aining at a basi	: level in	the field	of innov	ation	
	3,5									
	4,0									
	4,5									

2. Roni Reiter-Palmon, Team Creativity and Innovation, 2011

3. Paul S Chinowsky, James E Meredith, Strategic Corporate Management for Engineering, Oxford University Press, 2000

				-							-			
Field of s	study		Mate	erials Scienc	e and	d Engineering	9							
Mode of	study		stati	onary		Level		first cy	cle	3.4	/ .1/	~1		
Graduate	e's quali	fication	inży	nier						N	/Til(Lh		
Fields of	f science		engi	neering and	tech	nology								
Disciplin	es of sci	ence	mate	erials engine	eering	g (100%)					_		<u> </u>	
Educatio	onal profi	le	gene	eral academ	ic									
Module														
Course u	unit		Bio-	inspired M	ateri	ials & Struc	ture	S						
Code			MSE	_1A_S_C25									Ĵ	
Field of s	specialis	ation												
Administ	tering fa	culty	Depa	artment of P	olym	er and Biom	ateria	als Scienc	ce	1				
ECTS			1,0		ECT:	S (forms)		1,0						
Form of	course c	redit	cred	its	Lan	guage		english						
Electives	s				Elec	tive group								
Form of	instructi	on	Cod	Semester		Hours	EC	CTS	Weight	Rea	alization		Crea	lit
laborato	ry course	9	L	5		15	0	,5	0,50		К		credi	its
lecture	-		w	5		15	C	,5	0,50		К		credi	its
Leading	teacher		El Fr	av Mirosław	a (Mi	roslawa.ElFra	av@z	ut.edu.pl)					
Other tea			Bart	kowiak Artu	r (Art	ur-Bartkowia	k@z	ut.edu.pl)	, El Fray Miro					
			(Miro	oslawa.ElFra	y@zı	ut.edu.pl), Sc	bole	wski Piotr	(psobolews	ki@zut.	edu.pl)			
Prerequi				<u> </u>										
W-1		-		gy and chemi	stry									
		nit objective							· · · ·					
C-1 C-2						ncepts of biom				tructure	S			
	-	-	-	-									- 1	c 1.
Course c T-L-1				us forms of		preparation a	nd ch	aractoriza	tion			NUN	nber of	nours
T-L-1 T-L-2				-		ecular inclusio								3
T-L-3					-	ls in hydrogel				d metho	ds			3
T-W-1				-	-	asic phenome		•						2
T-W-2	Molecu	ular design o	f biolo	gical and nan	io-mat	terials								3
T-W-3	Bio-ins	pired intellig	ent ar	nd morphing s	struct	ures								3
T-W-4	Functi	onal surfaces	s in bio	ology										2
T-W-5	Immot	oilisation of a	ctive	compounds										2
T-W-6	Bioimr	nobilisation o	of enzy	ymes and livii	ng cel	ls								3
Student	workload	d - forms of	activ	rity								Nun	nber of	f hours
A-L-1		pation in lab		y exercises										15
A-W-1	partici	pation in lect	tures											15
Teaching														
M-1		e with presen		1										
M-2		tory exercise												
				ive, P - final,)									
S-1	F	continuous												
5-2	P	questions, p	oroble	III SOIVING		1								<u> </u>
	Desigi	ned learning	g outo	comes		Reference to the learning outcome designed for the field study	s Lea	Reference to arning Outcomes qualifications at PQF 6, 7 or 8		Course objectives	Course con	tent	Teaching methods	Evaluation methods
Knowled	lge					I.			1	1	1		I	1
	-													

		-					_			
MSE_1A_C25_W01 the student defines t and bio-inspired stru		oncepts related to biomimetics	MSE_1A_W03	P6S_WG P6S_WK	P6S_WG	C-1 C-2	T-L-1 T-L-2 T-L-3 T-W-1 T-W-2	T-W-3 T-W-4 T-W-5 T-W-6	M-1 M-2	S-1 S-2
Skills							1			
	st importan	sses the student is able to t aspects of biomimetics and	MSE_1A_U03	P6S_UW	P6S_UW	C-1 C-2	T-L-1 T-L-2 T-L-3 T-W-1 T-W-2	T-W-3 T-W-4 T-W-5 T-W-6	M-1 M-2	S-1 S-2
Social competer	nces									
	nowledge ir	team, is prepared to use and n any professional environment terials	MSE_1A_K02	P65_KK	P6S_WK	C-1 C-2	T-L-1 T-L-2 T-L-3 T-W-1 T-W-2	T-W-3 T-W-4 T-W-5 T-W-6	M-1 M-2	S-1 S-2
Outcomes	Grade		E	valuation cr	iterion					
Knowledge										
MSE_1A_C25_W01	2,0 3,0 3,5 4,0 4,5 5,0	Positive grade of the final test (m	nore than 55% corr	ect answers)						
Skills	0,0									
MSE_1A_C25_U01	2,0 3,0 3,5 4,0 4,5 5,0	Positive evaluation of the laborat	oty report.							
Other social con	-	25								
MSE_1A_C25_K01	2,0	Positive grade of the final test an	d exam (more than	n 55% correct a	nswers)					
Required readin	g									
1. Y. Bar-Cohen, B	iomimetio	s Biologically Inspired Technol	ologies, CRC Tay	lor&Francis, N	lew York, 200	6				
		nd Bioengineering Handbook								
3. Andrew J. Ruys,	Biomime	tic biomaterials: Structure an	d Applications, V	Noodhead Pub	olishing Limite	d, 2013	3			

Field of stu Mode of st	udv	Mate	riale Scienc	a and English and	~~			7			
Mode of st	uuy	IMate	enais scienc	e and Engineeri	ng						
	tudy	stati	onary	Level		first o	cycle		C 1		
Graduate':	s qualification	inżyr	nier	I				WTil	Lh		
Fields of s	cience	engi	neering and	technology							
Disciplines	s of science		-	ering (100%)							
Education			-								
Module	arpronie	gene	general academic								
Course un	it.	Mat									
Code			erials for H	leanneale							
		MSE.	_1A_S_C26					- \ 🔳	C		
	pecialisation										
	ring faculty	-	artment of N	lanomaterials Pl	nysicoc		ry				
ECTS		4,0		ECTS (forms)		4,0		_			
Form of co	ourse credit	cred	its	Language		english		_			
Electives				Elective group							
Form of in	struction	Cod	Semester	Hours	EC	CTS	Weight	Realization	Credit		
lecturing c	course	Α	7	15	0	,5	0,25	К	credits		
laboratory	v course	L	7	30	1	,5	0,25	К	credits		
lecture		w	7	30	2	,0	0,50	К	credits		
Leading te	Pacher	Miio	wska Ewa (E	wa.Borowiak-Pa	len@zi	ut edu r	ـــــــــــــــــــــــــــــــــــــ				
Other teac Prerequisit		Pale	n@zut.edu.p	nta (Jolanta.Ban nieszka (Agniesz bl), Piegat Agnie ut.edu.pl), Zielin	szka (A	Agnieszk	ka.Piegat@zut	.edu.pl), Sobole			
Prerequisit W-1	tes Knowledge of the b burse unit objective The aim of the cors from heavy metals	Palei (psol pasic c es se is to	n@zut.edu.p bolewski@z ourse in phys	nieszka (Agniesz bl), Piegat Agnie ut.edu.pl), Zielin sics, chemistry an dent's knowledge	szka (A iska Be d mater in the a	Agnieszk eata (Be rials scie rea of m	ka.Piegat@zut ata.Zielinska@ nce at the elem aterials used in	edu.pl), Sobole zut.edu.pl) entary level medical diagnosis			
Prerequisit W-1 Module/co C-1	tes Knowledge of the b burse unit objective The aim of the cors from heavy metals life quality.	Paler (psol pasic c es se is to and d	n@zut.edu.p bolewski@z ourse in phys o develop stud rugs and in o	nieszka (Agniesz bl), Piegat Agnies ut.edu.pl), Zielin sics, chemistry an dent's knowledge verall the students	szka (A iska Be d mater in the a	Agnieszk eata (Be rials scie rea of m	ka.Piegat@zut ata.Zielinska@ nce at the elem aterials used in	edu.pl), Sobole zut.edu.pl) entary level medical diagnosis	wski Piotr s, water purification prmance to increase		
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Prerequisit W-1 Module/co C-1	tes Knowledge of the b burse unit objective The aim of the cors from heavy metals life quality. ntent divided into Characterization of	Palei (psol pasic c es se is tc and d vario	n@zut.edu.p bolewski@z ourse in phys o develop stud rugs and in o us forms of neric hydroge	nieszka (Agniesz bl), Piegat Agnies ut.edu.pl), Zielin sics, chemistry an dent's knowledge verall the students <i>instruction</i> ls: porosity, densi	szka (A ska Be d mater in the a s will be ty, aver	Agnieszk eata (Be rials scie rea of m e skilled t	ka.Piegat@zut ata.Zielinska@ nce at the elem aterials used in to designe mate ecular weight be	edu.pl), Sobole zut.edu.pl) entary level medical diagnosis rials and its perfo	wski Piotr s, water purification rmance to increase Number of hours		
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Prerequisit W-1 Module/co C-1 Course con T-A-1 T-A-2 T-A-3 T-A-4 T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6 T-W-1 T-W-2 T-W-2 T-W-3 T-W-2 T-W-3 T-W-4 T-W-5	tes Knowledge of the b burse unit objective The aim of the cors from heavy metals life quality. ntent divided into Characterization of Polymeric material properties and deg Analysis of influence discussion Analysis of failure of Determination of si Surface modificatio Photocatalytic rem Magnetic separatio Antibacterial coatir Composites for der Corrosive and tribo Antimicrobial mate Materials in medica Biosensors and bio The human eye: ar Intraocular lenses:	Palei (psol pasic c es se is tc and d vario f polyn s for h rradatio c of sele ize and of sele ize and of sele ize and of sele ize and on of b oval of on of h ngs for ntal ap pocorros erials: <i>I</i> al diag sensin natomy from e e intra	n@zut.edu.p bolewski@z ourse in phys o develop stud rugs and in o us forms of neric hydroge ealthcare - ca on profile. anparticles m cted metal m d Zeta potent iopolymers. C f drug molecu eavy metals f healthcare a plication: tecc sive wear of m Au, Cu, TiO2, nostics: overv g: concept, c y and pathoph early develop ocular space posites and c	nieszka (Agniesz bl), Piegat Agnie ut.edu.pl), Zielin sics, chemistry an dent's knowledge verall the students instruction ils: porosity, densi ase studies: surfac horphology on anti edical devices ial of polymeric m Contact angle dete iles form wastewater. pplications hnology and testir netallic biomateria ZnO - case study view, needs, persp lassification and c hysiology ment to the most	szka (A ska Be d mater in the a s will be ty, aver ce modi microbi icelles. erminati ter ng ils sectives ase stur implant	Agnieszk eata (Be rials scie rea of m e skilled 1 rage mole fication, al perfor on on	ca.Piegat@zut ata.Zielinska@ nce at the elem aterials used in to designe mate ecular weight be tailoring of mec mance: explana	edu.pl), Sobole zut.edu.pl) entary level medical diagnosis rials and its perfo etween crosslinks hanical	wski Piotr s, water purification rmance to increase Number of hours 2 3 3 5 5 5 5 5 5 5 5 5 5 5 5 5 3 3 3 3		

Faculty of Chemical Technology and Engineering

			racticy of chemi		ology an		cern	<u></u>			
Student wo	rkload	d - forms	s of activity						Nui	mber o	fhours
A-A-1	Partici	pation in	recitations								15
A-L-1	partici	pation in	laboratory exercises								30
A-L-2	prepar	ation of I	ab reports								5
A-L-3	prepar	ation for	laboratory exercises								3
A-L-4	prepar	ing for te	ests								5
A-L-5 (Consul	tations									2
A-W-1	partici	pation in	lectures								30
A-W-2	self-stı	udy of the	e literature								13
A-W-3	prepar	ing for te	ests								15
A-W-4	Consul	tations									2
Teaching m	nethod	ds / tools	5						•		
-	lecture										
M-2	case st	tudy									
M-3 I	labora	tory work	(
		-	d presentation of multimedia	presentations b	y the student	during the the	ematic e	exercis	es		
	self stu		•	•		5					
			progressive, P - final)								
			-								
5-1 5-2	P		passing test		_						
	F		ous assessment during rese)						
S-3	P		nent of lab reports								
S-4	F	participa	ation in the discussion during	g lectures	1						
Ľ	Desigr	ned lear	ning outcomes	Reference to the learning outcomes designed for the fields o study	Reference to Learning Outcomes f for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Cours	se content	Teaching methods	Evaluatio methods
Knowledge										-1	1
MSE_1A_C26_V knowledge in tl healthcare app	he area	i of materi Is	als that can be used in	MSE_1A_W04	P6S_WG P6S_WK		C-1	T-W-1 T-W-2 T-W-3 T-W-4	T-W-6 T-W-7	M-1	S-1 S-4
Skills											
MSE_1A_C26_U abilities to des increase the lif	sign ma	terials and y.	evaluate its performance to	MSE_1A_U07	P6S_UW	P6S_UW	C-1	T-A-1 T-A-2 T-A-3 T-A-4 T-L-1	T-L-2 T-L-3 T-L-4 T-L-5 T-L-6	M-2 M-3 M-4 M-5	S-2 S-3
Social comp	peten	ces									
MSE_1A_C26_K The student un development a	nderstar		portance of materials healthcare	MSE_1A_K02	P65_KK	P6S_WK	C-1	T-A-1 T-A-2 T-A-3 T-A-4 T-L-1 T-L-2 T-L-3 T-L-3 T-L-4 T-L-5 T-L-6	T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-5 T-W-6 T-W-7 T-W-8 T-W-9	M-1 M-2 M-3 M-4	S-1 S-2 S-3 S-4
Outcom	es	Grade		E	Evaluation cr	iterion					
Knowledge		1 1									
MSE_1A_C26_V	W01	3,5 4,0 4,5	from 50 to 55% of percentage p	oints							
		5,0									

Faculty of Chemical Technology and Engineering

Skills		
MSE_1A_C26_U01	2,0	
	3,0	from 50 to 55% of percentage points
	3,5	
	4,0	
	4,5	
	5,0	
Other social con	npetenc	es

MSE_1A_C26_K01	2,0	
	3,0	from 50 to 55% of percentage points
	3,5	
	4,0	
	4,5	
	5,0	

Required reading

1. Vijay K. Varadan, LinFeng Chen, Jining Xie, Nanomedicine Design and Applications of Magnetic Nanomaterials, Nanosensors and Nanosystems, Wiley, 2008, ISBN-13 : 978-0470033517

2. Marina A Dobrovolskaia, Scott E McNeil, Handbook of Immunological Properties of Engineered Nanomaterials, World Scientific Publishing, 2013, ISBN-13 : 978-9814390255

3. Seila Šelimović, Nanopatterning and Nanoscale Devices for Biological Applications (Devices, Circuits, and Systems), CRC Press, 2014, ISBN-13 : 978-1466586314

				-									
Field of st	tudy		Mate	rials Science	e and E	Engineering							
Mode of s	tudy		stati	onary	L	evel	first cyc	cle					
Graduate	's qualif	ication	inżyr	nier					1 W	/ 1	ICł	1	
Fields of s			-	neering and	techno	ology							
Discipline	s of scie		-	erials engine					1 E	_			
Educatior				ral academi		,							
Module			gene		C					- 1			
Course ur	nit		Entr	onronours	hin for	r Engineers				- 1			
Code	<i>IIC</i>			_1A_S_C27a		Lingineers			•	- 1			
Field of s	pecialisa			_1A_3_0278									
Administe	ering fac	culty	RCIi	Т								4.	
ECTS			1,0		ECTS	(forms)	1,0		1				
Form of c	ourse cl	redit	cred	its	Langu	lage	english		-				
Electives			10		Electiv	/e group			1				
Form of ir	nstructio	on	Cod	Semester	H	ours	ECTS	Weight	Rea	alizatio	on	Crea	lit
lecture			W	7		15	1,0	1,00		K	-	cred	
Leading t	aachar			-		slawa.ElFray							
Other tea						Sidwa.EIFI dy	@zut.euu.pi)						
Prerequis		+ +h			- 1 41-								
W-1				s of high schoo	oi math	ematics.							
		nit objective											
C-1				-		repreneurship	-						
C-2 C-3						basic concepts r continuous e	-	-	-	nont			
	-	-							evelopi				
				us forms of i		<i>tion</i> (ey successes a	and failures of		nies		Nul	nber o	
T-W-1	Techno	ological comp	anies			-		young compe	incs.				5
T-W-2			-		•	rship Economy							5
T-W-3		ss models. St ctual Property			d vision	. Finding partr	iers and buildi	ng competitiv	e advar	ntages	·		5
Student v	vorkload	l - forms of	activ	ity							Nu	nber o	f hours
A-W-1	Classro	om participa	tion										15
A-W-2	Prepar	ing for the lea	cture										8
A-W-3	Self-st	udy of the lite	eratur	e									5
A-W-4	Consul	tations											2
	methor	ls / tools											
Teaching	meenoe												
Teaching M-1	Lecture	5											
M-1	Lecture		iress	ive, P - final)									
M-1	Lecture		iressi	ive, P - final)									
M-1 Evaluatio	Lecture n metho F	ods (F - prog				Reference to the learning outcomes ssigned for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Cours	e content	Teaching methods	
M-1 Evaluatio	Lecture n metho F Desigr	ods (F - prog Written test				learning outcomes esigned for the fields of	Learning Outcomes for qualifications at	learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering		Cours	e content		
M-1 Evaluation S-1 Knowledg MSE_1A_C27 Student has	Lecture n metho Design ne ra_w01 theory-ba	ods (F - prog Written test ned learning sed knowledge	outo	comes		learning outcomes esigned for the fields of	Learning Outcomes for qualifications at	learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering	C-1 C-2	Cours T-W-1 T-W-2	T-W-3		
M-1 Evaluation S-1 Knowledg MSE 1A C27	Lecture n metho Design ne ra_w01 theory-ba	ods (F - prog Written test ned learning sed knowledge	outo	comes		learning outcomes esigned for the fields of study	Learning Outcomes for qualifications at PQF 6, 7 or 8	learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering	objectives	T-W-1		methods	methods
M-1 Evaluation S-1 Knowledg MSE_1A_C27 Student has entrepreneu Skills MSE_1A_C27 Student can	Lecture n metho F Design de de da_W01 theory-ba rship for e da_U01 use the a	ods (F - prog Written test ned learning sed knowledge	within dge to	the scope of	de	learning outcomes esigned for the fields of study	Learning Outcomes for qualifications at PQF 6, 7 or 8	learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering	C-1 C-2	T-W-1		methods	Evaluation methods S-1 S-1

		r continuous education and e field of entrepreneurship for	MSE_1A_K03	P6S_KO	P6S_WK	C-1 C-2 C-3	T-W-1 T-W-2	T-W-3	M-1	S-1
Outcomes	Grade		E	valuation cri	iterion				-	
Knowledge										
MSE_1A_C27a_W01	2,0									
	3,0	Student demonstrates basic knov	vledge of entreprer	neurship for eng	jineers.					
	3,5									
	4,0									
	4,5									
	5,0									
Skills										
MSE_1A_C27a_U01	2,0									
	3,0	Student is able to use the acquire engineers.	ed knowledge at a l	basic level to re	cognize the bas	ic conce	pts of e	ntreprene	urship fo	r
	3,5									
	4,0									
	4,5									
	5,0									
Other social con	npetence	es								
MSE_1A_C27a_K01	2,0									
	3,0	The student understands the nee engineers.	d for continuous eo	ducation and tra	aining at a basic	level in	the field	d of entre	oreneurs	hip for
	3,5									
	4,0									
	4,5									
	5,0									
Required reading	g									
1. Uchino Kenji, Er	treprene	urship for engineers, CRC Pre	ss, 2009							
2. Alexander Oste	walder, א	ves Pigneur, Business Model	Generation, 201	1						

	-		-,				<u> </u>		-9			
Field of st	tudy	Mate	erials Scienc	e and I	Engineering							
Mode of s	study	stati	onary	L	evel	first cy	cle	1.4		<u>_</u> _		
Graduate	's qualification	inży	nier					N	/Til	Ln		
Fields of s	science	engi	neering and	techno	ology							
Discipline	es of science	mate	erials engine	ering	(100%)				_		_	
Educatior	nal profile	gene	eral academ	ic								
Module												
Course ui	nit	Stra	tegies for	Startu	ips							
Code		MSE	_1A_S_C27b									
Field of s	pecialisation											
Administe	ering faculty	RCli	Π									
ECTS		1,0		ECTS	(forms)	1,0						
Form of c	ourse credit	cred	its	Langu	uage	english						
Electives		10		Electiv	ve group							
Form of ii	nstruction	Cod	Semester	H	ours	ECTS	Weight	Re	alization		Crec	lit
lecture		W	7		15	1,0	1,00		К		cred	its
Leading t	teacher	El Fr	ay Mirosław	a (Miro	slawa.ElFray	@zut.edu.pl)					
Other tea			-		el.Zebrowski@		·					
Prerequis				•		<u> </u>						
W-1	Student knows th	e basic	s of high scho	ol math	ematics.							
Module/c	ourse unit objecti											
C-1	Consolidation of I		lge related to	the sta	rtups.							
C-2	Developing stude		-			of startups.						
С-3	Improving studer	nt's awa	reness of the	need fo	or continuous e	ducation and	professional d	levelop	ment.			
C-4	Acquiring knowle development.	dge on	startup develo	opment	proces and to	ols. Strategies	s to use in con	secutiv	e stages c	of busi	ness ve	enture
Course cu	ontent divided int	o vario	us forms of	instruc	tion					Nun	her of	f hours
T-W-1	Marketing strateg	gies for	startups. Anal	ysis of	the market nee		ends and mar	ket gro	wth	littan		5
	projections. Indus Positioning stater						and delivery s	trategy	,			
T-W-2	Marketing progra	ms.		-			-					5
T-W-3	Market research Viable Product; B											5
Student v	vorkload - forms o	of activ	rity							Nun	nber of	f hours
A-W-1	Participation in le	ctures	-									15
A-W-2	Self-study of the	literatur	re									13
A-W-3	Consultations											2
Teaching	methods / tools											
M-1	Lecture											
Evaluatio	n methods (F - pr	ogress	ive, P - final))								
S-1	P Written te	est										
	Designed learni	ng out	comes	d	Reference to the learning outcomes esigned for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course con	ntent	Teaching methods	Evaluation methods
						-	•	•	•			
Knowledg	ge											
MSE_1A_C27		dge withi	n the scope of		MSE_1A_W11	P65_WK		C-1 C-2 C-3 C-4	Т-W-1 Т-W-2 Т	-W-3	M-1	S-1

		dniopomorski U Faculty of Chemi								
MSE_1A_C27b_U01 Student can use the a concepts of startups.	acquired k	nowledge to recognize the basic	MSE_1A_U06	P6S_UW	P6S_UW	C-1 C-2 C-3 C-4	T-W-1 T-W-2	T-W-3	M-1	S-1
Social competen	ces									
MSE_1A_C27b_K01 Student is aware of tl professional developr		or continuous education and e field of startups.	MSE_1A_K03	P6S_KO	P65_WK	C-1 C-2 C-3 C-4	T-W-1 T-W-2	T-W-3	M-1	S-1
Outcomes	Grade		E	valuation cr	iterion				•	
Knowledge	1	1								
MSE_1A_C27b_W01	2,0									
	3,0	Student demonstrates basic know	ledge of startups.							
	3,5									
	4,0									
	4,5									
	5,0									
Skills										
MSE_1A_C27b_U01	2,0									
	3,0	Student is able to use the acquire	ed knowledge at a	pasic level to re	cognize the ba	sic conce	epts of st	artups.		
	3,5									
	4,0									
	4,5									
Other secial com	5,0									
Other social com	1									
MSE_IA_C2/D_K01	2,0 3,0	The student understands the nee	d for continuous of	ducation and tra	ining at a basi		the field	l of startu	DC	
	3,5						the neit		ps.	
	4,0									
	4,5									
	5,0									
Required reading	 a									
	-	eurship for engineers, CRC Pre	ss 2009							
1. Uchino Kenii, Er	ill epiene		JJ, 200J							

4. Ash Maurya, Running Lean: Iterate from Plan A to a Plan That Works, 2011

			,					5	5	
Field of st	udy	Mate	rials Scienc	e and	Engineeri	ng				
Mode of s	tudy	statio	onary		Level		first o	cycle	VA/T:L	Ch
Graduate'	s qualification	inżyn	nier						WTil	UN
Fields of s	science	engir	neering and	techr	nology					_
Discipline	s of science	mate	rials engine	ering	(100%)					<u> </u>
Education	al profile	gene	ral academ	ic						
Module										
Course un	nit	Biom	naterials S	cienc	e Project	Rese	arch			\mathbf{O}
Code		MSE_	1A_S_D01a							
Field of sp	pecialisation									
Administe	ering faculty	Depa	rtment of P	olyme	er and Bio	materia	als Scier	nce		
ECTS		9,0		ECTS	5 (forms)		9,0			
Form of co	ourse credit	credi	ts	Lang	guage		english	l		
Electives		11		Elect	tive group					
Form of in	struction	Cod	Semester	ŀ	Hours	EC	CTS	Weight	Realization	Credit
laboratory	/ course	L	7		180	9	,0	1,00	К	credits
Leading te	eacher	El Fra	ay Mirosław	a (Mir	oslawa.ElF	- ray@z	ut.edu.p	ol)		
<i>Other tea</i>	chers	(Miro Micha Paler	slawa.ElFra alkiewicz Be n@zut.edu.p	y@zu eata (I ol), Pie	t.edu.pl), l Beata.Mich egat Agnie	lgnacza nalkiew szka (<i>F</i>	ak Wojci vicz@zu Agnieszł	t.edu.pl), Mijov (a.Piegat@zut.	awa .lgnaczak@zut. vska Ewa (Ewa. edu.pl), Sobole du.pl), Zielinsk	Borowiak- wski Piotr
Prerequisi	ites									
W-1	Passing classes from	m sem	ester I-VI							
Module/co	ourse unit objective	es								
C-1	Consolidation of de	tailed	knowledge re	elated	to the key i	ssues o	f materia	als science and e	ngineering.	
C-2	Developing student		-							
C-3	Developing student		-	-	-				-	g.
C-4	Developing of students		• •					-	-	tioning of technical
C-5	solutions in the fiel	d of m	aterials engir	neering	g.	-		-		
С-6	Improving students	s' awar	eness of the	need f	for continuo	us educ	ation an	d professional de	evelopment.	1
Course co	ntent divided into									Number of hours
T-L-1	Presentation the pr opinions. Breakdow	n of co	ontent. Lingu	istic co	orrectness.	Quoting	literatu	re. Plagiarisms.		5
T-L-2	Presentation of the culture of discussin		for the prese	ntatior	n of the pro	gress in	the diplo	oma thesis. Princ	ciples and	5
T-L-3	Conducting researc	-	asurements,	calcula	ations relate	ed to th	e subject	of dissertation.		85
T-L-4	Presentation by stu the results obtained						the subje	ect of dissertatio	n. Discussion of	40
T-L-5	Discussion of mate dissertation defens								ed for the	45
Student w	orkload - forms of	activi	ty							Number of hours
A-L-1	participation in clas	sses								180
A-L-2	preparing a presen									40
A-L-3	preparation for disc	cussior	n on issues co	vered	by progran	n conte	nt			40
A-L-4	Consultations									10
	methods / tools									
М-1 М-2	Seminar Didactic discussion									
			NO D First							
Evaluation S-1	n methods (F - prog	-	ve, P - final, ne presented		ntations					
1-1			ie presented	preser	inations					

			progressive, P - final)							
5-2	F		based on the student's contin							
S-3	Р	Final cr	redit based on the average of	the positive ma	rks from the p	resentation ar	nd parti	cipation in the	discussi	ions.
	Desigi	ned lea	rning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course content	Teaching methods	Evaluatio methods
Knowledge	1			-	•					
MSE_1A_D01a Student has a the key issues	well-est		detailed knowledge related to ineering.	MSE_1A_W04	P6S_WG P6S_WK		C-1 C-2 C-3 C-4 C-5 C-6		M-1 M-2	S-1 S-2 S-3
Skills							00			
MSE_1A_D01a Student has th from the litera	ne ability	y to acqui d formula	ire and critically evaluate data te reports.	MSE_1A_U09	P6S_UW		C-1 C-2 C-3 C-4 C-5 C-6		M-1 M-2	S-1 S-2 S-3
MSE_1A_D01a Student is able materials engi	e to dev		results of research in the field of	MSE_1A_U09	P6S_UW		C-1 C-2 C-3 C-4 C-5 C-6		M-1 M-2	S-1 S-2 S-3
MSE_1A_D01a Student is able research resul	e to pre	pare and e field of r	present the development of naterials engineering.	MSE_1A_U12	P6S_UO		C-1 C-2 C-3 C-4 C-5 C-6		M-1 M-2	S-1 S-2 S-3
Social com	peten	ces								
MSE_1A_D01a Student is awa professional de	are of th		or continuous education and	MSE_1A_K01	P65_KK	P6S_WK	C-1 C-2 C-3 C-4 C-5 C-6	T-L-1 T-L-4 T-L-2 T-L-5 T-L-3	M-1 M-2	S-1 S-2 S-3
Outcom	nes	Grade		E	Evaluation cr	iterion				
Knowledge										
MSE_1A_D01a	_W01	2,0								
		-	Student is able to explain key op	erations and proce	esses in the field	of materials en	gineering	g.		
		3,5								
		4,0								
		4,5 5,0								
Skills		5,0								
MSE_1A_D01a	U01	2,0								
	-	3,0	Student is able to acquire and cr	itically evaluate inf	formation from I	iterature and pr	epare a	report at a basic	level.	
		3,5		,		P.				
		4,0								
		4,5								
		5,0								
MSE_1A_D01a	_U02	2,0								
		3,0	Student is able to prepare a sim	ole development of	the results of re	esearch in the fi	ield of ma	aterials engineer	ring.	
		3,5								
		4,0								
		4,5								
		5,0								
		2,0								
MSE_1A_D01a	_U03									
MSE_1A_D01a	_U03		Student can prepare and presen	t an oral presentati	ion on issues in	materials engin	eerina.			
MSE_1A_D01a	_U03	3,0	Student can prepare and presen	t an oral presentati	ion on issues in	materials engin	eering.			
MSE_1A_D01a	_U03	3,0 3,5	Student can prepare and presen	t an oral presentati	ion on issues in	materials engin	eering.			
MSE_1A_D01a	_U03	3,0	Student can prepare and presen	t an oral presentati	ion on issues in	materials engin	eering.			

Zachodniopomorski Uniwersytet Technologiczny w Szczecinie Faculty of Chemical Technology and Engineering

Other social com	petenc	es
MSE_1A_D01a_K01	2,0	
	3,0	Student is able to understand key operations and processes in the field of materials engineering.
	3,5	
	4,0	
	4,5	
	5,0	
Required reading	g	
1. Wise D.L., Bioma	aterials a	and Bioengineering Handbook, Marcel Dekker, New York, 2000

2. Ratner B.D., Biomaterials Science, Elsevier, New York, 2004

Field of st								-			
	tudy	Mate	rials Scienc	e and Engineeri	ng						
Mode of s	study	statio	onary	Level		first cy	cle	3.4.7	TUC		
Graduate'	's qualificatior	າ inżyn	nier	I				W	TilC	h	
Fields of s	science	engir	neering and	technology						_	
Discipline	es of science	mate	rials engine	ering (100%)							
Education	nal profile	gene	ral academ	ic							
Module											
Course ur	nit	Mate	erials Engi	neering Projec	t Rese	arch					
Code			1A S D01b							C	
Field of st	pecialisation										
-	ering faculty	Depa	rtment of N	lanomaterials Pl	nvsicoc	hemistry	/				
ECTS		9,0		ECTS (forms)	-	9,0		-			
	ourse credit	credi	ts	Language		english		-			
Electives		11		Elective group		english		-			
			Comostor				Waight	Booli	Tation	Croc	1:+
Form of in			Semester	Hours	EC		Weight	Realiz		Crea	
project co		P	7	180	9,		1,00	ľ k	<	cred	Its
Leading te	eacher	-		wa.Borowiak-Pa (Xuecheng.Cher							
Other tea	achers	Micha Paler	alkiewicz Be n@zut.edu.p	y@zut.edu.pl), I eata (Beata.Mich ol), Piegat Agnie ut.edu.pl), Wrób	nalkiewi szka (A	icz@zut. gnieszka	edu.pl), Mijov a.Piegat@zut.	wska Ewa .edu.pl), S	a (Ewa.Bo Sobolews	prowiak- ski Piotr	
Prerequis	sites										
W-1	Passing classe	es from sem	ester I-VI								
	ourse unit obje	ectives									
Module/co C-1	ourse unit obje Forming the a the form of ar	e <i>ctives</i> ability to revi a oral preser	iew and seled	t available public.				dissertatio	on and the	ir elaborat	ion in
Module/co	ourse unit obje Forming the a the form of ar	e <i>ctives</i> ability to revi a oral preser	iew and seled	ct available public search results and				dissertatio	n and the	ir elaborat	ion in
Module/cc C-1 C-2	ourse unit obje Forming the a the form of ar	ectives ability to revi o oral preser or the develo	iew and selec ntation opment of res	search results and				dissertatio		ir elaborat lumber of	
Module/co C-1 C-2	ourse unit obje Forming the a the form of ar Preparation fo ontent divided Discussion of	ectives ability to revi n oral preser or the develo <i>into variou</i> the subject	iew and selec ntation opment of res us forms of of engineerir	search results and instruction ng dissertation in t	their re	liable inte	erpretation als science an	d enginee	۸ ring		
Module/cc C-1 C-2 Course co	ourse unit obje Forming the a the form of ar Preparation fo ontent divided Discussion of	ectives ability to revi- n oral preser or the develo <i>i into variou</i> the subject ow the exter	iew and selec ntation opment of res us forms of of engineerir	search results and	their re	liable inte	erpretation als science an	d enginee	۸ ring		f hours
Module/cc C-1 C-2 Course co T-P-1	ourse unit objective Forming the a the form of ar Preparation for Discussion of Getting to know their impleme	ectives ability to revi n oral preser or the develo <i>i into variou</i> the subject ow the exter entation	iew and select ntation opment of res <i>us forms of</i> of engineerir rimental meth	search results and instruction ng dissertation in t	their re the area	liable inte	erpretation als science an	d enginee	۸ ring		f hours 15
Module/cc C-1 C-2 Course co T-P-1 T-P-2	ourse unit objective Forming the a the form of ar Preparation for Discussion of Getting to know their impleme	ectives ability to revi or al preser or the develo <i>into variou</i> the subject ow the exter entation ow the test s	iew and select ntation opment of rest of engineerin imental methers stand and check	search results and instruction ng dissertation in t nods applied in the	their re the area	liable inte	erpretation als science an	d enginee	۸ ring		f hours 15 40
Module/cc C-1 C-2 Course co T-P-1 T-P-2 T-P-3 T-P-4	ourse unit object Forming the a the form of ar Preparation for ontent divided Discussion of Getting to know their implement Getting to know	ectives ability to revi or oral preser or the develo <i>into variou</i> the subject ow the exter entation ow the test s reliminary te	iew and select ntation opment of res us forms of of engineerin rimental meth stand and chosests	search results and instruction ng dissertation in t nods applied in the	their re the area	liable inte	erpretation als science an	d enginee	ring ss of		f hours 15 40 30 95
Module/cc C-1 C-2 Course co T-P-1 T-P-2 T-P-3 T-P-4	ourse unit objet Forming the a the form of ar Preparation for ontent divided Discussion of Getting to know their impleme Getting to know Conducting pr	ectives ability to revi or or al preser or the develo <i>into variou</i> the subject ow the exter entation ow the test s reliminary te ms of activi	iew and select ntation opment of res us forms of of engineerir imental meth stand and che ests	search results and instruction ng dissertation in t nods applied in the	their re the area	liable inte	erpretation als science an	d enginee	ring ss of	lumber of	f hours 15 40 30 95
Module/cc C-1 C-2 Course co T-P-1 T-P-2 T-P-3 T-P-4 Student w	ourse unit objectives of the forming the arrival the form of an experiment of the form of an experiment of the form of the for	ectives ability to revi n oral preser or the develo the subject the subject ow the exter entation ow the test s reliminary te ms of activi in laboratory	iew and select ntation opment of res us forms of of engineerir imental meth stand and che ests	search results and instruction ng dissertation in t nods applied in the	their re the area	liable inte	erpretation als science an	d enginee	ring ss of	lumber of	f hours 15 40 30 95 f hours
Module/cc C-1 C-2 Course co T-P-1 T-P-2 T-P-3 T-P-4 Student w A-P-1	ourse unit obje Forming the a the form of ar Preparation for Ontent divided Discussion of Getting to kno their impleme Getting to kno Conducting pr workload - form Participation i studying of lit	ectives ability to revi or oral preser or the develo <i>into variou</i> the subject ow the subject ow the exter entation ow the test s reliminary te <i>ns of activi</i> in laboratory terature	iew and select ntation opment of res <i>us forms of</i> of engineerir imental meth stand and che ests <i>ty</i> classes	search results and instruction ng dissertation in t nods applied in the	their re the area e dissert	liable inte	erpretation als science an	d enginee	ring ss of	lumber of	f hours 15 40 30 95 f hours 180
Module/cc C-1 C-2 Course co T-P-1 T-P-2 T-P-3 T-P-4 Student w A-P-1 A-P-2	ourse unit obje Forming the a the form of ar Preparation for Ontent divided Discussion of Getting to kno their impleme Getting to kno Conducting pr workload - form Participation i studying of lit	ectives ability to review or al preserver or the develor the subject the subject ow the exter entation ow the test s reliminary te ms of activi in laboratory terature esearch and a	iew and select ntation opment of res <i>us forms of</i> of engineerir imental meth stand and che ests <i>ty</i> classes	search results and instruction ng dissertation in t nods applied in the ecking its operatio	their re the area e dissert	liable inte	erpretation als science an	d enginee	ring ss of	lumber of	f hours 15 40 30 95 f hours 180 15
Module/cc C-1 C-2 Course co T-P-1 T-P-2 T-P-3 T-P-4 Student w A-P-1 A-P-2 A-P-3 A-P-3 A-P-4	ourse unit obje Forming the a the form of an Preparation fo Discussion of Getting to kno Getting to kno Conducting pr workload - form Participation i studying of lit Performing re	ectives ability to revi or oral preser or the develo the subject the subject ow the exter entation ow the test s reliminary te ms of activi in laboratory rerature search and a	iew and select ntation opment of res <i>us forms of</i> of engineerir imental meth stand and che ests <i>ty</i> classes	search results and instruction ng dissertation in t nods applied in the ecking its operatio	their re the area e dissert	liable inte	erpretation als science an	d enginee	ring ss of	lumber of	f hours 15 40 30 95 f hours 180 15 65
Module/cc C-1 C-2 Course co T-P-1 T-P-2 T-P-3 T-P-4 Student w A-P-1 A-P-2 A-P-3 A-P-3 A-P-4	ourse unit obje ourse unit obje Forming the a the form of ar Preparation for ontent divided Discussion of Getting to know Getting to know Conducting pr workload - form Participation i studying of lit Performing re consultations	ectives ability to review or al preserver or the develor into variou the subject ow the exter entation ow the test server reliminary teens of activi in laboratory terature esearch and a obs	iew and select ntation opment of res <i>us forms of</i> of engineerir imental meth stand and che ests <i>ity</i> <i>v</i> classes analysis of th	search results and instruction ng dissertation in t nods applied in the ecking its operatio	their re the area e dissert	liable inte	erpretation als science an	d enginee	ring ss of	lumber of	f hours 15 40 30 95 f hours 180 15 65
Module/cc C-1 C-2 Course co T-P-1 T-P-2 T-P-3 T-P-4 Student w A-P-1 A-P-2 A-P-3 A-P-3 A-P-4 Teaching M-1	Jourse unit obje ourse unit obje Forming the a the form of ar Preparation for ontent divided Discussion of Getting to know Getting to know Getting to know Conducting proverkload - form Participation i studying of lit Performing re consultations methods / too Continuous we	ectives ability to review or al preser- or the develor into variou the subject ow the exter- entation ow the test s reliminary te ms of activi in laboratory erature esearch and a ols ork with a st	iew and select ntation opment of res us forms of of engineerir imental meth stand and cho ests ty classes analysis of th cudent in the	search results and instruction ng dissertation in t nods applied in the ecking its operatio	their re	of materi	erpretation als science an I checking the	d enginee correctnes	N ring ss of N	lumber of	f hours 15 40 30 95 f hours 180 15 65
Module/cc C-1 C-2 Course co T-P-1 T-P-2 T-P-3 T-P-4 Student w A-P-1 A-P-3 A-P-3 A-P-3 A-P-4 Teaching M-1 M-2	Jourse unit obje ourse unit obje Forming the a the form of ar Preparation for ontent divided Discussion of Getting to know Getting to know Getting to know Conducting proverkload - form Participation i studying of lit Performing re consultations methods / too Continuous we	ectives ability to review or al preserver or the develor the subject the subject ow the exter- entation ow the test server reliminary teens of activi in laboratory terature esearch and a ols ork with a sta	iew and select ntation opment of res <i>us forms of</i> of engineerir imental meth stand and che ests <i>ity</i> classes analysis of th cudent in the egarding the	search results and instruction ng dissertation in t nods applied in the ecking its operation ne obtained results laboratory correctness of the	their re	of materi	erpretation als science an I checking the	d enginee correctnes	N ring ss of N	lumber of	f hours 15 40 30 95 f hours 180 15 65
Module/cc C-1 C-2 Course co T-P-1 T-P-2 T-P-3 T-P-4 Student w A-P-1 A-P-3 A-P-3 A-P-3 A-P-4 Teaching M-1 M-2	ourse unit obje ourse unit obje Forming the a the form of an Preparation for ontent divided Discussion of Getting to know Getting to know Conducting preparation i Vorkload - form Participation i studying of lit Performing re consultations methods / too Substantive d n methods (F P Writte	ectives ability to revi or oral preser or the develo the subject the subject ow the exter entation ow the test s reliminary te ms of activi in laboratory erature isearch and a ols ork with a st liscussions re - progressi n report on t	iew and select ntation opment of res <i>us forms of</i> of engineerir imental meth stand and che ests <i>ity</i> <i>r</i> classes analysis of the tudent in the egarding the <i>ve, P - final</i> , the implement	search results and instruction ng dissertation in t nods applied in the ecking its operation he obtained results laboratory correctness of the hation of the assu	their re the area e dissert on 5	of materi ation and arried out	erpretation als science an I checking the 	d enginee correctnes	Ν ring ss of Ν </td <td>lumber of</td> <td>f hours 15 40 30 95 f hours 180 15 65 10</td>	lumber of	f hours 15 40 30 95 f hours 180 15 65 10
Module/cc C-1 C-2 Course co T-P-1 T-P-2 T-P-3 T-P-4 Student w A-P-1 A-P-2 A-P-3 A-P-3 A-P-4 Teaching M-1 M-2 Evaluation	ourse unit obje ourse unit obje Forming the a the form of an Preparation for ontent divided Discussion of Getting to know Getting to know Conducting preparation i Vorkload - form Participation i studying of lit Performing re consultations methods / too Substantive d n methods (F P Writte	ectives ability to revi- n oral preser- or the develo into variou the subject ow the exter- entation ow the test s reliminary te ms of activi in laboratory rerature isearch and a ols ork with a st liscussions re - progressi n report on filic evaluation	iew and select ntation opment of res <i>us forms of</i> of engineerir imental meth stand and che ests <i>ity</i> <i>r</i> classes analysis of the tudent in the egarding the <i>ve, P - final</i> , the implement	search results and instruction ng dissertation in t nods applied in the ecking its operation he obtained results laboratory correctness of the	their re the area e dissert on 5	of materi ation and arried out	erpretation als science an I checking the 	d enginee correctnes	Ν ring ss of Ν </td <td>lumber of</td> <td>f hours 15 40 30 95 f hours 180 15 65 10</td>	lumber of	f hours 15 40 30 95 f hours 180 15 65 10
Module/cc C-1 C-2 Course co T-P-1 T-P-2 T-P-3 T-P-4 Student w A-P-1 A-P-2 A-P-3 A-P-3 A-P-4 Teaching M-1 M-2 Evaluation S-1	ourse unit obje Forming the a the form of an Preparation for ontent divided Discussion of Getting to know their impleme Getting to know Conducting present vorkload - form Participation i studying of lit Performing re consultations methods / too Substantive d n methods (F - P Writte F Period thesis	ectives ability to revi- n oral preser- or the develo into variou the subject ow the exter- entation ow the test s reliminary te ms of activi in laboratory serature isearch and a ols ork with a st iscussions re - progressi n report on fi	iew and select ntation opment of res <i>is forms of</i> of engineerir imental meth stand and che ests <i>ity</i> classes analysis of the cudent in the egarding the <i>ve, P - final;</i> the implement n of the cours	search results and instruction ng dissertation in t nods applied in the ecking its operation he obtained results laboratory correctness of the hation of the assu	their re he area e dissert on 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	of materi ation and arried out search an of the ass	erpretation als science an I checking the 	d enginee correctnes	Ν ring ss of Ν </td <td>lumber of</td> <td>f hours 15 40 30 95 f hours 180 15 65 10</td>	lumber of	f hours 15 40 30 95 f hours 180 15 65 10

Faculty of Chemical Technology and Engineering

Knowledge									
		ials science and engineering uses ocess and interpretation of	MSE_1A_W05	P6S_WG P6S_WK		C-1 C-2	T-P-1 T-P-3 T-P-2 T-P-4	M-1 M-2	S-1 S-2 S-3
Skills									
the subject of enginee in the process of self- - build a research star operations and unit p	ering thesi education nd, use an rocesses r	he basis of collected literature on is and deepening his knowledge alytical methods to control related to the thesis of d interpret the obtained results	MSE_1A_U01 MSE_1A_U03 MSE_1A_U07 MSE_1A_U08	P6S_UK P6S_UW	P6S_UW	C-1	T-P-1	M-2	S-1
Social competen	ces								
MSE_1A_D01b_K01 Student is aware of th professional developn		r continuous education and	MSE_1A_K02	P6S_KK	P6S_WK	C-1 C-2		M-1 M-2	S-1 S-2 S-3
Outcomes	Grade		E	valuation cr	iterion				
Knowledge	•								
MSE_1A_D01b_W01	2,0								
	3,0	Student is able to explain key ope	erations and proce	sses in the field	of materials en	gineerir	g.		
	3,5								
	4,0								
	4,5								
	5,0								
Skills									
MSE_1A_D01b_U01	2,0								
	3,0	Student is able to acquire and crit	tically evaluate inf	ormation from I	iterature and pr	repare a	report at a basic	level.	
	3,5								
	4,0								
	4,5								
	5,0								
Other social com	petence	9 <i>5</i>							
MSE_1A_D01b_K01	2,0								
	3,0	Student is able to understand key	operations and p	rocesses in the	field of materia	ls engine	eering.		
	3,5								
	4,0								
	4,5								
	5,0								
Required reading									
2014, ISBN-13 : 97	8-35273		-		-	-		ons, Wile	y,
2. Jin Zhang, Zhong	g-lin War	ng, Jun Liu, Self-Assembled Na	nostructures, Sp	oringer, 2002,	ISBN-13:978	3-03064	172992		
3. Zhifeng Ren, Yu	cheng La	n, Oinvong Zhang, Advanced	Thermoelectrics	. Materials, C	ontacts. Devid	ces, and	Systems, CR	Press.	2017.

3. ∠nifeng Ken, Yucher ISBN 9781498765725

			-						
Field of stu	Jdy	Mate	erials Scienc	e and Engineer	ing				
Mode of st	tudy	stati	onary	Level		first o	cycle	VA/T:L	
Graduate's	s qualification	inżyr	nier	·				WTil(Ln
Fields of s	cience	engi	neering and	technology					_
Disciplines	s of science	mate	erials engine	ering (100%)					
Education	al profile	gene	eral academ	ic					
Module									
Course un	it	Diss	ertation R	esearch in Ma	tSci				
Code		MSE	_1A_S_D02a						
Field of sp	ecialisation	-							C
Administer	ring faculty	Depa	artment of P	olymer and Bio	materia	als Scie	nce		
ECTS		15,0		ECTS (forms)		15,0			
	ourse credit	cred		Language		english	1	-	
Electives		12		Elective group				-	
Form of in	struction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
		PD	7	0		5,0	1,00	K	credits
Leading te	Pacher		av Mirosław	a (Miroslawa.El		-		I	
Other teac		(Mirc Mijov (Agn	oslawa.ElFra wska Ewa (E iieszka.Piega	(Xuecheng.Che y@zut.edu.pl), wa.Borowiak-Pa at@zut.edu.pl), rut.edu.pl), Zieli	Michalk alen@z Sobole	ciewicz ut.edu.µ wski Pic	Beata (Beata.N ol), Piegat Agni otr (psobolewsl	/lichalkiewicz@; ieszka <i@zut.edu.pl),< td=""><td></td></i@zut.edu.pl),<>	
Prerequisi									
W-1	knowledge and skil	ls acq	uired through	out the course of	f educati	on			
Module/co	urse unit objective	<i>es</i>							
C-1	Acquire the basic s		-		obtaine	d results	s in the field of m	naterials science	
C-2	Acquire the skills in	l data	collection and	d interpretation					
Course co	ntent divided into								Number of hours
T-PD-1	Presentation of rec								0
T-PD-2	Gathering and anal the subject of the v		by the studer	nt the literature c	ontainin	g the cu	rrent state of kn	owledge about	0
T-PD-3	Formulating the ba		int of the diss	ertation by the st	tudent a	nd indica	ating the issues	that should be	0
T-PD-4	solved in dissertation Depending on the s		city of the wo	ork, the student p	erforms	a measu		or	0
	computational part						-		
T-PD-5	The student's analy The student's perfo							ables and other	0
T-PD-6	annexes to the diss	ertati	on.			, u o			0
T-PD-7	Editing the disserta		-						0
T-PD-8	Preparation of oral	prese	ntation for the	e defense					0
	orkload - forms of		,						Number of hours
A-PD-1	Collecting and anal				disserta	ation			60
A-PD-2	Performing measur								260
A-PD-3	Carrying out the an	-	of the receiv	ed work results.					75
A-PD-4 A-PD-5	Writting the dissert Preparing for the de		<u>د</u>						45 20
			-						20
Teaching i M-1	methods / tools Consultations with	the th							
	methods (F - prog								
S-1	P Consultation		h the thesis s						

		-								
Desig	ned leai	rning outcomes	Reference to the learning outcomes designed for the fields of study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course	e content	Teaching methods	Evaluation methods
Knowledge			I				1			
MSE_1A_D02a_W01 Student is able to exp		ssues related to manufacturing of and structure-property	MSE_1A_W02	P6S_WG	P6S_WG	C-1 C-2	T-PD-2 T-PD-3	T-PD-5 T-PD-6 T-PD-7 T-PD-8	M-1	S-1
Skills				•						
MSE_1A_D02a_U01 Student can acquire a literature, databases		lly evaluate information from sources	MSE_1A_U07 MSE_1A_U08	P6S_UK P6S_UW	P6S_UW	C-1 C-2	T-PD-2 T-PD-3	T-PD-5 T-PD-6 T-PD-7 T-PD-8	M-1	S-1
Social competer	ices			•						
MSE_1A_D02a_K01 Student understands professional develop		for continuous education and	MSE_1A_K04 MSE_1A_K05	P6S_KR	P6S_WK	C-1 C-2	T-PD-2 T-PD-3	T-PD-5 T-PD-6 T-PD-7 T-PD-8	M-1	S-1
Outcomes	Grade		E	Evaluation cr	iterion					
Knowledge	1	1								
MSE_1A_D02a_W01	2,0									
	3,0	Student is able to explain key cor relationship at a basic level.	mponents for vario	ous materials ma	anufacturing and	d describ	e structi	ure-prope	erties	
	3,5									
	4,0									
	4,5									
	5,0									
Skills										
MSE_1A_D02a_U01	2,0									
	3,0	Student can acquire information t	from the literature	at a basic level						
	3,5 4,0									
	4,0									
	5,0									
Other social com	petence	es								
MSE_1A_D02a_K01	2,0									
	3,0	is able to critically assess the kno	wledge and conte	nt received						
	3,5									
	4,0									
	4,5									
	5,0									
Required reading	-									
	-	ubject of research - papers, m								
1. Literature dealir	ng with s	ubject of research - papers, m	ionographs, boo	ks, patents, 20	020					

Field of st Mode of st Graduate' Fields of s	tudy				e and	Engineering Level	first o	vcle					
Graduate'. Fields of s	,		statio	onary		Level	first o	vcle					
Fields of s	s qualit	of study stationary <i>Level</i> first cycle											
		ication	inżyn	ier					1	WTil	Ch		
Discipling	cience		engir	neering and	techr	nology			1	_		÷.,	
Disciplines	s of scie	ence	mate	rials engine	ering	(100%)						<u> </u>	
Education	al profi	le	gene	ral academi	ic								
Module													
Course un	nit		Diss	ertation Re	esear	rch in MatEn	g						
Code			MSE_	1A_S_D02b									
Field of sp	pecialisa	ation										_	
Administe	ring fac	culty	Depa	rtment of N	lanom	naterials Physi	cochemist	ſУ				L	
ECTS			15,0		ECTS	(forms)	15,0						
Form of co	ourse c	redit	credi	ts	Lang	guage	english						
Electives			12		Elect	ive group							
Form of in	structio	on	Cod	Semester	ŀ	lours	ECTS	Weight	t F	Realization		Crea	lit
			PD	7		0	15,0	1,00		К		cred	its
Leading te	eacher		Mijov	vska Ewa (E	wa.Bo	prowiak-Palen	@zut.edu.p))					
Other tead			(Miro Mijov	slawa.ElFra vska Ewa (E	y@zu wa.Bo	heng.Chen@z t.edu.pl), Mich prowiak-Palen t.edu.pl), Wró	nalkiewicz I @zut.edu.p	Beata (Bea ol), Piegat A	ta.Micha Agnieszł	alkiewicz@ <a< td=""><td></td><td>•</td><td></td></a<>		•	
Prerequisi													
W-1	knowle	edge and skil	ls acqu	uired through	out th	e course of edu	cation						
		nit objective											
C-1 C-2					-	pretation of obta	ained results	in the field	of mater	ial engineer	ring.		
				collection and		tation based or	the subiect	literature re	esearch a	and obtaine	d expe	rimenta	al
С-3	results												
Course co				is forms of	instru	ction					Num	nber of	f hours
T-PD-1		cting laborat							<u> </u>				0
T-PD-2		bject of the v		by the studer	it the l	literature conta	ining the cui	rent state o	t knowle	dge about			0
T-PD-3		•		n of obtained									0
T-PD-4	Prepar	ation of oral	preser	ntation for the	e defei	nse							0
Student w	orkload	l - forms of	activi	ty							Num	nber of	f hours
A-PD-1		-		experiments									260
A-PD-2	-			n of obtained	l resul	ts							50
A-PD-3 A-PD-4	_	the disserta											100
		-	erense										40
Teaching I M-1	-		n doal	ing with the f	form o	f degree's thesi	s and progr	occ in oditin	a of thos	ic			
M-1 M-2						iture analysis, c	• •		-				
				ve, P - final)		, , , .							
S-1	F		-			dies and progre	ss in editing	of degree's	thesis				
5-2	F	-		vity and indiv									
5-3	Р	Valuation of		-									
	Desigr	ned learning	g outc	omes		Reference to the learning outcomes designed for the fields o			omes ons at that object		ontent	Teaching methods	Evaluation methods
						study	PQF 6, 7 or 8	engineerir competenc	ng				

Faculty of Chemical Technology and Engineering

		· · · · · · · · · · · · · · · · · · ·			··· _·· J···		- 5		
MSE_1A_D02b_W01 Student is able to exp various engineering r relationship	olain key o naterials a	components for manufacturing and structure-property	MSE_1A_W03	P6S_WG P6S_WK	P65_WG	C-1 C-2 C-3		M-1 M-2	S-1 S-2 S-3
Skills									
studies is able to pre	pare docu	earch and results of conducted mentation dealing with problems while cooperating with other	MSE_1A_U01	P6S_UW	P6S_UW	C-2 C-3	T-PD-2 T-PD-3 T-PD-4	M-2	S-1
to control unit operat	ion and pr	t station, use analytical methods rocesses, work out and ts, can use statisticall methods to	MSE_1A_U07 MSE_1A_U08 MSE_1A_U09	P6S_UK P6S_UW	P6S_UW	C-1 C-2 C-3	T-PD-1 T-PD-4 T-PD-3	M-1 M-2	S-1 S-2 S-3
Social competer	ices								
on the final results of	group wo	ble realization of self-work tasks rk, can determine the order of share knowledge and discuss	MSE_1A_K01 MSE_1A_K02	P65_KK	P65_WK	C-1 C-2 C-3	T-PD-1 T-PD-3 T-PD-2 T-PD-4	M-1 M-2	S-1 S-2
Outcomes	Grade		E	valuation cr	iterion				
Knowledge	1	1							
MSE_1A_D02b_W01	2,0								
	3,0	Student is able to explain key cor relationship at a basic level.	nponents for vario	us materials ma	anufacturing an	d descrit	pe structure-prope	erties	
	3,5								
	4,0								
	4,5								
	5,0								
Skills									
MSE_1A_D02b_U01	2,0								
	3,0	Student can acquire information f	rom the literature	at a basic level					
	3,5								
	4,0								
	4,5								
	5,0								
MSE_1A_D02b_U02	2,0	Guided by the tutor, he builds a re	esearch stand use	s the indicated	analytical met	ods to c	ontrol operations	and unit	
	3,0	processes related to the subject of							
	3,5								
	4,0								
	4,5								
Other and states a	5,0								
Other social com	-	es							
MSE_1A_D02b_K01	2,0								
	3,0	is able to critically assess the kno	wiedge and conter	nt received					
	3,5 4,0								
	4,0								
	5,0								
Required reading									
-									
1. Literature deali	ng with s	ubject of research - papers, m	onographs, bool	ks, patents, 2	020				

1. Literature dealing with subject of research - papers, monographs, books, patents, 2020

				- ,						5			
Field of st	tudy		Mate	erials Scienc	e and Engineeri	ng							
Mode of s	tudy		stati	onary	Level		first cy	ycle		/ I /	~ 1		
Graduate	's qualifi	cation	inżyr	nier					- W	/Til(Lh		
Fields of s	science		engi	neering and	technology								
Discipline	s of scie	nce	mate	erials engine	ering (100%)				1 🗖				
Educatior				eral academ									
Module	- 1		J		-								
Course ur	nit		Prac	ticum (Int	erniship)							1	
Code			Practicum (Interniship) MSE_1A_S_P01									//	
Field of s	pecialisa	tion										4	
Administe			Depa	artment of P	olymer and Bior	mater	ials Scien	ce	- '				
ECTS	ing rac		6,0		ECTS (forms)	nacer	6,0		_				
Form of c	ourse cr	edit	cred	its	Language		english		_				
Electives		cure	cicu		Elective group		crigiisti		-				
	+ + : -		Carl	Comoston		-		14/0-2010-4					
Form of ir	nstructio	n	Cod	Semester	Hours		CTS	Weight	Кеа	alization		Crea	
			PR	6	180		6,0	1,00		K		credi	ICS
Leading t			Żwir	Marek (Mar	ek.Zwir@zut.ed	u.pl)							
Other tea	chers												
Prerequis	ites												
W-1				ties and testi	ng								
W-2		ls engineeri	-										
W-3	Materia	ls processin	g and	identification	in industry								
C-1	1. raw r 2. the c materia 2. meth 3. autor 4. pract optimiz 5. use c	materials an ourse of ma als take place nods of mana mation and p tical course of ation of raw mater	d mat terials ageme proces of des ials, e	erials used in s production a ent and organ ss control me igning produc energy and th	encies related to: the processes of and processing, fo ization of product thods used in prace ts, equipment an e reduction and m fety regulations for	od, en tion tice d techi nanage	ergy and o nologies, a ment of wa	ther processes nd the procedu aste in industri	ures for al proce	their impl	ementat	tion a	and
Course co				us forms of							Numb		fhours
T-PR-1	Acquair required that can materia analysis of resea certifica work in	ntance with t d specific ma rry out proce als with the r s and charac arch and dev ation and ap the materia	techno ateria edures requiro teriza velopr prova ls eng	ological proce l characterist for the supe ed specific ch ation of raw m nent work, or l of the qualit gineering and	esses in the indust ics, or in institutio rvision, identificat aracteristics. Acquaterials and materials the organization y of raw materials related industries pervision, control	ns that ion an uisitior rials ir and im and e s, desig	t maintain d analysis, of practice technolog plementat ngineering on offices, s	design studios certification a al methods of gical processes ion of procedu materials. Pr scientific and r	and lab nd approselection , or in th res for c reparations esearch	oratories oval of n, ne course control, on to			6
Student v	vorkload	- forms of	activ	ity							Numb	er of	f hours
A-PR-1				n (internship)									178
A-PR-2	Contact	t with superv	/isor										2
Teaching	method	s / tools											
M-1	Profess	ional Practic	e										
Evaluatio	n metho	ds (F - prog	gress	ive, P - final,									
S-1		Evaluation c		-									
5-2	Р	Assessment	in the	e form of oral	credit by the pers	son res	ponsible fo	or the course					
S-2 P Assessment in the form of oral credit by the person responsible for the course Designed learning outcomes Reference to the learning outcomes designed for the fields of study Reference to the learning outcomes of or valifications at level 6 or 7 that enable acquiring engineering competences							Course objectives	Course con		aching ethods	Evaluatior methods		

Knowledge									
of materials industry a the course of material and other processes ir materials take place; I management and org used in practice and ti understands the cours technologies, and the optimization; he/she k energy and limiting th industrial processes; F	and other s product n which st he/she kn anization; he ways of ce of desig procedur nows the e creation he/she kno	d materials used in the processes industries; he/she understands tion and processing, food, energy tructural transformations of nows the ways of production ; he/she knows the automatics of controlling processes; he/she gning products, devices and es of their implementation and ways of using raw materials, n and management of waste in ows the valid safety regulations materials and apparatus used.	MSE_1A_W02 MSE_1A_W04 MSE_1A_W07 MSE_1A_W09 MSE_1A_W11	P65_WG P65_WK	P6S_WG	C-1	T-PR-1	M-1	5-1 S-2
Skills								i	
technological processe	es in the f ods and t	e acquired knowledge of field of material chemistry, techniques for testing and	MSE_1A_U01 MSE_1A_U06 MSE_1A_U07 MSE_1A_U08 MSE_1A_U09	P6S_UK P6S_UW	P6S_UW	C-1	T-PR-1	M-1	S-1 S-2
Social competent	ces								
influence of own actio	ns on the	a team, being aware of the results of work of the whole te with team members.	MSE_1A_K02 MSE_1A_K04	P6S_KK P6S_KR	P6S_WK	C-1	T-PR-1	M-1	S-1 S-2
Outcomes	Grade		E	valuation cri	iterion				
Knowledge									
MSE_1A_P01_W01	2,0 3,0 3,5	Student sufficiently demonstrated knowledge necessary to perform materials and the ways of their ch management and energy and safe	the tasks assigned naracterization, the	during the prac	ctice in terms o	f knowle	dge of materia	ls and raw	n has
	4,0								
	4,5								
	5,0								
Skills									
MSE_1A_P01_U01	2,0 3,0	The student is able to sufficiently manufacturing techniques (e.g.: t etc.).							
	3,5								
	4,0								
	4,5 5,0								
Other social com									
MSE_1A_P01_K01									
	2,0 3,0 3,5	The student is able to work in a te	eam, being aware o	of the influence	of his own acti	ons on tl	ne work of the	whole team	
	4,0								
	4,5								
	5,0								
Required reading	1								
1. 2011, Brak									
L									

			-						
Field of st	udy	Mate	erials Scienc	e and Engineeri	ng				
Mode of s	tudy	stati	onary	Level		first o	cycle	347721	
Graduate	's qualification	inży	nier					WTil	LN
Fields of s	science	engi	neering and	technology					
Discipline	s of science	mate	erials engine	ering (100%)					<u> </u>
Education	nal profile	gene	eral academ	ic					
Module									
Course ur	nit	Intr	o to Chemi	stry					C
Code		MSE	_1A_S_U01						
Field of sp	pecialisation								
Administe	ering faculty	Dep	artment of li	norganic and An	alytica	l Chemi	stry		
ECTS		0,0		ECTS (forms)	,	0,0			
	ourse credit	cred	its	Language		english			
Electives				Elective group		e	·		
Form of ir	struction	Cod	Semester	Hours	FC	TS	Weight	Realization	Credit
				30	-	-	0,50	K	credits
lecturing	course	A	1			,0	-		
lecture		W	1	15		,0	0,50	К	credits
Leading to Other tea		Bosa Koło	acka Monika dziej Beata	vigniew (Zbignie (Monika.Bosack (Beata.Kolodziej adowski@zut.ed	a@zut @zut.e	.edu.pl) du.pl),	, Filipek Elżbiet Rozwadowski Z		pek@zut.edu.pl),
Prerequis	ites								
W-1	The basic knowled	ge of f	undamental c	hemistry (inorgan	ic and o	organic)			
Module/co	ourse unit objective	es							
C-1	Knowledge and une	dersta	ndig the basi	c concepts and lav	vs of ch	emistry			
Course co	ontent divided into	vario	us forms of	instruction					Number of hours
T-A-1	Nomenclature and	formu	llas of inorgar	ic compounds					4
T-A-2	Chemical reactions	and o	chemical equa	itions					4
T-A-3	Oxidation – reducti	on rea	actions						4
T-A-4	Calculations based	on ch	emical equati	ons. Yield of react	ions				4
T-A-5	Concentrations of s		-						4
T-A-6	The stoichiometry								4
T-A-7	The electronic stru				ble				2
T-A-8	The equilibrium lav				acont F	quilibria	involving woold	molocularacido	2
T-A-9	and bases		i aqueous soi	utions. The pri col	icept. E	quiibria	involving weak i		2
T-W-1	Introduction to che	mistry	/. Nomenclatu	ire of inorganic co	mpound	ls. Atom	s, molecules and	moles	2
T-W-2	Fundamental chem	nical la	IWS						2
T-W-3	Chemical reactions								2
T-W-4	The periodic table			s of the elements					2
T-W-5	Chemical bonding:	-	-						2
T-W-6	Reaction rate, equi		· ·	constants, cataly	ts.				1
T-W-7	Electrolytes, pH co	-							1
T-W-8	An introduction to	-	-						3
	vorkload - forms of		-						Number of hours
A-A-1	Participation in rec		IS						30
A-A-2	Preaparation for cla								30
A-A-3	Individual problem	solvin	ig						27
A-A-4	Consultations								3
A-W-1	Participation in lect		15						

Faculty of Chemical Technology and Engineering

Student w	Number of hours Number of hours												
A-W-2	Prepara	ation for	final test								15		
A-W-3	Individ	ual litera	ture studies								28		
A-W-4	Consult	tations									2		
Teaching r	nethod	ls / tools	;										
M-1	Lecture	9											
М-2	Discuss	sion											
Evaluation	ion methods (F - progressive, P - final)												
S-1	P Final test												
5-2	P Continuous assessment: test (exercises)												
	P Continuous assessment: test (exercises) Designed learning outcomes Reference to learning outcomes designed for the fields of study Reference to bearing outcomes for qualifications at PQF 6, 7 or 8 Reference to learning outcomes anable acquiring engineering competences Course Course content Teaching methods Evaluation methods												
Knowledge	9												
Skills													
Social com	petenc	ces											
Outcon	nes	Grade		E	valuation cri	iterion							
Knowledge	è												
Skills													
Other soci	al com	petence	S										
Required r	eading												
1. C. E. Hou	secroft	and A. G	. Sharpe, Inorganic Chemistr	y, Pearson Educa	ation Limited,	Edinburgh, Ul	<, 2001, I	SBN 058	2-31080	-6			
2. P. W. Atk 1990, ISBN			n, M. J. Frazer, R. A. Y. Jones,	Chemistry. Prin	ciples and app	olications, Lon	gman Gr	oup UK L	imited,	New	York,		
3. J. E. Brad	y, Gene	ral Chem	istry. Principles and Structur	e, John Wiley & S	Sons, New Yor	k, 1990, ISBN	0-471-62	2131-5					
	. W. W. Porterfield, Inorganic Chemistry. A Unified Approach, Academic Press Inc., London, 1993, ISBN 0-12-562981-8												
	5. G. L. Miessler, D. A. Tarr, Inorganic Chemistry, Pearson Education Inc., New Jersey, 2004, ISBN 0-13-120198-0												
	G. C. Hill, J. S. Holman, Chemistry in Context, Thomson Nelson and Sons Ltd, Edinburgh, UK, 1989, ISBN 0-17-438401-7												
-	hn E. McMurry, Organic Chemistry, New York, 2012, (8th Edition)												
8. G. Marc L	audon,	Organic	Chemistry, Oxford, New York	x, 2002, (4th edit	ion)								

			-								
Field of s	study	Mate	erials Scienc	e and Engineerii	ng						
Mode of :	study	stati	onary	Level	14/701/	~1					
Graduate's qualification		inżyr	nier	I		ļ		WTil	_h		
Fields of	science	engi	neering and	technology							
Discipline	es of science	mate	erials engine	ering (100%)							
-	nal profile		eral academ	-							
Module		gene									
	nit	Intr	o to Biolog								
Course unit			-	у		O					
Code		MSE	_1A_S_U02								
	pecialisation										
Administering faculty		- ·	artment of C	Chemical and Pro							
ECTS		0,0		ECTS (forms)		0,0		-			
Form of a	course credit	credits		Language		english					
Electives	;			Elective group							
Form of i	instruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit		
lecturing	course	Α	1	30	0,	0	0,50	к	credits		
lecture		w	1	15	0,	0	0,50	К	credits		
Leading	toachar	Mark	Markowska-Szczupak Agata (Agata.Markowska@zut.edu.pl)								
				upak Agata (Aga				Sobolewski Piot	r		
Other tea	achers		bolewski@z								
Prerequis	sites										
W-1	knowledge at the b	basic o	f natural scie	nce, biology or rela	ated sub	ojects					
Module/c	ourse unit objectiv	es									
C-1	To introduce stude genetics and evolu	nts to		f structure, functio	on and i	nteractio	ons of living orga	anisms including o	ell theory,		
				in star stiss					Number of bound		
T-A-1	ontent divided into Design and pannin				othodc i	n Piolog			Number of hours		
Т-А-1 Т-А-2	Calculation of conc	-				II BIOlOg	У		5		
T-A-2	The kinetics of gro			tions cell bology					5		
T-A-4	Examination of pla		diversitv.						5		
T-A-5	Introduction to microbial culture methods: microscopy.										
T-W-1	History of Biology.	History of Biology. Definition. Division of Biological Sciences.									
T-W-2	An introduction to Classification and taxonomy.										
T-W-3	Biological Law/ Cer	3									
T-W-4	Cellular assemblies		3								
T-W-5	An introduction to		3								
T-W-6	Environmental biosafety, bioresources, biodiversity. 2										
Student	workload - forms of	activ	ity						Number of hours		
A-A-1	Participation in recitations								30		
A-A-2	studing literature								10		
A-A-3	preparing of writte		10								
A-A-4	consultations		10								
A-W-1	participating in lec	15									
A-W-2	individual consultations										
A-W-3	prepartion for tests 3										
	methods / tools										
M-1	power point preser										
М-2 М-3	disscusion during t recitation class	he lect	tures								

Teaching methods / tools																
M-4	private	private study , tutorials, learning materials														
Evaluation methods (F - progressive, P - final)																
S-1	F	multiple	multiple choice test													
S-2	F	evaluat	evaluation of reports													
Designed learning outcomes					Reference to the learning outcomes designed for the fields study	Reference to Learning Outcomes for qualifications at PQF 6, 7 or 8	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course content	Teaching methods	Evaluation methods					
Knowledge																
Skills																
Social competences																
Outcom	comes Grade Evalu								Evaluation cr	aluation criterion						
Knowledge																
Skills																
Other social competences																
Required reading																
1. Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, Jane B. Reece, Campbell Biology in Focus, Global Edition, Pearson, 2016																
2. Karen Hopkin, Alexander D Johnson, David Morgan, Martin Raff, Keith Roberts,, Essential Cell Biology, W. W. Norton & Company;, 2011, 5																
3. Kristi Lew, Taxonomy: The Classification of Biological Organisms (Heredity and Genetics), Enslow Publishing, 2018																
Supplementary reading																
1. R. Dawkins, The Selfish Gene: 30th Anniversary edition, OUP Oxford, Oxfors, 2006, 1																
2. Michael T. Madigan , Kelly S. Bender Daniel H. Buckley, W. Matthew Sattley, Brock Biology of Microorganisms, Pearson, 2019, 14											4					
3. Biology Jo	3. Biology Journals, 2010, Frontiers in Biology, PLoS Biology, Journal of Theoretical Biology, Biological Reviews															