

training method;

conversational lecture; multimedia presentation

M-2

### Zachodniopomorski Uniwersytet Technologiczny w Szczecinie

	Га	icui	ty of Cn	emicai rec	nnoi	ogy a	na Engin	eering	
Field of s	study	Mate	erials Scienc	e and Engineeri	ng				
Mode of	study	stati	ionary	Level		first o	cycle	\	C L
Graduate	e's qualification	inży	nier	•		<b>'</b>		WTil	Ch
Fields of	science	engi	neering and	technology					_
Disciplin	es of science	mat	erials engine	ering (100%)				11 _	
Educatio	nal profile	gene	eral academ	ic					
Module									
Course u	ınit	Phy	sical Educa	tion 1					C
Code		MSE	_1A_S_A01a					\	
Field of s	specialisation								
Administ	tering faculty	Stuc	lium Wychov	vania Fizyczneg	o i Spo	rtu			
ECTS		0,0		ECTS (forms)		0,0			
Form of	course credit	cred	lits	Language		english			
Electives	5			Elective group					
Form of i	instruction	Cod	Semester	Hours	EC	CTS	Weight	Realization	Credit
lecturing	course	Α	1	30	0	,0	1,00	K	credits
Leading	teacher	Trub	oiłko Joanna	(Joanna.Walczal	k@zut.	edu.pl)			
Other tea	achers	Olsz	ewska Tama	ıra (Tamara.Ols	zewska	@zut.e	du.pl)		
Prerequis	sites								
W-1	no health contraind	licatio	ns to exercise	9					
W-2	students completel	y exe	mpt from phy	sical exercise					
Module/c	course unit objective								
C-1	C1 - teaching techn C2 - to care for one circulatory, nervous C3 - increasing the C4 - develop the ha organization of spo C5 - to oppose soci physical activity.	s and value bit of rting al pat	n health throu other system of motor skil using motor and tourist ev chologies /alco	igh exercise as a s. ls: strength, speed exercises for recre ents and the rule holism, drug addi	prevent d, endureational s of bas ction, n	rance, ag purpose ic sports icotinism	illity, power. s.Transfer of kn disciplines. / by proposing p	owledge about p participation in w	hysical culture, the idely understood
C-2	To awaken care for respiratory, blood, To acquaint studen transfer of knowled	nervo ts wit	us and other. h the history	Mobilization for pof physical culture	ro-healt and sp	th attitud ort, the i	es. egulations of se		
Course c	content divided into	vario	ous forms of	instruction					Number of hour
T-A-1	- the influence pressure, breathing - body weight - history of th	dents s of p ivity a sical e of p g, pos conti	ble sports. with semestel hysical activit and addictions activity amon hysical exerci ture defects, i rol mpic games	r and full year me y g health determin se on the physiolo	dical ex ants	emption:	5;		30
Student	workload - forms of	activ	rity				-		Number of hour
A-A-1	Group exercises, sp	orts t	training, parti	cipation in tourist	events	and spor	ts camps.		30
Teaching	g methods / tools				-				
M-1	teaching method for practical method: practical method: practive method; reconstructive method: peripheral-station retraining method:	reser cture didac hod; t	ntation; , description, etic discussion eask-oriented;	talk, explanation;			·		

Evaluation I	metho	ds (F -	progressive, P - final)							
S-1	F		t's assesment based on his/he d of selected sports discipline			activity in clas	ses, as	well as moven	nent skil	ls in
S-2	F	colloqui	ium, test on knowledge of ph	ysical culture						
[	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					•				<u>'</u>	1
Skills										
	ls in sele		ns of physical activity - can nents 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 comp		ces								
Knows the rela	to enga itionship sical act omote it	between tivity acco	ro-healthy lifestyle. n physical activity and health. ording to health condition, age,	MSE_1A_K01	P6S_KK	P6S_WK	C-1	T-A-1	M-1 M-2	S-1 S-2
He or she can a skills in various activities. He o	apply th s sports or she ca	discipline an work a	ed motor, technical and tactical es and in tourist and recreational nd cooperate in a group both on the sports field and in	MSE_1A_K03	P6S_KO	P6S_WK	C-1	T-A-1	M-1 M-2	S-1 S-2
of sport, regula organize sport- active participa environment. H	_ knowled ations of -recreat ant of sp He or sh sport. H	f sport dis ional and ports life a e promot	field of physical culture, history sciplines, can organize and cotourist events. He or she is an at the university and in his or her ses 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
Outcom		Grade		E	valuation cr	iterion				<u> </u>
Knowledge										
Skills										
MSE_1A_A04-1	_U01	2,0								
ı		3,0	The student has basic technical s	skills of various spo	rts disciplines; t	the exercoses a	re carrie	d out with techn	ical errors	5
		3,5								
		4,0								
		4,5 5,0								
Other sesia	d com									
Other socia		2,0	<del>2</del> 5							
M3L_IA_A04 I			- knows basically the basis conce	epts and issues reg	arding health pr	omotion;				
		3,0	- he/she can not put his/her skills	into practice;						
		3,5 4,0								
		4,5								
		5,0								
MSE_1A_A04-1	_K02	2,0								
		3,0	- understands the principle of "fa	ir play" at the basi	c level;					
		3,5								
		4,0								
		4,5								
MCE 14 404 7	K02	5,0								
MSE_1A_A04-1	_KU3	2,0	and the state of t		to decrease to the state of the	- 11				
		3,0 3,5	- manifests interest in various for	rms or physical act	ivity at the basic	ievei				
		4,0								
		T, U	Î.							
		4,5								



#### Supplementary reading

- 1. S.Owczarek, Atlas ćwiczeń korekcyjnych, WSiP, Warszawa, 2005
- 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. 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



peripheral-station method;

conversational lecture; multimedia presentation

training method;

### Zachodniopomorski Uniwersytet Technologiczny w Szczecinie

	ŀ	·acul	ty of Ch	emical Tec	nnoi	ogy a	ind Engin	eering	
Field of s	study	Mate	erials Scienc	e and Engineeri	ng				
Mode of	study	stati	onary	Level		first o	cycle	\ \ / <del>\ .</del>	CI
Graduate	e's qualification	inży	nier	1		ll.		WTil	Ch
Fields of	science	engi	neering and	technology					
Disciplin	es of science	mate	erials engine	eering (100%)				1 _	
Educatio	nal profile	gene	eral academ	ic					
Module									
Course u	ınit	Phy	sical Educa	tion 2					
Code		MSE	_1A_A_A01b					1 \	
Field of s	specialisation								
Administ	tering faculty	Stud	lium Wychov	wania Fizyczneg	o i Spo	rtu			_
ECTS		0,0		ECTS (forms)		0,0			
Form of	course credit	cred	lits	Language		english	)		
Electives	5			Elective group					
Form of	instruction	Cod	Semester	Hours	E	CTS	Weight	Realization	Credit
lecturing	, course	А	2	30	C	),0	1,00	К	credits
Leading		Trub	iłko Ioanna	 (Joanna.Walczał		edu.pl)			
Other te				ra (Tamara.Ols:			du.pl)		
Prerequi		0.52	- Tarrie	(		26 241.6			
W-1	no health contrai	ndicatio	ons for physica	al exercise					
W-2	Students complete								
Module/a	course unit objecti	VAS							
C-1	C2 - to care for or circulatory, nervo C3 - increasing the C4 - develop the organization of sp C5 - to oppose so physical activity.	ne's own bus and ne value habit of porting a cial pat	n health throu other system of motor skil using motor and tourist ev hologies /alco	ls: strength, speed exercises for recre ents and the rules holism, drug addi	orevent d, endu eationa s of bas ction, n	rance, ac I purpose ic sports icotinism	gility, power. es.Transfer of kn disciplines. n/ by proposing	owledge about p	hysical culture, the idely understood
C-2	respiratory, circu to acquaint stude	latory, r ents with	nervous and on the history o	nealth through ex ther systems. of physical culture c, recreation and t	and sp	ort, regu			
Course c	content divided int	o vario	us forms of	instruction					Number of hour
T-A-1	selects one of the  2 - lectures for st -health effe - physical a - place of pl - the influer pressure, breathi - body weig - history of	e availal udents cts of p ctivity a nysical a nce of p ng, post ht conti	ble sports.  with semester hysical activity and addictions activity amon hysical exerci ture defects, i rol mpic games	g health determin se on the physiolo	dical ex ants	emption	s;		30
Student	workload - forms	of activ	rity						Number of hour
A-A-1				ticipation in touris with semester an				5	30
Teaching	g methods / tools								
M-1	practical method delivery method:	preser lecture d; didac ethod; t	ntation; , description, etic discussion ask-oriented;	synthetic, analytitalk, explanation; , task-oriented, di			·		

Evaluation n	netho	ds (F -	progressive, P - final)							
S-1	F	student	t's assesment based on his/he d of selected sports discipline			ctivity in clas	ses, as	well as moven	nent skil	ls in
S-2			ium, test on knowledge of ph		CSC					
		<u> </u>	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				'	•			•		
Skills										
	skills in		d forms of physical activity - can ments 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	etenc	es								
Knows the relati Can select phys gender and pror	o enga ionship ical act mote it	betweer	oro-healthy lifestyle. In physical activity and health. Ording to health condition, age,	MSE_1A_K01	P6S_KK	P6S_WK	C-1 C-2	T-A-1	M-1 M-2	S-1 S-2
tactical skills in recreational act	n apply various ivities.		ired movement, technical and disciplines 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 sp co-organize spo active participal environment.He	in the ports di prts, rec nt of spe/she pr	sciplines reationa orts life omotes	ohysical culture, history of sports, s, he/she is able to organize and I and tourist events.He/she is an at the university and in his/her the social and cultural ultivates his/her own tastes in	MSE_1A_K03	P6S_KO	P6S_WK	C-1 C-2	T-A-1	M-1 M-2	S-1 S-2
Outcome	es	Grade		Е	Evaluation cri	iterion				
Knowledge	,									
Skills										
MSE_1A_A04-2_	U01 .	2,0 3,0 3,5 4,0 4,5 5,0	The student has basic technical s	skills of various spo	rts disciplines. T	The exercises ar	e carried	d out with techni	cal errors	
Other social	comp		es							
MSE_1A_A04-2_	K01	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	omotion;				
MSE_1A_A04-2_	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_A04-2_	K03	5,0 2,0 3,0 3,5 4,0	- manifests interest in various for	rms of physical act	ivity at the basio	clevel				
	-	4,5 5,0								

#### Supplementary reading

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



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- 2. R.Trześniowski, Gry i zabawy ruchowe, WSiP, Warszawa, 2005
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- 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
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- 12. R.Karpiński, Nauczanie pływania, AWF Katowice, Katowice, 1995



lecture W 1 45 4,0 1,00 K C  Leading teacher Czech Zbigniew (psa_czech@wp.pl)  Other teachers Czech Zbigniew (psa_czech@wp.pl), Sobolewski Piotr (psobolewski@zut.edu.pl)  Prerequisites  W-1 Basic knowledge of European history at high school graduate level is required.  Module/course unit objectives  C-1 A concise presentation of the European History from ca. 800 to the present days, from the perspective of political social, economic, cultural, diplomatic, and intellectual history.  C-2 Consolidation of knowledge related to the basic facts and interpretation.  C-3 Developing student's ability to historical argumentation in writing and discusing.  C-4 Improving student's awareness of the need for continuous education and professional development.	Tredit
Graduate's qualification inżynier  Fields of science engineering and technology  Disciplines of science materials engineering (100%)  Educational profile general academic  Module  Course unit European History  Code MSE_1A_S_A02a  Field of specialisation  Administering faculty  Department of Organic Chemical Technology and Polymer Materials  ECTS 4.0 ECTS (forms) 4.0  Form of course credit credits Language english  Electives 1 Elective group  Form of instruction Cod Semester Hours ECTS Weight Realization (Code lecture W 1 1 45 4.0 1.00 K code lecture W 1 40 4.00 K code l	
Fields of science engineering and technology  Disciplines of science materials engineering (100%)  Educational profile general academic  Module  Course unit European History  Code MSE_1A_5_A02a  Field of specialisation  Administering faculty Department of Organic Chemical Technology and Polymer Materials  ECTS 4.0 ECTS (forms) 4.0  Form of course credit credits Language english  Electives 1 Elective group  Form of instruction Cod Semester Hours ECTS Weight Realization Collecture W 1 45 4.0 1.00 K collecture  Leading teacher Czech Zbigniew (psa_czech@wp.pl)  Other teachers Czech Zbigniew (psa_czech@wp.pl)  Other teachers Czech Zbigniew (psa_czech@wp.pl), Sobolewski Piotr (psobolewski@zut.edu.pl)  Prerequisites  W-1 Basic knowledge of European history at high school graduate level is required.  Module/course unit objectives  C-1 A concise presentation of the European History from ca. 800 to the present days, from the perspective of political social, economic, cultural, alplomatic, and intellectual history.  C-2 Consolidation of knowledge related to the basic facts and interpretation.  C-3 Developing student's ability to historical argumentation in writing and discusing.  C-4 Improving student's awareness of the need for continuous education and professional development.  Course content divided into various forms of instruction  T-W-1 Medieval Review: Manor, Feudalism, and Church, 100 Years' War, The Black Death, The Great Schism;  T-W-2 Renaissance: The Five Main Ideals: individualism, Secularism, Humanism, Virtu, and Historical Consciousness, Arts and Sciences, Italy's Political Decline & Revival of Monarchy in Northern Europe;  T-W-3 Referentation: Questioning the Church (Luther, Zwingli, Calvin, and the Anabaptists), The English Reformation; Catholic Counter-Reformation;  T-W-4 The Age of Religious Wars: The French Wars of Religion; Spain and Phillip II; The Revolt of the Netherlands; Elizabethan England, The 30 Years' War;  T-W-5 Edition of Consciousness, Teach Sciences, Italy's Political Decline & Revival of	
Disciplines of science materials engineering (100%)  Educational profile general academic  Module  Course unit European History  Code MSE_1A_S_A02a  Field of specialisation  Department of Organic Chemical Technology and Polymer Materials  ECTS 4.0 ECTS (forms) 4.0  Form of course credit credits Language english  Electives 1 Elective group  Form of instruction Cod Semester Hours ECTS Weight Realization Collecture W 1 45 4.0 1.00 K collecture  W 1 45 4.0 1.00 K collecture  W 1 45 4.0 1.00 K collecture  Czech Zbigniew (psa_czech@wp.pl)  Other teachers Czech Zbigniew (psa_czech@wp.pl), Sobolewski Piotr (psobolewski@zut.edu.pl)  Prerequisites  W-1 Basic knowledge of European history at high school graduate level is required.  Module/course unit objectives  C-1 A concise presentation of the European History from ca. 800 to the present days, from the perspective of political social, economic, cultural, diplomatic, and intellectual history.  C-2 Consolidation of knowledge related to the basic facts and interpretation.  C-3 Developing student's awareness of the need for continuous education and professional development.  Course content divided into various forms of instruction  T-W-1 Medieval Review: Manor, Feudalism, and Church, 100 Years' War, The Black Death, The Great Schism;  T-W-2 Renaissance: The Five Main Ideals: individualism, Secularism, Humanism, Virtu, and Historical Consciousness, Arts and Sciences, Italy's Political Decline & Revival of Monarchy in Northern Europe;  T-W-3 Reformation: Questioning the Church fluther, Zwingli, Caivin, and the Anabaptists). The English Reformation; Custoria, Pre French Wars of Religion; Spain and Philip II; The Revolt of the Netherlands; Elizabethan England, The 30 Years' War;  T-W-45 Gairy Modern Thought and Culture: The Medieval World Wew, The Scientific Revolution, Myriers and	
Educational profile  General academic  Module  Course unit  European History  Code  MSE_1A_S_A02a  Field of specialisation  Administering faculty  Department of Organic Chemical Technology and Polymer Materials  ECTS  4.0  ECTS (forms)  1.  Elective group  Form of course credit  Language  english  Electives  1.  Elective group  Form of instruction  Cod Semester Hours  ECTS Weight Realization  K color Cache July (psa_czech@wp.pl)  Other teachers  Czech Zbigniew (psa_czech@wp.pl), Sobolewski Piotr (psobolewski@zut.edu.pl)  Prerequisites  W-1  Basic knowledge of European history at high school graduate level is required.  Module/course unit objectives  C-1  A concise presentation of the European History from ca. 800 to the present days, from the perspective of political social, economic, cultural, diplomatic, and intellectual history.  C-2  Consolidation of knowledge related to the basic facts and interpretation.  C-3  Developing student's ability to historical argumentation in writing and discusing.  C-4  Improving student's awareness of the need for continuous education and professional development.  Course content divided into various forms of instruction  T-W-1  Medieval Review: Manor, Feudalism, and Church, 100 Years' War, The Black Death, The Great Schism;  T-W-2  Consciousness, Arts and Sciences, Italy's Political Decline & Revival of Monarchy in Northern Europe;  T-W-3  Renaissance: The Five Main Ideals: Individualism, Secularism, Humanism, Virtu, and Historical Consciousness, Arts and Sciences, Italy's Political Decline & Revival of Monarchy in Northern Europe;  T-W-3  The Reformation: Questioning the Church (Luther, Zwingli, Calvin, and the Anabaptists), The English Reformation. Catholic Counter-Reformation:  T-W-4  The Age of Religious Wars: The French Wars of Religion: Spain and Philip II; The Revolt of the Netherlands; Elizabethan England, The 30 Years' War;  T-W-5  School Asserbation and Political Scientific Revolution, Writers and	
Module  Course unit  European History  Code  MSE_1A_S_A02a  Field of specialisation  Administering faculty  Department of Organic Chemical Technology and Polymer Materials  ECTS  4,0  ECTS (forms)  4,0  Form of course credit  credits  Language  english  Electives  1  Elective group  Form of instruction  Cod Semester Hours  ECTS  Weight  Realization  Celecture  W  1  45  4,0  1,00  K  Celecture  W  1  45  4,0  1,00  K  Celeding teacher  Czech Zbigniew (psa_czech@wp.pl)  Other teachers  Czech Zbigniew (psa_czech@wp.pl), Sobolewski Piotr (psobolewski@zut.edu.pl)  Prerequisites  W-1  Basic knowledge of European History at high school graduate level is required.  Module/course unit objectives  C-1  A concise presentation of the European History from ca. 800 to the present days, from the perspective of political social, economic, cultural, diplomatic, and intellectual history.  C-2  Consolidation of knowledge related to the basic facts and interpretation.  C-3  Developing student's ability to historical argumentation in writing and discusing.  C-4  Improving student's ability to historical argumentation in writing and discusing.  C-4  Improving student's awareness of the need for continuous education and professional development.  Course content divided into various forms of instruction  T-W-1  Medieval Review: Manor, Feudalism, and Church, 100 Years' War, The Black Death, The Great Schism;  T-W-2  Consciousness, Arts and Sciences, Italy's Political Decline & Revival of Monarchy in Northern Europe;  T-W-3  The Reformation: Cubelic Counter-Reformation:  The Age of Religious Wars: The French Wars of Religion; Spain and Philip II; The Revolt of the Netherlands; Elizabethan England, The 30 Years' War;  The Age of Religious Wars: The French Wars of Religion; Spain and Philip II; The Revolt of the Netherlands; Elizabethan England, The 30 Years' War;  The Age of Religious Wars: The French Wars of Religion; Spain and Philip II; The Revolt of the Netherlands; Elizabethan England, The 30 Years' War;  The Age of Religious Wars:	
Materials   ECTS   4,0   ECTS (forms)   4,0	
Form of course credit credits Language english  Electives 1 Elective group  Form of instruction Cod Semester Hours ECTS Weight Realization Collecture W 1 45 4,0 1,00 K collecture Czech Zbigniew (psa_czech@wp.pl)  Other teachers Czech Zbigniew (psa_czech@wp.pl), Sobolewski Piotr (psobolewski@zut.edu.pl)  Prerequisites  W-1 Basic knowledge of European history at high school graduate level is required.  Module/course unit objectives  C-1 A concise presentation of the European History from ca. 800 to the present days, from the perspective of political social, economic, cultural, diplomatic, and intellectual history.  C-2 Consolidation of knowledge related to the basic facts and interpretation.  C-3 Developing student's ability to historical argumentation in writing and discusing.  C-4 Improving student's awareness of the need for continuous education and professional development.  Course content divided into various forms of instruction  T-W-1 Medieval Review: Manor, Feudalism, and Church, 100 Years' War, The Black Death, The Great Schism;  T-W-2 Renaissance: The Five Main Ideals: Individualism, Secularism, Humanism, Virtu, and Historical Consciousness, Arts and Sciences, Italy's Political Decline & Revival of Monarchy in Northern Europe;  T-W-3 The Reformation: Questioning the Church (Luther, Zwingli, Calvin, and the Anabaptists), The English Reformation, Catholic Counter-Reformation:  T-W-4 Nabsolutism and Constitutionalism: Stuart England and the English Civil War, The Restoration and the Glorious Revolution, Louis XIV of France, Hohenzollerns and Hapsburgs, Russia and Peter the Great;  T-W-5 Early Modern Thought and Culture: The Medieval World View, The Scientific Revolution, Writers and	
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	2
The Transatlantic Economy, Trade Wars, and Colonial Rebellion: Mercantilism and Early Colonialism,  T-W-7 Black African Slavery, Plantation System, and the Atlantic Economy, Mid-Eighteenth Century Wars and the American Revolution;	2
T-W-8 The French Revolution: The Ancien Regime/Financial Crisis, Early Stages of the Revolution, The Reign of Terror, Thermidorean Reaction and Results;	2
The Napoleonic Era: The Rise of Napoleon and the Consulate of France, Haitian Revolution and Napoleon's Empire, Napoleon's Defeat and the Congress of Vienna;	
The Age of Metternich: Romanticism, Nationalism, and Revolt: The Romantic Movement, The Conservative Order and the Emergence of Nationalism, Revolts of the 1820s and 1830s, Revolts of 1848;	2
Industrial Change and Social Unrest: Life in the 18th Century, The Agricultural Revolution, The Industrial Revolution, Industrial Society and the Labor Force, Socialism: Utopian Socialism, Anarchism, and Marxism;	2
T-W-12 The Age of Nation-States: The Eastern Question and the Crimean War, Italian Unification, German Unification, France, The Habsburg Empire, and Russia, Great Britain –Toward Democracy;	
The US History: Europeans vs. Native Americans, Characteristics of the 13 British Colonies, Causes of the Revolutionary War, Westward Expansion, Causes of the Civil War, Industrialization, The Interwar Period, Social Movements, The Post-Cold War World;	2



Course co		ivided into various forms							Nun	nber of	f hours
T-W-14	Urban Socialis	and Politics Leading to Wor Life, Women's Experiences i Sm, and Politics to WWI;	in the Late	e Nineteenth Cer	ntury, Jewish E	Emancipation,	Labor,				2
T-W-15		phy and Ideas Pre-WWI: Posecture, Nietzsche and Freud,				e Church Und	er Siege	e, Art and			2
T-W-16	Empire	alism, Militarism, and Nation is of France, Belgium, and ot ism and the New Industrialize	thers, Bisr	marck and the B	alance of Pow						2
T-W-17		ssian Revolution: Lenin and			.,						2
T-W-18	The Int	erwar Years: The Treaty of \ , Russia and the Rise of Stal	Versailles, lin. The Ri	It's Impact on G	Germany, Dep The Rise of Hi	ression in Eur	ope, Eas	stern			2
T-W-19		War II: Causes, At War, Racis						alks;			2
T-W-20	70s, De Russia	ld War: Causes and the Eme ecolonization, The Collapse o Rise of Radical Political Isla	of Europea imism;	an Communism,	The Breakup	of Yugoslavia	, Resurg	gence of			2
T-W-21	Movem Art, Re	Cultural, and Economic Cha nent of Peoples, The Welfare ligion, Technology, The Eurc	State and opean Uni	d Work Patterns, on and Financial	Transformati Crisis;	ons in Knowle	dge and	d Culture,			2
T-W-22	The De Indepe	land History: Baptism: The E luge1, Reforms & Constituti ndence: The Second Polish I ity, The Third Polish Republi	ion of 179 Republic,	1, Poland vanish	es from maps	for 123 years	s, Regai	ning			3
Student v	workload	l - forms of activity							Nun	nber of	f hours
A-W-1	Particip	oation in lectures									45
A-W-2	Self-stu	udy of the literature									60
A-W-3	Consul	tations									15
Teaching	method	ls / tools									
M-1	Lecture	2									
Evaluatio	n metho	ods (F - progressive, P - fi	nal)							-	
S-1	Р	Written test									
	Desigr	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	itent	Teaching methods	Evaluation methods
Knowledg	ge										
European Hi literacy and further histo	miliarize th istory knov develop a ory study. <sup>-</sup>	emselves with the main resource viledge in order to acquire this bi- set of foundational skills to be a The main skills to be focused on e listed in the following learning	asic applied to this	MSE_1A_W10	P6S_WK	P6S_WG	C-1 C-2 C-3 C-4			M-1	S-1
Skills											
of historical sources of a knowledge t	o describe facts. Stud historical to unfamili d critical a	, analyze, and make critical assedents will work to recognize the knowledge. will be asked to app ar phenomena in order to be abl and aesthetic judgments of diversional work.	diverse bly this le to make	MSE_1A_U10	P6S_UO		C-1 C-2 C-3 C-4			M-1	5-1
Social cor	mpeten	ces									
successfully approach the broader cult	tically about communice e relations tural conte	ut the global context and being a cate these thoughts to. Students thip between historical knowleds xts and ideas with a critical mine that can be applied to a broad r as and career activities.	s learn to ge and d that	MSE_1A_K01 MSE_1A_K02	P6S_KK	P6S_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	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	petence	es es
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 reading	g	
1. https://www.e-b	ooksdire	ctory.com/listing.php?category=110
2 https://www.eur	oneana e	MI

2. https://www.europeana.eu



Field of st	tudy	Materials Scien	ice and Engineer	ing				
Mode of s	study	stationary	Level		first c	ycle	\A/T:1/	C L
Graduate	's qualification	inżynier					WTil	un
Fields of s	science	engineering an	d technology					
Discipline	es of science	materials engir	neering (100%)					<u> </u>
Education	nal profile	general acader	nic					
Module								
Course ur	nit	European Art	and Music					Cil
Code		MSE_1A_S_A02	b				\	
Field of s	pecialisation							
Administe	ering faculty	Department of Materials	Organic Chemic	al Techn	ology a	nd Polymer		
ECTS		4,0	ECTS (forms)		4,0			
Form of c	ourse credit	credits	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	K	credits
Leading t	ading teacher Czech Zbigniew (psa_czech@wp.pl)							
Other tea	chers	Czech Zbigniev	v (psa_czech@w	p.pl), So	bolewsl	ki Piotr (psobol	ewski@zut.edı	ı.pl)
Prerequis	ites							
W-1	Basic knowledge a	bout European art	and music at high	school g	raduate	level is recomm	ended, but not r	equired.
Module/co	ourse unit objectiv	'es						
C-1	Learn new musical	l repertoire and ne	w pieces of visual	art.				
C-2	Grasp the historica					al arts.		
C-3	Learn how to think	c critically of arts a	s dynamic cultural	products				
Course co	ontent divided into							Number of hours
T-W-1	Reflect on the com Greek and Roman Tonality, Melody, F Listening: Excerpts from: Promenade. 1. The The Sugar Plum Fa Epitaph of Seikilos Stasimon of Oreste Bolero, Maurice Ra	heritage. Basic int Rhythm and Metre. e Gnome from Picto airy, Act II, from Th , 2nd Century BC, es, 5th Century BC avel (1928)	roduction to the el ures at an Exhibito e Nutcracker, Pyot	lements o n, Modes r llyich To	f music: t Mussor thaikovs	Instrumentation gsky (1874) ky (1892)	, Harmony	4
T-W-2	The Middle Ages: T paintings illustratir Gregorian chant, d cathedrals and the Ars subtilior Listening: Anonymous, Grego Anonymous, Grego Anonymous, Grego Leoninus, Viderunt Perotinus, Viderunt Guillaume de Mach Baude Cordier, Bel Jacob Senleches, L	ng scenes from the levelopment of not e parallels between orian Chant Puer N orian Chant Ut Que orian Chant Videru t omnes (Notre Da t omnes (Notre Da haut, Kyrie from th lle, Bonne, Sage (1	e Bible, manuscript cation in churches the development atus est Nobis cant Laxis nt omnes me de Paris) (c. 11 me de Paris) (c. 12 e Messe de Notre .4th C.)	t illuminat and mona of Gothic 60) 198)	cion, chu asteries. archited	rch architecture Architecture of cture and polyph	and sculpture. Gothic nony in France.	4



Course co	ontent 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, Symphony #40 in G Minor, K 550 - 1. Molto Allegro (1788)  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, Sonata No. 14 "Moonlight" 1: Adagio sostenuto and 3: Presto agitato  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 Nocturne Op. 9 No. 2 (1830-32) 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



	<b>-</b>							
Course co	ontent divided into various forms of inst	truction					Number o	f hours
	Romanticism II: Expansive symphonies aft							
	Wagner and the Gesamtkunstwerk - Fests Listening:	pielhaus Bayreuth	. Verdi and na	tionalism in m	nusic in	Italy.		
	Richard Wagner, Tannhauser - Overture (1	L845)						
	Richard Wagner, Tristan und Isolde - Prelu	de to Act 1 (1857-						
T-W-8	Richard Wagner, Der Ring des Nibelungen		Nibelung) - Die	· Walküre (The	e Valkyr	ie),		4
	WWV 86B - The Ride of the Valkyries (187 Giuseppe Verdi, Va Pensiero, Nabucco (18							
	Giuseppe Verdi, Va Tensiero, Nabacco (18							
	Johannes Brahms, Symphony no. 1 in c mi	nor Op. 68- 1st an						
	Johannes Brahms, Symphony no. 3 in F ma Gustav Mahler - Symphony no. 5, c sharp			.883)				
	Impressionism: Impressionism in fine arts,			noir. The influ	ence of	the		
	Gamelan and of Japanese prints. The Fren	ch composers Clau	ude Debussy, (	Gabriel Fauré				
	Ravel's music in relation with French "Syn	nbolist" literature -	· Verlaine, Mal	larmé, etc.				
T-W-9	Listening: Claude Debussy, Pagodes from Estampes	(Prints), L.100 (19	03)					4
	Claude Debussy, Nuages (Clouds) from No	cturnes L. 91 (189	99)					
	Claude Debussy, Prélude à l'après-midi d'				ino			
	Gabriel Fauré Clair de lune, Op. 46 No 2 (1 Maurice Ravel, Oiseaux Tristes (Sad birds)				ine.			
	Modernism I: Pre-and Post-World War I ar				life. A p	recursor		
	to Modernism: Art Nouveau in Europe and							
	Expressionists and Strauss's Salome. The Schoenberg, Alban Berg, Anton Webern).	Austrian Expressio Kandinsky's relatio	onists and the onship with Scl	zna viennese hoenbera. Pai	School is and t	(Arnoid he		
	Ballets Russes (Matisse and Picasso's proj							
T-W-10	(1913).							3
1-00-10	Listening: Richard Strauss, Dance of the Seven Veils	from the opera Sa	alome (1915)					3
	Arnold Schoenberg Three Piano Pieces, Op	ous 11, 1st and 3rd	d Movements (					
	Arnold Schoenberg Pierrot Lunaire (Moons Alban Berg, Wozzeck (1922)	truck Pierrot), Opu	ıs 21, Moveme	ent 1, Moondr	unk (19	12)		
	Anton Webern, Symphonie, Opus 21, 1st N	Movement (1928)						
	Igor Stravinsky, Le Sacre du printemps (19	913)						
	Modernism II: World War II, post-war art e. U.S.S.R. Abstract Expressionism in art in t							
	Abstract Expressionists. New sound mater	ials, electronic mu	isic and space	as a composi	tional p	arameter		
	at the Philips Pavilion in Brussels. Ligeti ar		•	·	·			
	Listening: Olivier Messiaen, Quartet for the End of Ti	me (10/11)						
	Richard Strauss, Metamorphosen (1945)	1110 (1541)						
T 14/ 11	Dmitri Shostakovich, Lady Macbeth of Mts			2 (1056)				2
T-W-11	Dmitri Shostakovich, The Suite for Variety Krzysztof Penderecki, Threnody to the Vic			2 (1956)				3
	Benjamin Britten, Dies Irae and Lacrimosa			!)				
	John Cage, Ryoanji (1983, 1985)							
	John Cage, 4'33' (1952) Iannis Xenakis, Metastaseis (1953-54)							
	lannis Xenakis, Concrete PH (1958)							
	Edgard Varèse, Poème électronique (1958 György Ligeti, Atmospheres (1961) and Ky		(1963-5)					
	Post-Modernism and after: Minimalism in I	•		ich. Philip Gla	ss. Terry	/ Rilev.		
T-W-12	John Adams, related to Minimalism in art,							3
	through the Sixties and Seventies. Ellswor last few decades. Contemporary classic m			i, Donald Judd	. Opera	in the		
Ctudont	workload - forms of activity		-				Number o	fhour
A-W-1	Participation in lectures						Number o	45
A-W-2	Self-study of the literature							60
A-W-3	Consultations							15
M-1	methods / tools							
Evaluatio S-1	n methods (F - progressive, P - final)  P Written test							
5-1	P Written test		1	l .	1			<del></del>
		Reference to the	Reference to	Reference to learning outcomes				
				for qualifications at	_			
	Designed learning outcomes	learning outcomes designed for the fields of	Learning Outcomes for qualifications at	level 6 or 7 that enable acquiring	Course objectives	Course con	tent Teaching methods	Evaluation methods
	Designed learning outcomes	learning outcomes	Learning Outcomes	level 6 or 7 that		Course con		



European Art and Musunderstanding and de applied to further stud	sic knowle evelop a se dy. The ma	s with the main resources of the dge in order to acquire this et of foundational skills to be ain skills to be focused on this the following learning	MSE_1A_W10	P6S_WK	P6S_WG	C-1 C-2 C-3	T-W-1		M-1	S-1
Skills										
phenomenons. Stude the art. Will be asked	nts will wo to apply t	yze a musical and art ork with the diverse sources of his knowledge to make well- udgments of the cultural events.	MSE_1A_U10	P6S_UO		C-1 C-2 C-3	T-W-1 T-W-2	T-W-12	M-1	S-1
Social competen	ces									
and being able to suc	cessfully o	e global context of the culture communicate these thoughts to. wledge to further studies and	MSE_1A_K01 MSE_1A_K04	P6S_KK P6S_KR	P6S_WK	C-1 C-2 C-3	T-W-5 T-W-6	T-W-12	M-1	S-1
Outcomes	Grade		Е	valuation cr	iterion					
Knowledge										
MSE_1A_A02b_W01	2,0									
		Student is able to use the acquire	ed knowledge at a	basic level to re	ecognize the bas	sic conce	epts of co	ulture.		
	3,5									
	4,0									
	4,5									
	5,0									
Skills										
MSE_1A_A02b_U01	2,0									
	3,0	Student is able to use the acquire	ed knowledge at a	basic level to re	ecognize the bas	sic conce	epts of co	ulture.		
	3,5									
	4,0									
	4,5									
	5,0									
Other social com	petence	es								
MSE_1A_A02b_K01	2,0									
	3,0	Student is able to use the acquire	ed knowledge at a	basic level to re	ecognize the bas	sic conce	epts of co	ulture.		
	3,5									
	4,0									
	4,5									
	5,0									
Required reading	9									
1. https://www.eur	opeana.e	PU								
2. http://youtube.c	om									



Field of st	tudy	Mate	erials Scienc	e and Engineeri	na				
Mode of s			onary	Level		first c	vcle		
	-	inży		20001		mse e	.,	WTil	Ch
Fields of s			neering and	technology				* * * * * * * * * * * * * * * * * * * *	
				eering (100%)					_
-									
Education	пат ргоппе	gene	eral academ	IC					
Module									
Course un				operty and Sta	andari	zation	(ISO, EU)		Cil
Code		MSE	_1A_S_A03					\	
Field of sp	pecialisation								
Administe			artment of C erials	Organic Chemica	al Tech	nology a	and Polymer		_
ECTS		1,0		ECTS (forms)		1,0			
Form of co	ourse credit	cred	lits	Language		polish			
Electives				Elective group					
Form of in	nstruction	Cod	Semester	Hours	EC	CTS	Weight	Realization	Credit
lecture		W	1	15	1	,0	1,00	K	credits
Leading to	eacher	Czec	ch Zbianiew	(psa_czech@wp	la.c				
Other tea				(psa_czech@wp	-				
Prerequisi									
W-1	none								
Module/co	ourse unit objective.	S							
C-1	The aim of the cours		to get knowle	dge in the field of	intelle	tual prop	perty law and EU	I/ISO standardiza	ation.
Course co	ontent divided into v	vario	us forms of	instruction					Number of hours
T-W-1	Introduction to the c						property, non-m	aterial goods,	2
T 111 0	standards and stand Preliminary characte						ertv rights, indu	strial models.	
T-W-2	trade-marks, compu	ıter s	oftware etc.					·	2
T-W-3	Protecting intellectu				1				1
T-W-4	The protection of Int								1
T-W-5	Entities involved in t			<u> </u>					1
T-W-6	Negotiation and exp The right balance be					. , .	nrivacy and		1
T-W-7	prorection of intelec	tual	property			•			1
T-W-8	Significance of intell innovation growth a				gns, pa	ents, cop	oyrights for		1
T-W-9	Standardization and				t of vie	w.			1
T-W-10	ISO and CEN, interna	ation	al standardiza	ation system, ESS	, nation	al standa	ards, industrial st	andards etc.	1
T-W-11	European Standardi	zatio	n as a key ins	trument for the S	ingle Ma	arket			1
T-W-12	Standards as a value production. Example					rove per	formance and sa	afety of the	2
Student w	vorkload - forms of a	activ	rity						Number of hours
A-W-1	Participation in lectu	ıres							15
A-W-2	Self-study of the lite	eratui	re						10
A-W-3	Consultations								5
t contract to the contract to	Consultations								
Teaching	methods / tools								
Teaching M-1									
M-1	methods / tools	ıress	ive, P - final,	)					



		<u> </u>					<u> </u>			
Desig	gned lea	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	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_A03_W01 The student has a ba law and about standa	asic knowle ards and st	edge about intellectual property tandardization.	MSE_1A_W08	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										
projects in terms of i	ntellectual	valuate creative works and property law. He can also formation from standards	MSE_1A_U12	P6S_UO		C-1			M-1	S-1
Social competer	nces									
		nportant role of intellectual on system from the point of view	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
Outcomes	Grade		E	Evaluation cr	iterion					
Knowledge										
MSE_1A_A03_W01	2,0									
	3,0	Student describes selected issue	s at a basic level (	(score => 50%)						
	3,5									
	4,0									
	4,5									
	5,0									
Skills										
MSE_1A_A03_U01	2,0									
	3,0									
	3,5									
	4,0									
	4,5									
	5,0									
Other social con		es								
MSE_1A_A03_K01	2,0									
	3,0	Student describes selected issue	s at a basic level (	(score => 50%)						
	3,5									
	4,0									
	4,5 5,0									
Domilios de se se elle	_									
Required readin		ual Dranarty Law Direction - 0	UD Overal 201	4						
		ual Property Law Directions, O	UP, Uxtora, 201	4						
2. www.cencenele		wth/single market/suranges	standards on							
5. https://ec.europ	Ja.eu/gro	wth/single-market/european-s	stanuarus_en							

4. https://www.iso.org/standards.html



Field of stu	ıdy	Mate	erials Science	and Engine	eering							
Mode of st	udy	stati	ionary	Level		first cy	cle	1.4	/T: I	CL		
Graduate's	s qualification	inży	nier					V\	/Til	<b>C</b> r	]	
Fields of se	cience	engi	ineering and	technology							-	
Disciplines	of science	mat	erials engine	ering (100%	o)						<u>.</u>	
Education	al profile	gene	eral academi	С								
Module								1				
Course un	it	ОН	and Ergon	omics						7 (		
Code		MSE	_1A_S_A04							l '		
Field of sp	ecialisation										4	
Administe	ring faculty	Dep	artment of Ca	atalytic and	Sorbent	: Materials [	Engineering	]			4	
ECTS		1,0		ECTS (form:	s)	1,0		1				
Form of co	ourse credit	cred	lits	Language		polish		1				
Electives				Elective gro	 oup			1				
Form of in:	struction	Cod	Semester	Hours		ECTS	Weight	Rea	alizatio	7	Crea	 lit
lecture		W	1	15		1,0	1,00	1	K		credi	its
Leading te	eacher	Mich	nalkiewicz Be	ata (Beata I	—- Michalki∈		<u> </u>					
Other tead			nalkiewicz Bei									
Prerequisit		1		- (			- 1s.4					
W-1	none											
	urse unit objective											
C-1	Gaining knowledge		t the problems	of occupation	nal healt	h and safety	and ergonomi					
Course cou	ntent divided into									Nur	nber of	hours
T-W-1	Legal regulations in				and safet	y in the law	of the Europea	n Unior	n and	1007	11001 01	3
T-W-2	Poland											2
T-W-3	Ergonomics Interaction between	n Hun	nan and Techn	ical Systems								1
T-W-4	Work with dangero			-								2
T-W-5	Workplace diagnos											2
T-W-6	Certification of prod		, machines and	devices to n	neet safet	y requireme	nts					1
T-W-7	Accidents at work											1
T-W-8	Occupational disea	se, oc	cupational risk									2
T-W-9	Safety Managemen	it										1
Student w	orkload - forms of	activ	vity							Nur	nber of	hours
A-W-1	Participation in lect	ures										15
A-W-2	Preparation for test											13
A-W-3	Individual consultat	tions										2
	methods / tools											
M-1	lecture											
-	methods (F - prog	gress	ive, P - final)									
S-1	P Test						T		1		1	
	Designed learning	g out	comes	learning designed fo		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	9								1			
MSE_1A_A04_ Student know and ergonom	W01 s the problems of occu	nation	nal health and saf	fety MSE 1	14 W00	P6S_WK		C-1	T-W-1 T-W-2 T-W-3	T-W-6 T-W-7	M-1	S-1



Skills		
Social competer	nces	
Outcomes	Grade	Evaluation criterion
Knowledge	<u> </u>	
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 con	npetence	es
Required readin	g	
1. Benjamin O. All	i, Fundan	nental Principles of Occupational Health and Safety, International Labour Office, Geneva, 2008



Field of s	tudy	Mate	rials Science	e and Engineerin	g							
Mode of s	study	statio	onary	Level	f	irst cyc	cle	3.4	/T:1/	~ 1		
Graduate	's qualification	inżyr	nier					W	/Til(	٦n		
Fields of	science	engir	neering and	technology								
Discipline	es of science	mate	erials engine	ering (100%)					_		_	
Education	nal profile	gene	ral academi	С								
Module											7	
Course ui	nit	Libra	ary Orienta	tion/Library Sk	ills Trai	ning					П	
Code		MSE_	_1A_S_A05								7	
Field of s	pecialisation									_		
Administe	ering faculty	Biblio	oteka Główn	a						_		
ECTS		0,0		ECTS (forms)	0,0	)						
Form of c	course credit	credi	its	Language	en	glish						
Electives				Elective group								
Form of i	nstruction	Cod	Semester	Hours	ECTS		Weight	Rea	lization		Cred	it
lecturing	course	Α	1	5	0,0		1,00		K	(	redi	S
Leading t	teacher	Piąte	k-Hnat Mart	a (marp@zut.ed	===== u.pl)			•				
Other tea	achers	Narlo	och Anna (Ar	nna.Narloch@zut	.edu.pl),	Piątek	-Hnat Marta	(marp	@zut.edu	ı.pl)		
Prerequis	sites											
W-1	Knows the basics of	f using	computer an	d www network								
Module/c	ourse unit objectiv	es										
C-1	To acquaint users v	with th	e organization	n, functioning and	principles	of using	g the library, i	ts colle	ctions and	service	S	
Course co	ontent divided into	vario	us forms of i	nstruction						Numb	er of	hours
T-A-1	The Main Library in organization, opera The training can be Under E-services / General courses, a Training program:  1. general informathours Rules of using the collections availabl 3. basic sources of Using the Aleph on	ation, a e found E-educ nd in the cion ab library' e: usen scient	and use of the don the universation in the cours the library out the library is collections at registration, ific information	library, its collecti rsity website www ourse categories p se ZUT Main Librar y: library collection and services, with using the reading n, databases	ons and s .zut.edu.p lease indi y - Library , organiza particular room, bor	ervices.  I cate  trainin  ational s  emphaserowing,	g tructure and sis on the rule interlibrary lo	location es of ma pans	king			5
	in to the system: p loan period, checki	lacing	orders for the	lending library an								
Student v										A	er of	hours
	workload - forms of		-							мить		
A-A-1	To become familian the collections and Szczecin" - Annex t	with t servic	the contents of the Mair	n Library of the We	st Pomera	anian Ur	niversity of Te			Numb		2
A-A-1 A-A-2	To become familian	with t servic	the contents of the Mair	n Library of the We	st Pomera	anian Ur	niversity of Te			Numb		2
A-A-2	To become familial the collections and Szczecin" - Annex t	with t servic	the contents of the Mair	n Library of the We	st Pomera	anian Ur	niversity of Te			Numb		
A-A-2	To become familial the collections and Szczecin" - Annex the written test	with t servic	the contents of the Mair	n Library of the We	st Pomera	anian Ur	niversity of Te			Numb		
A-A-2 Teaching M-1	To become familian the collections and Szczecin" - Annex to written test  methods / tools	with t servic to the (	the contents of the Mair les of the Mair Order No. 58 of	n Library of the We	st Pomera	anian Ur	niversity of Te			Numb		
A-A-2 Teaching M-1 Evaluatio	To become familian the collections and Szczecin" - Annex to written test  methods / tools online training on methods (F - pro	with to service the G	the contents of the Mair Order No. 58 of the M	n Library of the We	st Pomera	anian Ur	niversity of Te			Numb		
A-A-2 Teaching M-1	To become familian the collections and Szczecin" - Annex to written test  methods / tools online training on methods (F - pro	with t service to the G	ive, P - final) e basis of 70%	n Library of the We of the Rector of ZU	st Pomera T dated 2	anian Ur	niversity of Te			Te	aching ethods	1
A-A-2 Teaching M-1 Evaluatio	To become familian the collections and Szczecin" - Annex to written test  methods / tools online training on methods (F - pro	with t service to the G	ive, P - final) e basis of 70%	6 correct answers	st Pomera T dated 2	ence to Outcomes ications at 1	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering	Course	yy in	Te		



Skills									
Aleph system (search borrowing or as part	hing, 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	ibrary system of ZUT and knows	MSE_1A_K01	P6S_KK	P6S_WK	C-1	T-A-1	M-1	S-1
Outcomes	Grade		E	valuation cr	iterion				
Knowledge	•								
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	'S					
	3,5								
	4,0								
	4,5								
	5,0								

#### Required reading

<sup>1. &</sup>quot;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



Field of study	Materials Science	e and Engineerin	ıg						
Mode of study	stationary	Level	first	cycle	3.4	/T: I	C L		
Graduate's qualification	inżynier		·		V	√Til	Cr	1	
Fields of science	engineering and	technology						-	
Disciplines of science	materials engine	ering (100%)				_	_	<u>-</u>	
Educational profile	general academi	С							
Module									
Course unit	OHS Training						7 (		
Code	MSE_1A_S_A06				<b>\</b>		l '		
Field of specialisation								4	
Administering faculty	Department of C	atalytic and Sork	ent Materia	ls Engineering	7			4	
ECTS	0,0	ECTS (forms)	0,0		1				
Form of course credit	credits	Language	englis	h					
Electives		Elective group							
Form of instruction	Cod Semester	Hours	ECTS	Weight	Re	alization	)	Cred	dit
lecture	W 1	5	0,0	1,00		K		cred	its
Leading teacher	Michalkiewicz Be	ata (Beata.Mich	alkiewicz@z	ut.edu.pl)			•		
Other teachers	Michalkiewicz Be	ata (Beata.Micha	alkiewicz@z	ut.edu.pl)					
Prerequisites									
W-1 none									
Module/course unit object	ives								
	ents with the knowled	ge of OSH legislati	on						
C-2 To acquaint stud	ents with the knowled	ge of dealing with	threats						
C-3 To acquaint stud	ents with the knowled	ge of first aid							
Course content divided in	to various forms of i	instruction					Nur	nber o	f hours
T-W-1 Selected legal is:									1
T-W-2 Threats to life ar									1
T-W-3 Protection against									1
T-W-4 Dealing with three	eats								1
T-W-5 First aid									1
Student workload - forms							Nur	nber o	f hours
A-W-1 Participation in le	ectures								5
Teaching methods / tools									
M-1 Lecture									
Evaluation methods (F - p.	rogressive, P - final)								
S-1 P Test	in a in Index								
S-2 F Participat	ion in lectures			T	1	1		1	
Designed learn	ing outcomes	Reference to th learning outcom designed for the fiel study	es Learning Outco	level 6 or 7 that	Course objectives	s Course o	ontent	Teaching methods	Evaluation methods
Knowledge									
MSE_1A_A06_W01 Student knows the problems of or	cupational health and sa	fety MSE_1A_W0	9 P6S_Wk		C-1 C-2 C-3		T-W-4 T-W-5	M-1	S-1 S-2
Skills									
Social competences									



Outcomes	Grade	Evaluation criterion
Knowledge		
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 com	petence	es
Required reading	g	
1, selfmade mat	erials, 20	011



							<b></b>	- Ind Engine		
Field of study	<b>,</b>		rials Scienc			ng			_	
Mode of study	У	statio	onary		Level		first o	cycle	\A/T:1/	C L
Graduate's qu	ualification	inżyr	nier						WTil(	<u>اا</u> ت
Fields of scie	nce	engir	neering and	techr	nology					_
Disciplines of	science	mate	rials engine	ering	(100%)				_	<u> </u>
Educational p	profile	gene	ral academi	ic					1	
Module									1	
Course unit		Mati	nematics 1							C
Code		MSE	1A_S_B01a						1 \	
Field of speci	alisation	_								
Administering		Studi	ium Matema	atvki						
ECTS	, racarty	6,0	- Idili Pideeine		(forms)		6,0			
Form of cours	so crodit	-	nination				english		1	
	se crean	exam	IIIIation		guage		english	<u> </u>	1	
Electives					ive group			T		
Form of instru	uction	Cod	Semester	F	Hours	EC	TS.	Weight	Realization	Credit
lecturing cou	rse	Α	1		30	2	,0	0,41	K	credits
lecture		W	1		30	4	,0	0,59	K	examination
Leading teach	her	Iglew	ska-Nowak	Ilona	(Ilona.Igle	wska-N	lowak@	zut.edu.pl)		
Other teache	rs	Iglew	ska-Nowak	Ilona	(Ilona.Igle	wska-N	lowak@	zut.edu.pl)		
Prerequisites										
<i>W-1</i> Kn	owledge of math	emati	cs at A level.							
Module/cours	e unit objective	===== es								
C 1 Th	e target is that th	ne stud	dents have kr	nowled	lge and abi	ities to	use mat	hematical metho	ods to describing	physical and
cn	emical processes vareness of the n					athema	ical tool	s necessary for	further studies.	
										T
	nt divided into					•				Number of hours
	ercise solving an	a prob	iem discussio	on rega	arding topic	s from	ne lectu	ire.		26
	sts. gebraic calculatio	n prod	rame, introd	uction	to Matham	atica				2
	ementary function		-				evnoner	ntial functions lo	ngarithms	8
	fferential calculus		<u>-</u>						gantiinis.	4
Δn	plication of differ								na, monotonicity	
	a function.	- C' 'L -					-I:cc			4
	egral calculus: de bles of integrals,				grais, relatio	on with	airrerent	lation,		8
<i>T-W-6</i> Or	dinary differentia	al equa	tions of the f	irst or	der: separa	ble ODE	, linear (	ODE.		4
Student work	load - forms of	activi	ty							Number of hours
	aining participation									30
A-A-2 Inc	dividual work: exe	ercise	solving and t	est pre	eparation.					24
<i>A-A-3</i> Co	nsultation.									4
A-A-4 Fir	nal test.									2
<i>A-W-1</i> Pa	rticipation in the	lectur	es							30
A-W-2 Ind	dividual study of	lecture	notes and g	iven lit	terature.					52
<i>A-W-3</i> Co	nsultations.									10
	eparation for the	exam								25
<i>A-W-5</i> Th	e exam.									2
Teaching met										
	cture. Presentation									
M-2 Tra	aining. Exercise s	olving	, problem dis	cussio	n.					
Evaluation m	ethods (F - prog	gressi	ve, P - final)	)						

Evaluation	meth	ods (F -	progressive, P - final)								
S-1	Р	Written	exam.								
S-2	Р	Exercise	e tests.								
S-3	F	Lecture	: based on discussions. Train	ing: based on so	lved exercises	5.					
	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	Evaluation methods
Knowledge	9							•		•	
MSE_1A_B01_ Knows the ba	W01 sic defin	itions, the	orem 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 app the litarature	ly the m		ught in the course and found in	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_ Is aware of th		of further s	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
Outcon	nes	Grade		E	valuation cr	iterion				•	
Knowledge											
MSE_1A_B01_		2,0									
		3,0	Student demonstrates basic kno	wledge of mathem	atics						
		3,5									
		4,0									
		<i>4,5</i> 5,0									
Skills		5,0									
MSE_1A_B01_	U01	2,0									
	.001		Student is able to use the acquir	ed knowledge at a	basic level to so	olve mathematic	al proble	ems.			
		3,5			545.6 .6 .6 .6		ж. р. оъ.				
		4,0									
		4,5									
		5,0									
Other soci	al com	petence	es								
MSE_1A_B01_	K01	2,0									
			The student understands the nee	ed for continuous e	ducation and tra	aining at a basio	level.				
		3,5									
		4,0									
		4,5 5,0									
Required r	reading										
-	_		Vol. I, Juohn Wiley & Sons, h	ttns://www.dora	ci com br/dow	nloads/matom	natica/^	nostol	Calculu	s vol-1	ndf
			https://notendur.hi.is/adl2/Ca			oau3/111ate11	iauca/A	ρυσιυι_	Calculus	_v0I-1.	Jui
			matica GuideBook for Symbo			book/10.1007	/0-387-2	28815-	5		
									-		
Suppleme			s: theory, examples, exercise	c https://pol/re-	kall filas war	darace cam /2	012/10/	calcul:	ic pdf		
ı. jeiney Lo	CKSIIII),	, calculus	s. theory, examples, exercise	s, HLLPS://POKTOV	vatt.iiies.wor	upi ess.com/2	012/10/	caicuit	ıs.µuı		



M-2

Training. Exercise solving, problem discussion.

# Zachodniopomorski Uniwersytet Technologiczny w Szczecinie

			- <b>,</b>					
Field of s	study	Mate	erials Scienc	e and Engineeri	ng			
Mode of	study	stat	ionary	Level	first	cycle	\ \ / <del>T</del> :1/	~ 1
Graduate	e's qualification	inży	nier	-	<u> </u>		WTil(	₋n
Fields of	science	eng	ineering and	l technology				_
Disciplin	es of science	mat	erials engine	eering (100%)				
Educatio	nal profile	gen	eral academ	ic				
Module								
Course u	ınit	Mat	hematics 2	2				
Code		MSE	1A S B01b	)			1	
Field of s	specialisation							
	tering faculty	Stuc	dium Matem	atyki				_
ECTS		4,0		ECTS (forms)	4,0			
	course credit	-	mination	Language	englis	h		
Electives				Elective group				
Form of	instruction	Cod	Semester	Hours	ECTS	Weight	Realization	Credit
lecturing		A	2	30	2,0	0,41	K	credits
lecture	Course	W	2	30	2,0	0,41	K	examination
		1					K	examination
Leading		+		Ilona (Ilona.Igle		<u> </u>		
Other tea	achers ————————————————————————————————————	Igle	wska-Nowak	Ilona (Ilona.Igle	wska-Nowak(	@zut.edu.pl)		
Prerequi								
W-1	Mathematics I.							
C-2	Awareness of the r	need c	of fair and sys	tematic work.		nis fiecessary for	Turtiler studies.	
	content divided into							Number of hours
T-A-1	Exercise solving ar	nd pro	blem discussi	on regarding topic	s from the lect	ure.		26
T-A-2	Tests. Ordinary differenti	al oqu	ations of the	first order: Bornou	Ili oquation So	cond order lines	r ODE with	4
T-W-1	constant coefficier	nts.			iii equation. Se	cond order iiirea	TODE WITH	4
T-W-2	Differentiation of f							2
T-W-3	Partial differential							6
T-W-4	Linear algebra: ope		ns on vectors	and matrices, solv	ing linear equa	ition systems.		8
T-W-5 T-W-6	Dimensional analy	SIS.						2
T-W-7	Error function.  Probability, standa	rd die	tributions var	riance standard d	eviation regres	ssion correlation		6
				Tarice, staridard d	eviation, regres	Sion, correlation		
A-A-1	workload - forms of							Number of hours
A-A-1 A-A-2	Individual work: ex			test preparation				30 24
A-A-3	Consultation.	CI CISC	s solving and t	test preparation.				4
A-A-4	Final test.							2
A-W-1	Lecture participation	on						30
A-W-2	Individual study of	lectur	re notes and g	given literature.				14
A-W-3	Consultations.							7
A-W-4	Preparation for the	exan	า					8
A-W-5	The exam.							2
Teaching	g methods / tools							
M-1	Lecture. Presentat	ion of	theory and sa	mple exercises.				
14.2	Tarinia - Francisco	1,						

Evaluation	n metho	ods (F -	progressive, P - final)								
S-1	Р	Written	exam.								
S-2	Р	Exercise	e tests.								
S-3	F	Lecture	: based on discussions. Train	ing: based on so	lved exercises	ò.					
	Desigr	ned lear	ning 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	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				•			•		•	
	b_W01 asic defin	itions, the	eorem and calculation methods.	MSE_1A_W01	P6S_WG P6S_WK	P6S_WG	C-1	T-W-4		M-1	S-1 S-3
Skills											
MSE_1A_B01 Is able to ap the litarature	oly the m		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 cor	npeten	ces			•		•				
MSE_1A_B01 Is aware of t		of further s	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
Outco	mes	Grade		E	valuation cr	iterion					
Knowledg	<u>е</u>										
MSE_1A_B01		2,0 3,0	Student demonstrates basic kno	wlodge of mathem	atics						
		3,5	Student demonstrates basic kno	wiedge of mathem	atics.						
		4,0									
		4,5 5,0									
Skills		3,0									
MSE_1A_B01	b_U01	2,0									
		3,0	Student is able to use the acquir	ed knowledge at a	basic level to so	lve mathematic	cal proble	ems.			
		3,5									
		4,0									
		4,5 5,0									
Other soc	ial com		<u></u>								
MSE 1A B01		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											
	•		Vol. I, Juohn Wiley & Sons, h								
			rential Equations for Engineer	·			ential-e	quations	-for-en	gineers	.pdf
file:///C:/Us	ers/sm/[	Download	Weigand, and Hassan Gomaa ds/2017_Book_DimensionalAı	nalysisForEngine	er.pdf						
			George C. Runger, Applied S n/montgomery.pdf	tatistics and Pro	bability for En	gineers,					



Field of s	tudy	Mate	erials Scienc	e and Engineeri	ng				
Mode of s	study	stati	onary	Level		first c	ycle	\ \ / <del></del>	~ I
Graduate	e's qualification	inżyr	nier			'		WTil(	۰n
Fields of	science	engii	neering and	l technology					_
Discipline	es of science	mate	erials engine	eering (100%)					
-	nal profile	+	eral academ					1	
Module	,	1						1	
Course u	nit	Phys	sics of Mat	erials					
Code		+	1A S B02					· (	Ç
	pecialisation	11132	_17(_3_502					· \ •	
	ering faculty	Dena	artment of N	Nanomaterials Pl	vsicoc	hamistr			
ECTS	ering faculty	12,0		ECTS (forms)		12,0	У		
		-				-		_	
	course credit	exan	nination	Language		english			
Electives		<u> </u>		Elective group					
Form of i	nstruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
lecturing	course	Α	1	45	4,	.0	0,30	K	credits
laborator	y course	L	1	30	3,	0	0,30	K	credits
lecture		W	1	45	5,	0	0,40	K	examination
Leading t	teacher	Mijov	wska Ewa (E	wa.Borowiak-Pa	len@zu	ıt.edu.p	ol)		
Otherter				ztof (Krzysztof.L					
	achers		n@zut.edu.pal.Wrobel@z	ol), Szymczyk Ar zut.edu.pl)	ına (An	na.Szyr	nczyk@zut.ed 	lu.pl), Wróbel Ra	afał
Prerequis	sites	(Rafa	al.Wrobel@z	zut.edu.pl)				lu.pl), Wróbel Ra	atał
Prerequis W-1	Sites  Knowledge of the b	(Rafa	al.Wrobel@z	zut.edu.pl)				lu.pl), Wróbel Ra	afał
Prerequis W-1 Module/c	Knowledge of the books unit objective	(Rafa	al.Wrobel@z	zut.edu.pl)	ics at th	ne eleme	entary level		
Prerequis W-1	Sites  Knowledge of the b	(Rafa	al.Wrobel@z	zut.edu.pl)	ics at th	ne eleme	entary level		
Prerequis W-1 Module/c C-1	Knowledge of the bourse unit objective The students will g	(Rafa pasic co es pain kno	al.Wrobel@z	nematics and phys	ics at th	ne eleme	entary level		
Prerequis W-1 Module/c C-1	Knowledge of the knowledge unit objective The students will gnaterials  ontent divided into Heat (determination of h	es varion of Do	ourse in math	nematics and physics are area of fundame instruction ature and specific	ental phi	ne eleme	entary level  d skills to explo	re fundamental p urier's law in	roperties of
Prerequis W-1 Module/c C-1 Course co	Knowledge of the knowledge unit objective The students will gnaterials  In the students will gnat	oasic coes lain knoon of Doeat coo	ourse in math	nematics and physical area of fundame instruction ature and specific of Stefan's law are to I and II laws of	ental phi	ne eleme iscics an pacity; a 's law in	entary level  d skills to explo  pplication of Fo the calculation  s; efficiency of	re fundamental p urier's law in of heat	roperties of
Prerequis W-1 Module/c C-1 Course co T-A-1 T-A-2	Knowledge of the knowledge unit objective. The students will gnaterials content divided into the Heat (determination of horizontal production). Thermodynamics (determination of content the following t	oasic coes es ain knoon of Doeat coo	ourse in math owledge in the us forms of ebye temperanduction; use ations related ents of perfor	nematics and physics area of fundamental instruction ature and specific of Stefan's law are and II laws of mance for heat pu	ics at the	pacity; a	entary level  d skills to explo  pplication of Fo the calculation s; efficiency of rators)	urier's law in of heat	roperties of  Number of hours  5
Prerequis W-1 Module/c C-1 Course co T-A-1 T-A-2 T-A-3	Knowledge of the brownse unit objective The students will gmaterials  ontent divided into Heat (determination of hradiation) Thermodynamics (determination of content divided) Temperature (exprination)	varioo calcula oefficie	ourse in math owledge in the us forms of ebye temperanduction; use ations related ents of perfor temperature	nematics and physics area of fundamental instruction ature and specific of Stefan's law are and II laws of mance for heat pu	ics at the	pacity; a	entary level  d skills to explo  pplication of Fo the calculation s; efficiency of rators)	urier's law in of heat	roperties of  Number of hours  5  4
Prerequis W-1 Module/c C-1 Course co T-A-1 T-A-2 T-A-3 T-A-4	Knowledge of the brownse unit objective The students will graterials  International Heat (determination of heating) Thermodynamics (determination of content determination of substitution determination determination of substitution determination determination determination determination determination of substitution determination determinatio	es various calcula coefficieressing	ourse in math owledge in the us forms of ebye temperanduction; use eations related ents of perform temperature for factor	nematics and physics are area of fundamentary instruction ature and specific of Stefan's law are to I and II laws of mance for heat put in different scale	heat cand Wien's thermoson, calcul	pacity; a s law in dynamic d refrige ation of	entary level  d skills to explo  pplication of Fo the calculation s; efficiency of rators)	urier's law in of heat	Number of hours  5  4  5
Prerequis W-1 Module/c C-1 Course co T-A-1 T-A-2 T-A-3 T-A-4 T-A-5	Knowledge of the brownse unit objective The students will generals  Internation of head into determination of head into determination of content determination of second determination determination of second determination determination of second determination determination determination of second determination determinat	various calculato cesting tructuring of x-	ourse in math owledge in the us forms of ebye temperature ations related ents of perform temperature feactor effector	nematics and physical area of fundamentary and specificature and specificature and II laws of mance for heat put in different scale on patter in Powde	heat cand wien's thermost and so, calcul	pacity; a responsible for the second	entary level  d skills to explo  pplication of Fo the calculation s; efficiency of rators)	urier's law in of heat	roperties of  Number of hours  5  4  5  2 2
Prerequis W-1 Module/C C-1 Course CC T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6	Knowledge of the brownse unit objective The students will gmaterials  ontent divided into Heat (determination of hradiation) Thermodynamics (determination of comperature (expringuids) Determination of second computer modelling Calculation of band	calculation of x-d gap b	ourse in math owledge in the us forms of ebye temperanduction; use ations related ents of perfor temperature re factor ray diffractions on expressing on expression of the exp	nematics and physical area of fundamental area of fundamental area of fundamental area and specification are and specification area of Stefan's law are and II laws of mance for heat put in different scale are patter in Powde perimental data, diesemble and patter in Powde perimental data, diesemble and patter in Powde perimental data, diesemble and physical area area area area.	heat cand when thermony and so, calcularcell soft	pacity; a s law in dynamic d refrige ation of	pplication of Fo the calculation s; efficiency of rators)	urier's law in of heat an engine;	roperties of  Number of hours  5  4  5  2  2  4
Prerequis W-1 Module/c C-1 Course co T-A-1 T-A-2 T-A-3 T-A-4 T-A-5	Knowledge of the brownse unit objective The students will gmaterials  ontent divided into Heat (determination of hradiation) Thermodynamics (determination of content divided) Determination of second content divided into	es various calcula coefficier essing tructuring of x-d gap baterials	ourse in math ourse in math ourse in math ourse in math ourse in the outside in t	nematics and physical representation are area of fundamentary and specification of Stefan's law are in different scale on patter in Powde perimental data, divide based on carbon	heat cand when thermony and so, calcularcell soft	pacity; a s law in dynamic d refrige ation of	pplication of Fo the calculation s; efficiency of rators)	urier's law in of heat an engine;	roperties of  Number of hours  5  4  5  2 2
Prerequis W-1 Module/c C-1 Course co T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6 T-A-7	Knowledge of the brownse unit objective The students will gmaterials  ontent divided into Heat (determination of hradiation) Thermodynamics (determination of comperature (expringuids) Determination of second computer modelling Calculation of band	various variou	ourse in math owledge in the us forms of ebye temperature ations related ents of performatements of easing on experience as a stydy of the control of the performance	nematics and physical representation and specifical representation at the latest and specifical representation of Stefan's law are in different scale on patter in Powder perimental data, discussed on carbon is - analysis	heat can heat can heat can d Wien' thermo mps and s, calcul	pacity; a s law in dynamic d refrige ation of	pplication of Fo the calculation s; efficiency of rators)	urier's law in of heat an engine;	Number of hours  5  4  5  2  2  4  5
Prerequis W-1 Module/c C-1 Course co T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6 T-A-7 T-A-8	Knowledge of the brownse unit objective The students will generals  Internation of head into determination of head into determination of content determination of some computer modelling calculation of band determination of band determination of content determination of some content determination determinati	es various calculation of Dieat con calculation of tructuring of x-di gap baterials of quar spectr	ourse in math owledge in the us forms of ebye temperanduction; use ations related ents of perfore temperature refactor eray diffraction basing on experiments of perfore temperature of the performance o	nematics and physical representation and specifical representation at the latest and specifical representation of Stefan's law are in different scale on patter in Powder perimental data, discussed on carbon is - analysis	heat can heat can heat can d Wien' thermo mps and s, calcul	pacity; a s law in dynamic d refrige ation of	pplication of Fo the calculation s; efficiency of rators)	urier's law in of heat an engine;	roperties of  Number of hours  5  4  5  2  2  4  5  5  5
Prerequis W-1 Module/c C-1 Course co 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	Knowledge of the knowledge unit objective. The students will gmaterials  In the students will gma	various variou	ourse in math owledge in the us forms of ebye temperanduction; use ations related ents of perfore temperature refactor eray diffraction basing on experiments of perfore temperature of the performance o	nematics and physical representation and specifical representation at the latest and specifical representation of Stefan's law are in different scale on patter in Powder perimental data, discussed on carbon is - analysis	heat can heat can heat can d Wien' thermo mps and s, calcul	pacity; a s law in dynamic d refrige ation of	pplication of Fo the calculation s; efficiency of rators)	urier's law in of heat an engine;	roperties of  Number of hours  5  4  5  2  2  4  5  5  5  5
Prerequis W-1 Module/c C-1 Course co 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	Knowledge of the brownse unit objective The students will graterials  International Heat (determination of hadiation) Thermodynamics (determination of content determination of content determination of section of the content determination of section of content determination of section of section of section of band of the content determination of section of the content determination determination of section of the content determination determination determination determination determination determination determination determinatio	calculation of year year of year year of year year year year year year year year	ourse in math owledge in the us forms of ebye temperature attions related ents of performation temperature refactor eray diffraction oasing on exponent and role of ecrum	nematics and physical real physical physical real physical	heat can heat can heat can d Wien' thermo mps and s, calcul	pacity; a s law in dynamic d refrige ation of	pplication of Fo the calculation s; efficiency of rators)	urier's law in of heat an engine;	roperties of  Number of hours  5  4  5  2  2  4  5  5  5  5
Prerequis W-1 Module/c C-1 Course co 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-A-11 T-L-1	Knowledge of the becourse unit objective The students will gmaterials  ontent divided into Heat (determination of hradiation) Thermodynamics (determination of content divided into determination of section of section of section of band divided into determination of section of sec	es various various calcula coefficier essing tructuring of x-d gap baterials of quar spectrular spe	ourse in math ou	nematics and physic error and specific of Stefan's law are in different scale on patter in Powde perimental data, dispassed on carbon s - analysis of X-ray diffraction of materials	heat cand Wien'thermore, calcularcell softs	pacity; a s law in dynamic d refrige ation of	pplication of Fo the calculation s; efficiency of rators)	urier's law in of heat an engine;	roperties of  Number of hours  5  4  5  2  2  4  5  5  5  5  5  5
Prerequis W-1 Module/c C-1 Course cc 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-A-11 T-L-1 T-L-2 T-L-3	Knowledge of the brourse unit objective The students will graterials  Internation of head into determination of head into determination of content divided into determination of some divided into determination of some divided into determination of some divided into divided into determination of some divided into determination of some divided into	calculation of Quarterials of quarte	ourse in math owledge in the us forms of ebye temperature ations related ents of performation temperature refactor eray diffraction obasing on experimental temperature and role of ecrum	enematics and physical enematics and physical enematics and physical enematics and physical enematics and specifical enematics of Stefan's law and to I and II laws of mance for heat put in different scale enematical data, displayed and carbon in patter in Powde perimental data, displayed on carbon in a second carbon in a second carbon in materials exions of copper are	heat cand wien's thermoomps and scussion materia	pacity; a significant pacity; a significant pacity; a significant pacity; a significant pacity and pacity at least 10 miles. The significant pacity are pacity at least 10 miles. The significant pacity are pacity at least 10 miles. The significant pacity are pacity at least 10 miles. The significant pacity are pacity at least 10 miles. The significant pacity are pacity at least 10 miles. The significant pacity are pacity at least 10 miles. The significant pacity are pacity at least 10 miles. The significant pacity are pacity at least 10 miles. The significant pacity are pacity; and the significant pacity at least 10 miles. The significant pacity are pacity at least 10 miles. The significant pacity are pacity at least 10 miles. The significant pacity are pacity at least 10 miles. The significant pacity at least 10 mile	entary level  d skills to explo  pplication of Fo the calculation s; efficiency of rators) thermal expans  an data analysi	urier's law in of heat an engine; sion of solids and	roperties of  Number of hours  5  4  5  2  2  4  5  5  5  5  5  5  5  5  5
Prerequis W-1 Module/C C-1 Course CC 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-A-11 T-L-1 T-L-2 T-L-3 T-L-4	Knowledge of the brownse unit objective The students will gmaterials  International determination of hadiation of content divided into determination of content determination of content divided into determination of some divided into determination of some divided into divided into determination of some divided into determination of some divided into determination of some divided into determination of some divided into divi	es various various calcula coefficie ressing tructuring of x-d gap be atterials of quar spectral lar spectral characteristics of quar spectral characteristics of quarteristics of quarter	ourse in math ou	nematics and physic are area of fundamentary and specific of Stefan's law are in different scale on patter in Powde perimental data, discontinuous analysis of X-ray diffraction of materials exions of copper are cture type and lat	heat cand wien's thermoomps and scussion materia	pacity; a significant pacity; a significant pacity; a significant pacity; a significant pacity and pacity at least 10 miles. The significant pacity are pacity at least 10 miles. The significant pacity are pacity at least 10 miles. The significant pacity are pacity at least 10 miles. The significant pacity are pacity at least 10 miles. The significant pacity are pacity at least 10 miles. The significant pacity are pacity at least 10 miles. The significant pacity are pacity at least 10 miles. The significant pacity are pacity at least 10 miles. The significant pacity are pacity; and the significant pacity at least 10 miles. The significant pacity are pacity at least 10 miles. The significant pacity are pacity at least 10 miles. The significant pacity are pacity at least 10 miles. The significant pacity at least 10 mile	entary level  d skills to explo  pplication of Fo the calculation s; efficiency of rators) thermal expans  an data analysi	urier's law in of heat an engine; sion of solids and	roperties of  Number of hours  5  4  5  2  2  4  5  5  5  5  5  5  5  5  5  5  5  5
Prerequis W-1 Module/C C-1  Course CC 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-A-11 T-L-1 T-L-2 T-L-3 T-L-4 T-L-5	Knowledge of the brownse unit objective The students will graterials  Internation of heat (determination of heat internation of content divided into determination of heat internation of content divided into determination of content divided into determination of heat internation of content divided into determination of content divided into determination of some content divided into determination divided into determination of some content divided into determination divided into determina	calculation of positive control of the control of t	ourse in math ourse in the ourse of the ourse of performance of the ourse of performance of the ourse	nematics and physical error and specific of Stefan's law are in different scale on patter in Powde perimental data, die based on carbon is - analysis of X-ray diffraction of materials exions of copper are cture type and late it field	heat cand wien's thermodynamics, calcularcell soft scussion material and iron tice consisted the consisted	pacity; a pacity	entary level  d skills to explo  pplication of Fo the calculation s; efficiency of rators) thermal expans  an data analysi  X-ray diffraction	urier's law in of heat an engine; sion of solids and	roperties of  Number of hours  5  4  5  2  2  4  5  5  5  5  5  5  5  5  5  5  5  5
Prerequis W-1 Module/c C-1 Course cc 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-A-11 T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6	Knowledge of the brownse unit objective The students will graterials  Internation of head (determination of content divided into determination of content determination of content divided into determination of some divided into determination of some divided into determination of content divided into determination of content divided into determination of content divided into determination of the determ	calculation of Quarterials of quarte	ourse in math owledge in the us forms of ebye temperature ations related ents of performation temperature acterization of ecrum experiments of reflections of reflective operations of reflective the magnetic structure of reflective the magnetic pendence of reflective operations of reflective the magnetic pendence pendence of reflective the magnetic pendence pendence pendence pendence pendence pendence pendence pendence pend	mematics and physical error and specific of Stefan's law are in different scale on patter in Powde perimental data, dispassed on carbon is - analysis of X-ray diffraction of materials exions of copper are cture type and later and magnetic permeab	heat cand wien's thermodynamics, calcularcell soft scussion material and iron tice consisted the consisted	pacity; a pacity	entary level  d skills to explo  pplication of Fo the calculation s; efficiency of rators) thermal expans  an data analysi  X-ray diffraction	urier's law in of heat an engine; sion of solids and	roperties of  Number of hours  5  4  5  2  2  4  5  5  5  5  5  5  3  5  5  3  4
Prerequis W-1 Module/C C-1  Course CC 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-A-11 T-L-1 T-L-2 T-L-3 T-L-4 T-L-5	Knowledge of the brownse unit objective The students will graterials  Internation of heat (determination of heat internation of content divided into determination of heat internation of content divided into determination of content divided into determination of heat internation of content divided into determination of content divided into determination of section in the content divided into determination of least least the content divided into determination of least lea	es various various of Dreat con calcula oefficieressing tructuring of x-d gap baterials of quar spectraliar spectr	ourse in math ou	nematics and physic e area of fundame instruction ature and specific of Stefan's law are in different scale in different scale on patter in Powde perimental data, divide based on carbon is - analysis of X-ray diffraction of materials exions of copper are cture type and later in the company of the company	heat cand Wien's thermore mps and scalcul scal	pacity; a s law in dynamic d refrige ation of laware n ls - Ram	pplication of Fo the calculation explorators) thermal expans an data analysi  X-ray diffraction	urier's law in of heat an engine; sion of solids and s	roperties of  Number of hours  5  4  5  2  2  4  5  5  5  5  5  5  3  5  5  3  3  5  5

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Course co		ivided into various forms of instr		- k 'k' k	la aa la a al.		L I	Nun	nber of	f hour
T-W-2		nternal energy, heat capacity and sp tion, thermal radiation, phonos, heat					nermai			5
T-W-3	Therm	odynamics (laws of thermodynamics, umps)	thermodynamic	s functions, he	eat engines, re	efrigera	tors and			4
T-W-4	1	nce between amorphous, semi-crysta								3
T-W-5	electro	ort properties: microscopic model of ns, Semiconductors								4
T-W-6	electro	nic structure, fluorescence: atom mon n transitions, fluorescence and spect	rometer	ure semicondu	ctors, electro	n orbita	ls,			3
T-W-7		band gap, electron doping, spectrop								4
T-W-8	Conde	nsed matter structure: Symmetry; cr	stallographic str	ructure types;	Bragg's equa	tion; dif	fraction			2
T-W-9	_	adiation; Powder X-ray diffractomete		•						2
T-W-10	insulat		-							2
T-W-11	depend	current and resistance: Electrical cur dence on temperature		-	·					1
T-W-12	effect,	ect and magnetoresistance: Magneti magnetoresistance; methods to mea nucleus, isotopes; - The phenomeno	sure the magnet	tic properties			ı, Hall			2
T-W-13	preces	nucleus, isolopes; - The phenomeno sion; - Quantum and classical descrip nd relaxation times; - Characteristics	tion of nuclear n	nagnetic resor	ance; - Chem	ical shit				2
T-W-14	Magne	tic susceptibility: Magnetic quantities	and units, Curie	-Weiss law, Fe	erro- and antif	erro-ma	gnetism			2
T-W-15	Partici	oation in the zero-term exam								4
Student w	orkload	l - forms of activity						Nun	nber of	f hour
A-A-1		pation in recitations								45
A-A-2	prepar	ing for tests						+		45
A-A-3	Prepar	Preparation for recitations								30
A-L-1	partici	participation in laboratory exercises								30
A-L-2	prepar	ation for laboratory exercises								15
A-L-3	prepar	ation of reports								
A-L-4	Prepar	ing for tests								
A-W-1	partici	oation in lectures								45
A-W-2	Individ	ual literature studies								45
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	subject	discussion during lectures, auditoriu	ım excercises an	d laboratories						
M-3	self stu	ıdies								
Evaluation	n metho	ods (F - progressive, P - final)								
S-1	Р	written exam								
<i>S-2</i>	F	written completion of exercises and	laboratories							
S-3	F	laboratory reports								
S-4	F	student activity during auditory exc	ercise and labora	ntories						
		<u>I</u>			Reference to					
	Desigr	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	Course co	ntent	Teaching methods	Evaluation method
Knowledg	е									
MSE_1A_B02	_W01	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	M-1	S-1
Skills							,			



MSE_1A_B02_U01 skills to explore the f	undament	al properties of materials	MSE_1A_U03	P6S_UW	P6S_UW	C-1	T-A-1 T-A-2 T-A-3 T-L-1 T-A-4 T-A-5 T-A-5 T-A-6 T-A-7 T-A-8 T-A-9 T-A-9	M-2 M-3	S-2 S-3 S-4
Social competer	ices								
MSE_1A_B02_K01 Is aware of the need	of further	study and systematic work.	MSE_1A_K02	P6S_KK	P6S_WK	C-1	T-A-1 T-A-2 T-A-3 T-A-4 T-A-4 T-A-6 T-A-7 T-A-7 T-A-7 T-A-9 T-A-10 T-A-11 T-A-11 T-L-1 T-L-1 T-L-2 T-L-3 T-A-13 T-L-5 T-A-15 T-W-15 T-W-10 T-L-1 T-W-10 T-L-1 T-W-10 T-L-1 T-W-10 T-L-1 T-W-10 T-L-2 T-W-12 T-W-13 T-L-3 T-W-13 T-W-15 T-W-15	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 po	pints						
Skills									
MSE_1A_B02_U01	2,0 3,0 3,5 4,0 4,5 5,0	from 50 to 55% of percentage po	pints						
Other social con	npetenc	es							
MSE_1A_B02_K01	2,0 3,0 3,5 4,0 4,5 5,0	from 50 to 55% of percentage po	pints						
Required readin	g								

- 1. Peter E. J. Flewitt, Robert K. Wild, Physical Methods for Materials Characterisation, CRC Press, 2017, ISBN 9781482245233
- 2. Prathap Haridoss, Physics of Materials: Essential Concepts of Solid-State Physics, Wiley, 2015, ISBN: 9788126557875
- 3. Yves Quere, Physics of Materials, CRC PRESS, 1998, ISBN 9789056991197



Field of stu	ıdy	Mate	erials Scienc	e and Engineeri	ng				
Mode of st	udy	stati	ionary	Level		first o	cycle	VA/T:10	~ I_
Graduate's	qualification	inży	nier					WTil	_n
Fields of so	cience	engi	neering and	technology					_
Disciplines	of science	mat	erials engine	eering (100%)					
Educationa	al profile	gene	eral academ	ic					
Module									
Course uni	t	Che	mistry						
Code		MSE	_1A_S_B03					\ <b>.</b>	
Field of spe	ecialisation		<del></del>						
Administer	ing faculty	Dep	artment of Ir	norganic and An	alytica	l Chemi	stry		_
ECTS		11,0	)	ECTS (forms)		11,0			
Form of co	urse credit	exar	mination	Language		english			
Electives				Elective group					
Form of ins	struction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
lecturing c	ourse	Α	2	30	2	.0	0,25	К	credits
laboratory	course	L	2	75	7	,0	0,50	К	credits
lecture		W	2	30	2	,0	0,25	K	examination
Leading te	acher	Tom	aszewicz Flż	zbieta (Elzbieta.	Tomasz	ewicz6	zut edu nl)		
Other teac	hers	Wojo Pelk Mato (Zbi	ciech (Wojcie a Rafal (Rafa eusz (Mateus gniew.Rozwa	ech.Ignaczak@z al.Pelka@zut.ed sz.Piz@zut.edu.p adowski@zut.ed	ut.edu. u.pl), P ol), Roz u.pl), S	pl), Koło egat Ag wadow: ośnicki	odziej Beata (B gnieszka (Agnie ski Zbigniew Jacek (Jacek.So	eata.Kolodziej@ eszka.Piegat@zi osnicki@zut.edu	ezut.edu.pl), ut.edu.pl), Piz u.pl), Struk
Prerequisit	es	•							
W-1	The basic knowledg	ge of f	fundamental a	and inorganic cher	nistry a	s wel as	basic safety rule	S	
Module/cou	urse unit objective	es							
C-1									
C-2							· ·		
			·	<u> </u>				· · · · · · · · · · · · · · · · · · ·	Number of hours
T-A-1				III3ti action					2
T-A-2	•	-							2
T-A-3	Acid-base equilibria	in sa	alt solutions						2
T-A-4			•	•					2
T-A-5	complexes.								2
T-A-6	Exercises in recogn formulas	izing	functional gro	oups, naming orga	nic com	pounds	and writing their	structural	5
T-A-7	Solving simple prob	olems	in organic ch	emistry					5
T-A-8						on			3
Module/course unit objectives  C-1 Knowledge and understanding the basic concepts and laws of inorganic and organic chemistry: type chemical reactions, classifications and characterisation of inorganic and organic compounds as well C-2 Knowledge of relationships between physico-chemical properties of the various classes of compound Course content divided into various forms of instruction  T-A-1 Equilibria in heterogeneous systems  T-A-2 Buffers: the control of pH  T-A-3 Acid-base equilibria in salt solutions  T-A-4 Equilibria in aqueous solutions of precipitates  T-A-5 Coordination compounds and their nomenclature. Equilibrium constant in aqueous solutions of complexes.  Exercises in recognizing functional groups, naming organic compounds and writing their structural formulas  T-A-7 Solving simple problems in organic chemistry									2
T-A-10						ton, Do	sis laboratory og	uinment.	5
T-L-1	Regulation and safe	ety ru	les in organic						5
	Acid-base titrimetry	y. Titr	ation of HCl so	olution. Determina	ation of	total hac	Irness of water.		5
				<u> </u>					10
				d V groups					5
1-L-5	Qualitative analysis	of ar	nions						5

Course co.	ntent a	ivided into various forms of instru	ıction					Nun	nber of	hours	
T-L-6	Qualita	tive 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	te by distillation							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	c viscosity as a measure of average r	molecular weigth							5	
T-L-13	Rheolo	gical behavior of polymers in melt								5	
T-L-14	Measu	rement of the rate of selected chemic	al reactions					5			
T-W-1	Orbita	hybridization and molecular structure	e					4			
T-W-2		of matter - gases, liquids, plasma and						2			
T-W-3	-	al properties of solutions (Henry's law								2	
T-W-4	Coordi	nation compounds and their nomencl	ature. Equilibria	in solutions of	coordination	compo	unds	2			
T-W-5	Organi	c chemistry in life and science (an int	roduction)							1	
T-W-6	Basic r	ules of organic chemistry								2	
T-W-7	Overvi	ew of the structures and properties of	f basic functiona	l groups						7	
T-W-8	Intridu	ction to basic definitions in polymer c	hmistry							2	
T-W-9	Mecha	nisms of polymerization reactions and	d polymers classi	ification						3	
T-W-10	Inorga	nic chemistry in industry								3	
T-W-11	Chemi	cal kinetics								2	
Student w	orkload	l - forms of activity						Nun	nber of	hours	
A-A-1	Partici	pation in recitations						3			
A-A-2	study	study of literature								20	
A-A-3	consultations								10		
A-L-1	participation in laboratory exercises								7		
A-L-2	study of literature								5		
A-L-3	prepar	ation of written reports									
A-L-4	consul	ations									
A-W-1	partici	oation in lectures						3			
A-W-2	study	f literature						2			
A-W-3	consul	ations								10	
A-W-4	The ex	am								1	
Teaching i	method	s / tools									
M-1	Lectur										
M-2	Discus										
M-3	Labs										
	moth	ods (F - progressive, P - final)									
S-1	P	Written exam (lecture)									
5-1 5-2	P	Continupus assessment: lab reports	and activity (lab	c)							
3-2	r	Continuous assessment, lab reports	T activity (labs	S) 			T			1	
	Desig	ed 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 co	ntent	Teaching methods	Evaluation methods	
Knowledge	e			1	<u> </u>					1	
MSE_1A_B03_ Students has and laws of c	_W01 knowled hemistry norganic	ge and understanding of basic concepts type of reactions, characterisation of compounds, kinetics, chemical methods	MSE_1A_W02	P6S_WG	P6S_WG	C-1 C-2	T-A-2 T T-A-3 T T-A-4 T T-A-5 T T-A-6 T T-A-7 T T-A-8 T	-W-2 -W-3 -W-4 -W-5 -W-6 -W-7 -W-8 -W-9 -W-10	M-1 M-2 M-3	S-1	



Skills										
MSE_1A_B03_U01 Students are able to measurements or cor the obtained results a	mputer 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	5-2
Social competer	ices									
MSE_1A_B03_K01 Students are able to team leader and have	cooperate e understa	and work in a group also as a anding 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 cr	iterion					
Knowledge	-									
MSE_1A_B03_W01	2,0									
	3,0	Min. 60% of scoring								
	3,5									
	4,0									
	4,5									
	5,0									
Skills										
MSE_1A_B03_U01	2,0									
	3,0	Positive grades of lab reports								
	3,5									
	4,0									
	4,5									
	5,0									
Other social con		es								
MSE_1A_B03_K01	2,0									
	3,0	Positive grades of lab reports								
	3,5									
	4,0									
	4,5									
	5,0									

#### Required reading

- 1. Andrew F. Parsons, Keynotes in Organic Chemistry, Blackwell Science, 2003
- 2. John McMurry, Organic Chemistry, Brooks/Cole, 2012, 8 ed
- 3. John McMurry, Organic Chemistry Solutions, Brook/Cole, 2012, 8 ed
- 4. James W. Zubrick, The Organic Chemistry Survival Manual, John Wiley & Sons, 1988, 2 ed
- 5. C. E. Housecroft and A. G. Sharpe, Inorganic Chemistry, Pearson Education Limited, Edinburgh, UK, 2001
- 6. P. W. Atkins, M. J. Clugston, M. J. Frazer, R. A. Y. Jones, Chemistry. Principles and applications, Longman Group UK Limited, New York, 1990
- 7. J. E. Brady, General Chemistry. Principles and Structure, John Wiley & Sons, New York, 1990
- 8. W. W. Porterfield, Inorganic Chemistry. An Unified Approach, Academic Press Inc., London, UK, 1993
- 9. G. L. Miessler, D. A. Tarr, Inorganic Chemistry, Pearson Education Inc., New Jersey, 2004

#### Supplementary reading

- 1. David R. Klein, Organic Chemistry as a Second Language. Translating the Basic Concepts, John Wiley & Sons, 2008, 2 ed
- 2. G. C. Hill, J. S. Holman, Chemistry in Context, Thomas Nelson and Sons Ltd., Wdinburgh, UK, 1989



Mode of study   Stationary   Level   first cycle	
Graduate's qualification inżynier Fields of science engineering and technology Disciplines of science materials engineering (100%)  Educational profile general academic  Module  Course unit Foreign Language 1  Code MSE_1A_S_B04a  Field of specialisation  Administering faculty Studium Języków Obcych  ECTS 6,0 ECTS (forms) 6,0  Form of course credit examination Language english  Electives Elective group  Form of instruction Cod Semester Hours ECTS Weight Realization Cred foreign language course LK 1 75 6,0 1,00 K examin  Leading teacher Obstawski Andrzej (Andrzej Obstawski@zut.edu.pl)  Koc Dorota (Dorota.Koc@zut.edu.pl), Sowińska-Dwornik Joanna (Joanna.Sowinska-Dwornik@zut.edu.pl), Stelmaszczyk Marek (Marek.Stelmaszczyk@zut.edu.pl), Waligórs Katarzyna (Katarzyna.Waligorska@zut.edu.pl)  Prerequisites  W-1 Baccalaureate in a language at the elementary or extended level.  Module/course unit objectives  C-1 Use the selected foreign language in a variety of everyday situations by skillfully applying the rules of grammar and vocabulary at the B2 language proficiency level.  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.	
Fields of science engineering and technology  Disciplines of science materials engineering (100%)  Educational profile general academic  Module  Course unit Foreign Language 1  Code MSE_1A_S_B04a  Field of specialisation  Administering faculty Studium Jezyków Obcych  ECTS 6,0 ECTS (forms) 6,0  Form of course credit examination Language english  Electives Elective group  Form of instruction Cod Semester Hours ECTS Weight Realization Credition of the science of the semantial of the science of the semantial of the science of the	
Educational profile general academic  Module  Course unit Foreign Language 1  Code MSE_1A_S_B04a  Field of specialisation  Administering faculty Studium Jezyków Obcych  ECTS 6,0 ECTS (forms) 6,0  Form of course credit examination Language english  Electives Elective group  Form of instruction Cod Semester Hours ECTS Weight Realization Crediterial foreign language course LK 1 75 6,0 1,00 K examination Language english  Leading teacher Obstawski Andrzej (Andrzej.Obstawski@zut.edu.pl)  Other teachers Word (Dorota.Koc@zut.edu.pl), Sowińska-Dwornik Joanna (Joanna.Sowinska-Dwornik@zut.edu.pl), Stelmaszczyk Marek (Marek.Stelmaszczyk@zut.edu.pl), Waligórs Katarzyna (Katarzyna.Waligorska@zut.edu.pl)  Prerequisites  W-1 Baccalaureate in a language at the elementary or extended level.  Module/course unit objectives  C-1 Use the selected foreign language in a variety of everyday situations by skillfully applying the rules of grammar and vocabulary at the B2 language proficiency level.  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.	
Educational profile general academic  Module  Course unit Foreign Language 1  Code MSE_1A_S_B04a  Field of specialisation  Administering faculty Studium Jezyków Obcych  ECTS 6,0 ECTS (forms) 6,0  Form of course credit examination Language english  Electives Elective group  Form of instruction Cod Semester Hours ECTS Weight Realization Creditely Indicated Profile (Andrzej, Obstawski@zut.edu.pl)  Leading teacher Obstawski Andrzej (Andrzej, Obstawski@zut.edu.pl)  Other teachers Owornik@zut.edu.pl), Stelmaszczyk Marek (Marek.Stelmaszczyk@zut.edu.pl), Waligórs Katarzyna (Katarzyna, Waligorska@zut.edu.pl)  Prerequisites  W-1 Baccalaureate in a language at the elementary or extended level.  Module/course unit objectives  C-1 Use the selected foreign language in a variety of everyday situations by skillfully applying the rules of grammar and vocabulary at the B2 language proficiency level.  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.	
Module  Course unit  Foreign Language 1  Code  MSE_1A_S_B04a  Field of specialisation  Administering faculty  Studium Jezyków Obcych  ECTS  6,0  Form of course credit  Electives  Elective group  Form of instruction  Cod Semester Hours ECTS Weight Realization Crediterial Green Course (India Course Course)  Form of instruction  Cod Semester Hours ECTS Weight Realization Crediterial Green Course (India Course Course)  Form of instruction  Cod Semester Hours ECTS Weight Realization Crediterial Green Course (India Course Course)  Form of instruction  Cod Semester Hours ECTS Weight Realization Crediterial Green Course (India Course Course)  Form of instruction  Cod Semester Hours ECTS Weight Realization Crediterial Green Course (India Course Course)  Form of instruction  Cod Semester Hours ECTS Weight Realization Crediterial Green Course Course Course Course Course Course Course Course (India Course Cours	
Course unit  Code  MSE_1A_S_B04a  Field of specialisation  Administering faculty  Studium Jezyków Obcych  ECTS  6,0  Form of course credit  Electives  Elective group  Form of instruction  Cod Semester Hours ECTS Weight Realization Credite of preign language course  LK 1 75 6,0 1,00 K examination  Leading teacher  Obstawski Andrzej (Andrzej.Obstawski@zut.edu.pl)  Koc Dorota (Dorota.Koc@zut.edu.pl), Sowińska-Dwornik Joanna (Joanna.Sowinska-Dwornik@zut.edu.pl), Stelmaszczyk Marek (Marek.Stelmaszczyk@zut.edu.pl), Waligórs Katarzyna (Katarzyna.Waligorska@zut.edu.pl)  Prerequisites  W-1  Baccalaureate in a language at the elementary or extended level.  Module/course unit objectives  C-1  Use the selected foreign language in a variety of everyday situations by skillfully applying the rules of grammar and vocabulary at the B2 language proficiency level.  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.	
Administering faculty    ECTS	7
Administering faculty    ECTS	
Administering faculty    ECTS	
Form of course credit examination Language english  Electives Elective group  Form of instruction Cod Semester Hours ECTS Weight Realization Credit foreign language course LK 1 75 6,0 1,00 K examin  Leading teacher Obstawski Andrzej (Andrzej Obstawski@zut.edu.pl)  Koc Dorota (Dorota Koc@zut.edu.pl), Sowińska-Dwornik Joanna (Joanna.Sowinska-Dwornik@zut.edu.pl), Stelmaszczyk Marek (Marek.Stelmaszczyk@zut.edu.pl), Waligórs Katarzyna (Katarzyna.Waligorska@zut.edu.pl)  Prerequisites  W-1 Baccalaureate in a language at the elementary or extended level.  Module/course unit objectives  C-1 Use the selected foreign language in a variety of everyday situations by skillfully applying the rules of grammar and vocabulary at the B2 language proficiency level.  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.	
Electives  Elective group  Form of instruction  Cod Semester Hours ECTS Weight Realization Cred foreign language course LK 1 75 6,0 1,00 K examin  Leading teacher  Obstawski Andrzej (Andrzej Obstawski@zut.edu.pl)  Koc Dorota (Dorota.Koc@zut.edu.pl), Sowińska-Dwornik Joanna (Joanna.Sowinska-Dwornik@zut.edu.pl), Stelmaszczyk Marek (Marek.Stelmaszczyk@zut.edu.pl), Waligórs Katarzyna (Katarzyna.Waligorska@zut.edu.pl)  Prerequisites  W-1 Baccalaureate in a language at the elementary or extended level.  Module/course unit objectives  C-1 Use the selected foreign language in a variety of everyday situations by skillfully applying the rules of grammar and vocabulary at the B2 language proficiency level.  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.	
Electives	
foreign language course LK 1 75 6,0 1,00 K examin  Leading teacher Obstawski Andrzej (Andrzej.Obstawski@zut.edu.pl)  Koc Dorota (Dorota.Koc@zut.edu.pl), Sowińska-Dwornik Joanna (Joanna.Sowinska-Dwornik@zut.edu.pl), Stelmaszczyk Marek (Marek.Stelmaszczyk@zut.edu.pl), Waligórs Katarzyna (Katarzyna.Waligorska@zut.edu.pl)  Prerequisites  W-1 Baccalaureate in a language at the elementary or extended level.  Module/course unit objectives  C-1 Use the selected foreign language in a variety of everyday situations by skillfully applying the rules of grammar and vocabulary at the B2 language proficiency level.  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.	
foreign language course LK 1 75 6,0 1,00 K examin  Leading teacher Obstawski Andrzej (Andrzej.Obstawski@zut.edu.pl)  Koc Dorota (Dorota.Koc@zut.edu.pl), Sowińska-Dwornik Joanna (Joanna.Sowinska-Dwornik@zut.edu.pl), Stelmaszczyk Marek (Marek.Stelmaszczyk@zut.edu.pl), Waligórs Katarzyna (Katarzyna.Waligorska@zut.edu.pl)  Prerequisites  W-1 Baccalaureate in a language at the elementary or extended level.  Module/course unit objectives  C-1 Use the selected foreign language in a variety of everyday situations by skillfully applying the rules of grammar and vocabulary at the B2 language proficiency level.  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.	it
Koc Dorota (Dorota.Koc@zut.edu.pl), Sowińska-Dwornik Joanna (Joanna.Sowinska-Dwornik@zut.edu.pl), Stelmaszczyk Marek (Marek.Stelmaszczyk@zut.edu.pl), Waligórs Katarzyna (Katarzyna.Waligorska@zut.edu.pl)  Prerequisites  W-1 Baccalaureate in a language at the elementary or extended level.  Module/course unit objectives  C-1 Use the selected foreign language in a variety of everyday situations by skillfully applying the rules of grammar and vocabulary at the B2 language proficiency level.  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.	ation
Koc Dorota (Dorota.Koc@zut.edu.pl), Sowińska-Dwornik Joanna (Joanna.Sowinska-Dwornik@zut.edu.pl), Stelmaszczyk Marek (Marek.Stelmaszczyk@zut.edu.pl), Waligórs Katarzyna (Katarzyna.Waligorska@zut.edu.pl)  Prerequisites  W-1 Baccalaureate in a language at the elementary or extended level.  Module/course unit objectives  C-1 Use the selected foreign language in a variety of everyday situations by skillfully applying the rules of grammar and vocabulary at the B2 language proficiency level.  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.	
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Module/course unit objectives  C-1 Use the selected foreign language in a variety of everyday situations by skillfully applying the rules of grammar and vocabulary at the B2 language proficiency level.  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.	
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vocabulary at the B2 language proficiency level.  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.	
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.	
Course content divided into various forms of instruction	
Number of Number	hours
T-LK-1 Present Simple, Present Continuous, Present Perfect Simple, Past Simple. (Phrasal verbs). Auxiliary verbs (do/ be/ have).	20
T-LK-2 Simple Past/ Past Continuous	20
T-LK-3 Selected specialized vocabulary in an area consistent with the student's major.	35
Student workload - forms of activity Number of	hours
A-LK-1 participating in classes	75
A-LK-2 Preparation for classes	75
A-LK-3 consultations	30
A-LK-4 The exam	1
Teaching methods / tools	
M-1 practical classes	
M-2 group work	
<ul><li>M-3 presentation</li><li>M-4 discussion</li></ul>	
<ul><li>M-4 discussion</li><li>M-5 work with text</li></ul>	
M-6 listening comprehension	
M-7 writing formal letters	
Evaluation methods (F - progressive, P - final)	
S-1 F diagnostic test (F)	
S-2 F control test / colloquium (F)	
S-3 F quiz (F)	
S-4 F presentation (F)	



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									•	
Skills										
subjects in verbal and	kills  SE_1A_A06-1a_U01 s the ability to communicate at level B2 with a variety of bjects in verbal and written form and reads with derstanding articles and reports concerning the contempo orld  SE_1A_A06-1a_U02 s the ability to understand texts and use the basic specialistic cabulary of his/her field  Ocial competences  SE_1A_A06-1a_K01 derstands the importance of language competence in futural of the second of language competence in futural			P6S_UU		C-1	T-LK-1	T-LK-2	M-1 M-2 M-3 M-5 M-6 M-7	5-2
MSE_1A_A06-1a_U02 has the ability to unde vocabulary of his/her f	erstand te Field	exts 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 impo professional activities	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
Outcomes	Grade		Е	valuation cr	iterion					
Knowledge										
Skills										
MSE_1A_A06-1a_U01	2,0									
	3,0	The student is able to communication	ate at a basic level	with various su	bjects in verbal	and writ	ten form	٦.		
MSE_1A_A06-1a_U02										
		The student understands the bas	ic specialist vocab	ulary in their fie	ld and uses the	m to a lir	nited ex	tent.		
046										
'		es								
MSE_IA_A06-1a_K01										
		The student recognizes the impo	rtance of language	competences ii	n future profess	ional wo	rk.			
Required reading										
		ENGLISH Pearson Longman	2006							
				7						
Supplementary re		55 25		-						
		USE OF ENGLISH, Macmillan, 2	2003							
		LISTENING AND SPEAKING, M								
		READING, Macmillan, 2003	acifiliali, 2003							
		WRITING, Macmillan, 2003								
		aukowe z dziedziny studiowar	nego kierunku 2	011						
J. A.L., TERSEY POPE	a.a0 II	danowe z dziedziny stadiowal	icgo kiciuliku, Z	V-1						



			,			-			
Field of st	udy	Mate	erials Scienc	e and Engineeri	ng				
Mode of st	tudy	stati	onary	Level		first o	cycle	\ \ /T:1/	C I.
Graduate'.	s qualification	inżyr	nier	<u> </u>		•		WTil(	un 🗀
Fields of s	cience	engii	neering and	l technology					_
Disciplines	s of science	mate	erials engine	eering (100%)					
Education	al profile	gene	eral academ	ic				1	
Module								† I 📕	
Course un	it	Fore	eign Langu	age 2					Ci
Code		MSE	1A S B04b	)				1 \	
Field of sp	ecialisation	<del>                                     </del>						1	
-	ring faculty	Stud	ium Językóv	v Obcvch					
ECTS		4,0	, 4-,	ECTS (forms)		4,0			_
	ourse credit	cred	its	Language		english	1	_	
Electives	ourse creare	Crea	100	Elective group		crigiisi	<u> </u>	_	
	atri ati an	Cod	Compostor			TC	Maiabt	Doglization	Cradit
Form of in		Cod	Semester	Hours		CTS	Weight	Realization	Credit
	nguage course	LK	2	75		,0	1,00	K	credits
Leading te	eacher			zej (Andrzej.Obs					
Other tead	chers	Dwo	rnik@zut.ed	ota.Koc@zut.edı lu.pl), Stelmaszc rzyna.Waligorsk	zyk Ma	arek (Ma			
Prerequisi	tes			<u>, , , , , , , , , , , , , , , , , , , </u>		,			
W-1	passes exam on F	oreign	language I						
Module/co	urse unit objectiv								
C-1	Use the selected f	oreign	language in a	a variety of everyd	lay situ	ations by	skillfully applyi	ng the rules of gra	ammar and
	vocabulary at the								
C-2 C-3	Understand and understand and understand and understand								
					utonon	ous lear			I
	ntent divided into				iro tono	o (going	to: will: Procent	Continuous to	Number of hours
T-LK-1	express the future	e; moda	il verbs expre	essing the future).	Grading	g of adje	ctives .	Continuous to	10
T-LK-2	The role of the inc verbs (must; have	to; mu	ıstn't; should;	shouldn't). Struct	ure - qu	iestion t	ags.		10
T-LK-3	Self-realization an forms - infinitive /					ent Perfe	ct Simple and C	ontinuous. Verb	10
T-LK-4	Learning about fo	reign co	ountries, their	r cultures, geograp	phical p				10
	Perfect Simple in Education. The ne								10
T-LK-5	manage). Past ter				Hulcath	ig possic	mity (carr, could	, to be able, to	10
T-LK-6	Selected specializ	ed voca	abulary in an	area consistent w	ith the	student's	major.		25
Student w	orkload - forms o	f activ	ity						Number of hours
A-LK-1	participation in cla	ass							75
A-LK-2	consultations								10
A-LK-3	study of literature	and vo	cabulary						35
Teaching I	methods / tools								
M-1	practical classes								
M-2	group work								
M-3	presentation								
M-4	discussion								
M-5	work with text								
M-6	listening compreh								
M-7	writing formal lett								
Evaluation	methods (F - pro	ogressi	ive, P - final,	)					

				· · · · · · · · · · · · · · · · · · ·			9		
Evaluatio	on meth	ods (F - progressive, P - final)				·			
S-1	F	diagnostic test (F)							
S-2	F	control test / colloquium (F)							
S-3	F	quiz (F)							
S-4	F	presentation (F)							
	Desig	ned learning outcomes	Reference to the learning outcomes designed for the fields of	Reference to Learning Outcomes for qualifications at	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring	Course objectives	Course content	Teaching methods	Evaluation methods

	Stady	1 4. 5, 7 5. 5	competences				
Knowledge							
Skills							
MSE_1A_A06-2a_U01 has the ability to communicate at level B2 with a variety of subjects in verbal and written form and reads with understanding articles and repor	MSE_1A_U13	P6S_UU		C-1	T-LK-1 T-LK-2 T-LK-3 T-LK-5	M-1 M-2 M-3 M-5 M-6 M-7	S-2
MSE_1A_A06-2a_U02 has the ability to understand texts and use the basic specialized vocabulary of his/her field	MSE_1A_U13	P6S_UU		C-2	T-LK-6	M-1 M-3 M-5	S-2 S-3 S-4

Social	competences

Outcomes

Grade

5,0

MSE_1A_A06-2a_K01					T-LK-1	T-LK-4	M-1	S-2
understands the importance of language competence in future	MSE_1A_K01	P6S_KK	P6S_WK	C-3		T-LK-5	M-2	S-3
professional activities					T-LK-3	T-LK-6	M-4	5-4

**Evaluation criterion** 

Knowledge		
Skills		
MSE_1A_A06-2a_U01	2,0	
	3,0	The student is able to communicate at a basic level with various subjects in verbal and written form.
	3,5	
	4,0	
	4,5	
	5,0	
MSE_1A_A06-2a_U02	2,0	
	3,0	The student understands the basic specialist vocabulary in their field and uses them to a limited extent.
	3,5	
	4,0	
	4,5	

#### Other social competences

MSE_1A_A06-2a_K01	2,0	
	3,0	The student recognizes the importance of language competences in future professional work.
	3,5	
	4,0	
	4,5	
	5,0	

#### Required reading

- 1. A..Clare, JJ Wilson, TOTAL ENGLISH, Pearson Longman, 2006
- 2. S..Cunningham, P. Moor, NEW CUTTING EDGE, Pearson Longman, 2007

#### Supplementary reading

- 1. S. T. Knowles, M. Mann, USE OF ENGLISH, Macmillan, 2003
- 2. S. T. Knowles, M. Mann, LISTENING AND SPEAKING, Macmillan, 2003
- 3. S. T. Knowles, M. Mann, READING, Macmillan, 2003
- 4. S. T. Knowles, M. Mann, WRITING, Macmillan, 2003
- 5. XYZ, Teksty popularno-naukowe z dziedziny studiowanego kierunku., 2011



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	course credit	cred	its	Language		english					
Electives				Elective group							
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lecture		W	2	2	0,	,0	1,00		K	cred	lits
Leading t	teacher	Gryt	a Anna (Ann	a.Gryta@zut.ed	u.pl)						
Other tea	achers	Gryt	a Anna (Ann	a.Gryta@zut.ed	u.pl), P	iątek-Hn	at Marta (ma	arp@zut	t.edu.pl)		
Prerequis	sites										
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databases. Develops	skills of so	n environment of scientific cientific communication. Is aware fic work - knows the basics of	MSE_1A_K01	P6S_KK	P6S_WK	C-1	T-W-1	M-1	S-1
Outcomes	Grade		E	valuation cri	iterion				
Knowledge	-1								
MSE_1A_A13_W01	2,0								
	3,0	not applicable							
	3,5								
	4,0								
	4,5								
	5,0								
Skills									
MSE_1A_A13_U01	2,0								
	3,0	not applicable							
	3,5								
	4,0								
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Other social con	<u>.</u>	es							
MSE_1A_A13_K01	2,0								
	3,0	not applicable							
	3,5								
	4,0								
	4,5 5,0								
	1 5,0								

#### 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



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T-W-4  T-W-5  T-W-6  T-W-7  Student w  A-W-1  A-W-2  A-W-3  A-W-4  Teaching i	authorship Professional Ethics design, deliberate Engineering Ethics including adaptive Facing the potenti encounter in their Written test  orkload - forms of Participation in cla Individual literatur Preparing for tests One-on-One Consumethods / tools Activating method  methods (F - professional) P Written fine	and Ir design and S design al ethic future  f activ ss e studing s - lector gress al exarcal	grity for Engiruman-animal ntegrity for En faults ustainability n, green technical dilemmas profession ity  des and presents  ture illustrate ive, P - final, n based on the illustrate illustrate in based on the illustrate illustrate in based on the illustrate illustrate illustrate in based on the illustrate	neers – falsification research subjects, gineers – fraud, co selected topics in nologies, economic case study of diff	of data hiding or rruption engine issues, erent s	n, fabricati conflicts o n, misman ering ethic care for t ituations v	on of data, pla f interest, gho nagement, poo cs related to s he environme which enginee	agiarism, stwriting, gu or product ustainability nt rs may	,	mber of	3 2 1 2 1 5 1 6 hours 15 8 5



professional ethics and integrity for engineers.    Skills											
MSE_1A_B06_W1 2.0 Unacceptable understanding of course material  3.0 Serious deficiencies in understanding the subject material  4.5 Some efficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the subject material  3.0 Serious deficiencies in understanding the subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material  3.0 Serious deficiencies in understanding the core subject material	Knowledge										
MSE_1A_B06_U01 Student possesses an ability to make informed ethical decisions with Confronted with engineering problems in different types of which confronted with engineering problems in different types of which confronted with engineering problems in different types of which confronted with engineering problems in different types of which confronted with engineering problems in different types of which confronted with engineering problems in different types of which confronted with engineering activity.  **MSE_1A_B06_K01**  **Student understands his/her duties and responsibilities as professionals. Student has an improved awareness and ability of pointing of potential ethical issues within an engineering context.  **Outcomes**  **Grade**  **Outcomes**  **Grade**  **Description**  **Description**  **Outcomes**  **Grade**  **Outcomes**  **Outcomes**  **Grade**  **Description**  **Description**  **Outcomes**  **O	Student possesses a	general kr nd integrit	nowledge of the research and y for engineers.	MSE_1A_W10	P6S_WK	P6S_WG	C-1	T-W-2 T-W-3	T-W-6	M-1	S-1
Student possesses an ability to make informed ethical decisions when confronded with engineering problems in different types of work. Student is able to assess the consequences and threats resulting from non-compliance with the rules of professional ethics in the engineer's activity.    Social completances	Skills										
MSE_1A_B06_K01 Student understands his/her duties and responsibilities as professionals. Student has an improved awareness and ability of pointing of potential ethical issues within an engineering  Outcomes  Grade  Evaluation criterion  Knowledge  MSE_1A_B06_W01 3,0 Serious deficiencies in understanding the core subject material 4,0 Some deficiencies in understanding the core subject material 4,5 Some mild deficiencies in understanding the core subject material 3,0 Serious deficiencies in understanding the core subject material 4,0 Some deficiencies in understanding the core subject material 4,0 Some deficiencies in understanding the core subject material 5,0 Complete Mastery of subject material  2,0 Unacceptable understanding the core subject material 3,1 Serious deficiencies in understanding the core subject material 3,0 Serious deficiencies in understanding the core subject material 4,0 Some deficiencies in understanding the core subject material 4,0 Some deficiencies in understanding the core subject material 4,0 Some deficiencies in understanding the core subject material 4,0 Some deficiencies in understanding the core subject material 4,0 Some deficiencies in understanding the core subject material 5,0 Complete Mastery of subject material  Other social competences  MSE_1A_B06_K01  2,0 Unacceptable understanding the core subject material 3,5 Some mild deficiencies in understanding the core subject material 4,0 Some deficiencies in understanding the core subject material 5,0 Some deficiencies in understanding the core subject material 5,0 Some deficiencies in understanding the core subject material 5,0 Some deficiencies in understanding the core subject material 5,0 Some deficiencies in understanding the core subject material 5,0 Some deficiencies in understanding the core subject material 5,0 Some deficiencies in understanding the core subject material 5,0 Some deficiencies in understanding the core subject material	Student possesses ar when confronted with work. Student is able resulting from non-co	engineer to assess mpliance	ing problems in different types of the consequences and threats with the rules of professional	MSE_1A_U06	P6S_UW	P6S_UW	C-1	T-W-3		M-1	S-2
Student understands his/her duties and responsibilities as an improved awareness and ability of professionals, Student has an improved awareness and ability of pointing of potential ethical issues within an engineering  Outcomes   Grade   Evaluation criterion  Knowledge  MSE_1A_B06_W01   2,0   Unacceptable understanding of course material  3,0   Serious deficiencies in understanding the core subject material  4,0   Some deficiencies in understanding the core subject material  4,0   Some deficiencies in understanding the core subject material  5,0   Complete Mastery of subject material  8kills  MSE_1A_B06_U01   2,0   Unacceptable understanding the core subject material  3,0   Serious deficiencies in understanding the core subject material  3,0   Serious deficiencies in understanding the core subject material  3,0   Serious deficiencies in understanding the core subject material  3,0   Serious deficiencies in understanding the core subject material  4,0   Some deficiencies in understanding the core subject material  4,0   Some deficiencies in understanding the core subject material  4,0   Some deficiencies in mastery of subject material  4,0   Some deficiencies in understanding the core subject material  5,0   Complete Mastery of subject material  6,0   Some deficiencies in understanding the core subject material  7,0   Some deficiencies in understanding the core subject material  8,0   Serious deficiencies in understanding the core subject material  9,0   Some deficiencies in understanding the core subject material  9,0   Some deficiencies in understanding the core subject material  1,0   Some deficiencies in understanding the core subject material  1,0   Some deficiencies in understanding the core subject material  1,0   Some deficiencies in understanding the core subject material  1,0   Some deficiencies in understanding the core subject material	Social competen	ces									
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		4,5	Some mild deficiencies in Mastery	of subject materi	al						
Required reading		5,0	Complete Mastery of subject mate	erial							
	Required reading	7									

#### Required reading

- 1. Naagarazan, R. S., A textbook on professional ethics and human values, New Age International, New Delhi, 2006
- 2. C.E. Harris Jr., M.S. Pritchard, M.J. Rabins, Engineering Ethics: Concepts and Cases, 4th Edition, Cengage Learning, Wadsworth, 2009, ISBN: 978-0-495-50279-1
- 3. C.B. Fleddermann, Engineering Ethics, 4th Edition, Prentice Hall, Upper Saddle River, New Jersey, 2012, ISBN: 978-0-13-214521-3

#### Supplementary reading

1. S.K. Starrett, A.L. Lara, C. Bertha, Engineering Ethics: Real World Case Studies, American Society of Civil Engineers, 2017, ISBN: 978-0-7844-1467-5



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Field of s	tudy	Mat	erials Scienc	e and Engineeri	ing				
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Prerequis									
W-1	The basic knowledg		the chemical	technology					
C-1	The aim of this cou the technology, saf case of incompatibi the different workir substances.	ety a	nd man; the s f the work in t	tudent will be awa the industrial syst	are resp ems; sti	onsibility udents w	for the work an ill be aware of th	d some legal cor e possible occur	nsequences in the ence of the risks at
Course co	ontent divided into	vario	ous forms of	instruction					Number of hours
T-W-1	Impact of the Envir	onme	ental Law and	EU Regulations or	n the de	velopme	nt of technology		1
T-W-2	Vienna Convention								1
T-W-3	Geneva Convention		•						2
T-W-4	Risks and mechanis				tallation	S			2
T-W-5	European Union dir								2
T-W-6	The Occupational S								1
T-W-7	Occupational Healt			<u> </u>					1
T-W-8	Employment law in			ment					1
T-W-9	The Toxic Substanc	es Co	ontrol Act						1
T-W-10	Nuclear safety								1
T-W-11 T-W-12	REACH regulation  Nanotechnology in	law r	egulations						1
	vorkload - forms of								Number of hours
A-W-1	Participation in the								15
A-W-2	Studies of the litera			h the classes					10
A-W-3	preparation for exa		John Colour Will						3
A-W-4	Concultations with		ecturer						2
	methods / tools								<u> </u>
M-1	Lecture with multin	nedia	l presentation						
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Desig	ıned 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	Evaluatio methods
Knowledge			•				1			•
MSE_1A_B07_W01 has knowledge abou environment	law and r	egulations at the working	MSE_1A_W09 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 T-W-9 T-W-10	M-1	S-1
Skills						•				•
MSE_1A_B07_U01 knows and understar industry and can app the working place	nd regulati ly it; can p	ons and OHS rules applicable in oredict and asses the danger in	MSE_1A_U06	P6S_UW	P6S_UW	C-1	T-W-4 T-W-5 T-W-6	T-W-7 T-W-8 T-W-10	M-1	S-1
Social competer	ices									
MSE_1A_B07_K01 Is aware of responsib and their effect on th	ility for the	e taken decisions during work ded environment	MSE_1A_K05	P6S_KR	P6S_WK	C-1	T-W-1 T-W-4 T-W-5 T-W-6 T-W-7	T-W-8 T-W-9 T-W-11 T-W-12	M-1	S-1
Outcomes	Grade		E	valuation cr	iterion	•	·			·
Knowledge										
MSE_1A_B07_W01	2,0									
	3,0	Min 50% of score from a final tes	st							
	3,5									
	4,0									
	4,5									
	5,0									
Skills										
MSE_1A_B07_U01	2,0									
	3,0	Min 50% of score from a final tes	it							
	3,5									
	4,0									
	4,5									
	5,0									
Other social con	npetence	es								
MSE_1A_B07_K01	2,0									
	3,0	Min 50% of score from a final tes	st							
	3,5									
	4,0									
	4,5									

#### Required reading

- 1. Ved Nanda, George (Rock) Pring, International Environmental Law and Policy for the 21st Century, Martinus Nijhoff Publishers, Boston, 2013
- 2. Nicholas A. Ashford, Charles C. Caldart, Technology, Law, and the Working Environment, Island Press, Island, 1996
- 3. Steven Vaughan, EU Chemicals Regulation, New Governance, Hybridity and REACH, University College London, UK, 2015

#### Supplementary reading

- 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



	tudy	Mate	erials Science	and Engineeri	ng	Materials Science and Engineering										
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-	nal profile		eral academic				1									
Module		9		<u>-                                      </u>			<b>┤</b> ▮			•						
Course ui	nit	Ous	lity Manage	ment and Ru	siness Econon	nice	<b>┤</b> ▮			J.	•					
Code	THE		_1A_S_B08	inent and bu	Siliess Econoli	1105	- 1									
		MSE	_1A_3_DU0				- \			4						
	pecialisation · · · · ·						- '	\_		_	_					
	ering faculty				materials Science	ce										
ECTS		1,0		ECTS (forms)	1,0											
Form of c	course credit	cred	lits	Language	english											
Electives			1	Elective group												
Form of i	nstruction	Cod	Semester	Hours	ECTS	Weight	Rea	alization		Cred	it					
lecture		W	2	15	1,0	1,00		K		credi	ts					
Leading t	teacher	FI Fr	av Mirosława	(Miroslawa FIF	ray@zut.edu.pl	)	<u> </u>									
Other tea					ray@zut.edu.pl											
			<u> </u>			,										
Prerequis W-1	none															
Module/co	ourse unit obje	ectives														
C-1	The aim of the	e course is naking, and			natic approach to nd interpret econd											
Course co	ontent divided	into vario	ous forms of ir	nstruction					Numk	ber of	hours					
T-W-1									1							
		jerrieries sy	rstems (QMS) ir	n developemnt o	f products (as exa	mple, ISO 134	185:201	6)			3					
T-W-2			vstems (QMS) ir Validation of Pr	<u>.</u>	f products (as exa	mple, ISO 134	185:201	6)								
T-W-2 T-W-3	Design, Verific	ation and	Validation of Pr	<u>.</u>		ample, ISO 134	185:201	6)			3					
	Design, Verific	cation and aluation (s	Validation of Pr ales plan and f	roducts	launch plan)	ample, ISO 134	185:201	6)			3					
T-W-3	Design, Verific  Pre-market ev  Regulatory ap	cation and aluation (s	Validation of Pr ales plan and f	roducts orecast, market	launch plan)	ample, ISO 134	l85:201	6)			3 2 2					
T-W-3 T-W-4	Design, Verific  Pre-market ev  Regulatory ap	cation and aluation (sproval (cer	Validation of Pr ales plan and f tificates, decla Development	roducts orecast, market	launch plan)	ample, ISO 134	ł85:201	6)			3 2 2 2					
T-W-3 T-W-4 T-W-5 T-W-6	Design, Verific Pre-market ev Regulatory ap Risk Analysis i	cation and raluation (s proval (cer in Products	Validation of Pr ales plan and f tificates, decla Development risks	roducts orecast, market	launch plan)	ample, ISO 134	l85:201	6)	Numk	ber of	3 2 2 2 2					
T-W-3 T-W-4 T-W-5 T-W-6	Design, Verific Pre-market ev Regulatory ap Risk Analysis i Business econ	cation and caluation (some proval (certification products) comics and calculated as of activities.	Validation of Pr ales plan and f tificates, decla Development risks	roducts orecast, market	launch plan)	ample, ISO 134	ł85:201 <sup>(</sup>	6)	Numb	ber of	3 2 2 2 2 2 4					
T-W-3 T-W-4 T-W-5 T-W-6	Design, Verific Pre-market ev Regulatory ap Risk Analysis i Business econ	cation and valuation (see proval (cer in Products comics and ins of actival lectures	Validation of Pr ales plan and fi tificates, decla Development risks	roducts orecast, market	launch plan)	ample, ISO 134	PRS:201	6)	Numb	ber of	3 2 2 2 2 2 4					
T-W-3 T-W-4 T-W-5 T-W-6 Student v	Design, Verific Pre-market ev Regulatory ap Risk Analysis i Business econ workload - form participation in	cation and valuation (see proval (cer in Products comics and ins of actival lectures	Validation of Pr ales plan and fi tificates, decla Development risks	roducts orecast, market	launch plan)	ample, ISO 134	PRS:201	6)	Numb	ber of	3 2 2 2 2 4 <i>thours</i>					
T-W-3 T-W-4 T-W-5 T-W-6 Student v A-W-1 A-W-2 A-W-3	Design, Verific Pre-market ev Regulatory ap Risk Analysis i Business econ workload - form participation ii individual stud	cation and raluation (see proval (cer in Products comics and ins of active in lectures dy of literate	Validation of Pr ales plan and fi tificates, decla Development risks	roducts orecast, market	launch plan)	ample, ISO 134	H85:201	6)	Numb	ber of	3 2 2 2 2 4 <i>hours</i> 15					
T-W-3 T-W-4 T-W-5 T-W-6 Student v A-W-1 A-W-2 A-W-3	Design, Verific Pre-market ev Regulatory ap Risk Analysis i Business econ workload - form participation ii individual stuc	cation and caluation (see proval (cer in Products and ins of active in lectures day of literature	Validation of Pr ales plan and fi tificates, decla Development risks	roducts orecast, market	launch plan)	ample, ISO 134	H85:201	6)	Numb	ber of	3 2 2 2 2 4 <i>hours</i> 15					
T-W-3 T-W-4 T-W-5 T-W-6 Student v A-W-1 A-W-2 A-W-3 Teaching M-1	Design, Verific Pre-market ev Regulatory ap Risk Analysis i Business econ workload - form participation ii individual stud consultations  methods / too Lecture with design in the consultation in the consult	cation and caluation (see proval (cer in Products comics and ins of active in lectures day of literated liscussion.	Validation of Pr ales plan and f tificates, decla Development risks rity	roducts orecast, market	launch plan)	ample, ISO 134	H85:201	6)	Numb	ber of	3 2 2 2 2 4 <i>hours</i> 15					
T-W-3 T-W-4 T-W-5 T-W-6 Student v A-W-1 A-W-2 A-W-3 Teaching M-1	Design, Verific Pre-market ev Regulatory ap Risk Analysis i Business econ workload - form participation ii individual stud consultations methods / too	cation and caluation (seproval (certin Products comics and caluation) are of actived as of actived the complex of literated as of actived the complex of actived the compl	Validation of Pr ales plan and f tificates, decla Development risks rity	roducts orecast, market	launch plan)	ample, ISO 134	H85:201	6)	Numb	ber of	3 2 2 2 2 4 <i>hours</i> 15					
T-W-3 T-W-4 T-W-5 T-W-6 Student v A-W-1 A-W-2 A-W-3 Teaching M-1 Evaluatio	Design, Verifice Pre-market events Regulatory aportion Risk Analysis in Business economorkload - form participation in individual study consultations  methods / too Lecture with design methods (F - form methods	cation and caluation (see proval (certin Products comics and carried and carri	Validation of Prales plan and frificates, declar Development risks	roducts orecast, market	he Reference to Learning Outcomes	Reference to learning outcomes for qualifications at	Course objectives	Course con	toot T		3 2 2 2 2 4 <i>hours</i> 15					
T-W-3 T-W-4 T-W-5 T-W-6 Student v A-W-1 A-W-2 A-W-3 Teaching M-1 Evaluatio S-1	Design, Verifice Pre-market even Regulatory ap Risk Analysis in Business economorkload - form participation in individual stude consultations methods / too Lecture with design methods (F-P) Final to Designed lead	cation and caluation (see proval (certin Products comics and carried and carri	Validation of Prales plan and frificates, declar Development risks	Reference to learning outco	he Reference to Learning Outcomes elds of for qualifications at	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering	Course		toot T	Feaching	3 2 2 2 4 6 hours 15 10 5					
T-W-3 T-W-4 T-W-5 T-W-6 Student v A-W-1 A-W-2 A-W-3 Teaching M-1 Evaluatio S-1 Knowledg MSE_1A_B08 knows the p and busines	Design, Verific Pre-market ev Regulatory ap Risk Analysis i Business econ workload - form participation ii individual stud consultations  methods / too Lecture with designed lead  Designed lead  ge B_W01 rinciples of products economic inform	cation and caluation (seproval (cere in Products comics and ins of active in lectures day of literated liscussion.  Is progresses the comic in the comic in the comics and ins of active in lectures day of literated liscussion.	Validation of Prales plan and frificates, declar Development risks  vity  ture  ive, P - final)	Reference to learning outco designed for the study	the 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	Course		toot T	Feaching	3 2 2 2 4 6 hours 15 10 5					
T-W-3 T-W-4 T-W-5 T-W-6 Student v A-W-1 A-W-2 A-W-3 Teaching M-1 Evaluatio S-1 Knowledg MSE_1A_B08 knows the p and busines	Design, Verific Pre-market ev Regulatory ap Risk Analysis i Business econ Workload - form participation ii individual stud consultations  methods / too Lecture with den methods (F - P Final to  Designed lead	cation and caluation (seproval (cere in Products comics and ins of active in lectures day of literated liscussion.  Is progresses the comic in the comic in the comics and ins of active in lectures day of literated liscussion.	Validation of Prales plan and frificates, declar Development risks  vity  ture  ive, P - final)	Reference to learning outco designed for the study	the 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	Course		toot T	Teaching methods	3 2 2 2 4 hours 15 10 5					



Social competer	nces						T 14/ 7	T 11/ 4		
MSE_1A_B08_K01 is ready to undertak organization	e economic	c-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	<u>'</u>									
MSE_1A_B08_W01	2,0									
	3,0	Min 50% of score from a final	test							
	3,5									
	4,0									
	4,5									
	5,0									
Skills										
MSE_1A_B08_U01	2,0									
	3,0	Positive grade of the final test	t (more than 55% corre	ect answers)						
	3,5									
	4,0									
	4,5									
	5,0									
Other social cor	npetence	es								
MSE_1A_B08_K01	2,0									
	3,0	positive grade of the final tes	t and exam (more thar	n 55% correct a	nswers)					
	3,5									
	4,0									
	4,5									
	5,0									
Required readin	ng									
1. Adam Smith, T	he Wealth	of Nations, 2010								
1. selfmade mate	rials, 202	0								
2 61 1 16: 1 1		anias Danias and Crashes	2014							

2. Charles Kinderberger, Manias, Panics, and Crashes, 2014



Field of st	udy	Mate	erials Scienc	e and Engineer	ing				
Mode of st	tudy	stati	onary	Level		first o	cycle		• 1
Graduate'	s qualification	inży	nier					WTil	.h
Fields of s	cience	engi	neering and	technology					
Disciplines	s of science	-		ering (100%)					
Education			eral academ						
Module	ai prome	gene	- Tar academ						
	ta.	D' - I	C T						
Course un	IT .		ogy for Eng	gineers					
Code		MSE	_1A_S_B09					\	
Field of sp	ecialisation								<u> </u>
Administe	ring faculty	Dep	artment of C	Chemical and Pr	ocess E	nginee	ring		
ECTS		3,0		ECTS (forms)		3,0			
Form of co	ourse credit	exar	mination	Language		english	1		
Electives				Elective group					
Form of in	struction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
lecturing o	course	Α	2	30	1	,0	0,30	K	credits
laboratory		L	2	30		,0	0,30	K	credits
lecture	Course	W	2	30		,0	0,40	K	examination
								N	examination
Leading te	eacher			upak Agata (Ag					
Other tead	chers		cowska-Szcz bolewski@z		jata.Ma	rkowska	a@zut.edu.pl), :	Sobolewski Pioti	•
Prerequisi	tes								
W-1	Finished course of	Intrdu	ction to Biolo	ЭУ					
Module/co	urse unit objective	e <i>s</i>							
C-1	To introduce stude them aware of app examples.	nts to licatio	modem biolo n of engineer	gy with an emphoing principles in b	asis on e piology,	volution and engi	of biology as a n neering robust so	nulti-disciplinary f olutions inspired b	ield, to make y biological
Course co	ntent divided into	vario	us forms of	instruction					Number of hours
T-A-1	Mendel' Law testing								10
T-A-2	Hardy-Weinberg La		ting						6
T-A-3	Chromosome Mapp	ing							4
T-A-4	Case studies from I	iterat	ure						10
T-L-1	Function of protein	s and	eznymes						4
T-L-2	Function of carbohy	ydrate	es						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 Mici	robial	culture meth	ods: biosafety & a	septic t	echnique	9		4
T-L-6	Introduction to Mici						5		4
T-L-7	Introduction to Mici				-				6
T-W-1	Engineering aspect						Chemistry.		1
T-W-2	Molecules of Life (p			ohydrates, nucle	ic acids)				8
T-W-3	Catabolic metabolic	•							3
T-W-4	Anabolic metabolic	•							3
T-W-5	Photorespiration, p		*		sis).				2
T-W-6	Cell cycle, aging, a								2
T-W-7	Gene Structure and				e regula	tion.			4
T-W-8	Cancer biology - Co								2
T-W-9	Physiology of nervo								2
T-W-10	Engineering design			pies in biology					3
Student w	orkload - forms of	activ	ity					4	Number of hours



_			raculty of chemi		ology un	Lingiii		9	1		
Student wo			<u> </u>						Nun	nber of	
	<u> </u>		recitations								30
			laboratory classes								30
A-W-1	participatio	n in	lectures								30
Teaching m	ethods / t	tools	5								
	lectures wi	th pr	resentation								
	disscussior	dur	ing lectures and seminar								
<b>M-</b> 3	aboratory	class	ses								
	recitation c										
M-5	Private stu	dy , t	tutorial, learning materials								
Evaluation	methods (	(F -	progressive, P - final)								
S-1	F mu	ltiple	choice test								
S-2	F eva	luati	ion of reports (labortory and i	recitation)							
[	Designed	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
Knowledge				l				1			
MSE_1A_B09_V knows and und the biosphere, understand the evolution for th become more of	erstand the know adaptice importance organisms complex as to transfer the	ve fe of d s, und hey g	ortance of biochemical cycling in eatures, adaptation and ifferent types of selection and derstand that organisms grow, nderstand that cell elopment of organisms and the	MSE_1A_W02	P6S_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-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								1.20	10		
MSE_1A_B09_U Select and colli- present it in a colli- that may involve number of sour	ate informat clear, logical ve a wide rai ces to ident ate a hypoth	form nge o ify 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											
MSE 1A B09 K	01	all t	ask on time and cooperate and	MSE_1A_K03	P6S_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 Gra	ade		<u>'</u> F	valuation cr	iterion	<u> </u>	1			
Knowledge	05   0.0				- Varaacion ei						
MSE 1A B09 V	V01 2,	Λ									
	3,	.0	use appropriate scientific and tec concepts to give basic explanatio (erned of 51% points on a test)								
	3,										
	4,	_									
	5,	-									
Skills	3,	-									
MSE_1A_B09_U	101 2,	0									
	3,	.0	Student is able to prepare writter identify a pattern or trend, selec laboratory procedure	n reports from labo t, describe and eva	ratory and pres aluate technique	ent literture stu es for a limited r	dy on giv	ven sub scientifi	ject, analy c operatio	/se data ons and	to
	3,		p - >=====								
	4,										
	4,				-						
	5,	.0									



Other social con	petenc	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 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	study	Mate	rials Scienc	e and Engineeri	ng			
Mode of	study	statio	onary	Level	first	cycle	\	C I
Graduat	e's qualification	inżyr	nier				WTil	Ch
Fields of	science	engii	neering and	l technology				_
Disciplin	es of science	mate	rials engine	eering (100%)				
-	onal profile	-	ral academ				†     <b> </b>	
Module	,						·	
Course u	ınit	Gran	hical Engi	 ineerina				C
Code		<del>-</del>	1A S C01				· \	
	specialisation	1.102					1	
		Depa	artment of I	norganic Chemic	 cal Technoloc	ıv and		
Administ	tering faculty		onment En					
ECTS		3,0		ECTS (forms)	3,0			
Form of	course credit	credi	ts	Language	englis	h		
Electives	s			Elective group				
Form of	instruction	Cod	Semester	Hours	ECTS	Weight	Realization	Credit
laborato	ry course	L	2	45	2,0	0,50	K	credits
lecture		W	2	15	1,0	0,50	K	credits
Leading	teacher	Pelka	a Rafal (Raf	al.Pelka@zut.edı			1	<u> </u>
				a (Karolina.Kielb	-	ı.pl), Pelka Rafa	l (Rafal.Pelka@	zut.edu.pl),
Other te	acners 			acek.Zaplata@zı				
Prerequi	isites							
W-1	Basics of mathema	itics ar	nd drawing at	the high school le	evel			
W-2	Basic computer ski	lls, bas	sics of IT					
Module/d	course unit objectiv	es						
C-1	Familiarize student	s with	the principle	s of technical drav	ving.			
C-2	Familiarize student							
C-3	Forming students'				nachine diagra	ms, installations,	devices.	
C-4	Forming students'				to alaminal dua.			
C-5	Shaping the studer				technical drav	vings.		
	content divided into		us forms of					
T-L-1	Rectangular projec							
T-L-2	, , ,			instruction merican method)				3
	Axonometric projec					<u> </u>		3
	Axonometric projections	ction	uropean or A					3 3 3
T-L-3 T-L-4 T-L-5	Axonometric project Cross sections Dimensioning of sin	ction	uropean or A					3
T-L-4 T-L-5	Axonometric project Cross sections Dimensioning of sin Drawing objects Drawing in the Aut	mple d	uropean or A etails program (28h	merican method)				3 3 3 3 3
T-L-4 T-L-5 T-L-6	Axonometric project Cross sections Dimensioning of sin Drawing objects Drawing in the Aut Test: preparation of	mple docad portion	uropean or A etails program (28h hnical drawir	n); ng using the AutoC				3 3 3 3 3 30
T-L-4 T-L-5 T-L-6 T-W-1	Axonometric project Cross sections Dimensioning of sin Drawing objects Drawing in the Aut Test: preparation of Basics of technical	mple d  oCAD p  of a tec	etails  program (28hhnical drawing: drawing f	n); ng using the AutoC ormats, scales, typ	pes of lines and	d their applicatior		3 3 3 3 3 30 2
T-L-4 T-L-5 T-L-6 T-W-1 T-W-2	Axonometric project Cross sections Dimensioning of sin Drawing objects Drawing in the Aut Test: preparation of Basics of technical Rectangular and ax	mple d  oCAD p  of a tec  drawir  konom	etails  program (28h hnical drawin ng: drawing f etric projecti	n); ng using the AutoC ormats, scales, typ	pes of lines and	d their applicatior		3 3 3 3 3 30 2 2
T-L-4 T-L-5 T-L-6 T-W-1 T-W-2 T-W-3	Axonometric project Cross sections Dimensioning of sin Drawing objects Drawing in the Aut Test: preparation of Basics of technical Rectangular and ax Dimensioning, draw	oCAD portion of a tector of a	etails  program (28h hnical drawin ng: drawing f etric projection	n); ng using the AutoCormats, scales, typon (European and	pes of lines and American met	d their application		3 3 3 3 30 2 2 2
T-L-4 T-L-5 T-L-6 T-W-1 T-W-2 T-W-3 T-W-4	Axonometric project Cross sections Dimensioning of sin Drawing objects Drawing in the Aut Test: preparation of Basics of technical Rectangular and ax	mple d  oCAD pf a tec  drawir  konom  wing no	etails  program (28h hnical drawin ng: drawing f etric projections crams of techr	n); ng using the AutoC ormats, scales, typ on (European and	pes of lines and American met	d their application		3 3 3 3 3 30 2 2
T-L-4 T-L-5 T-L-6 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5	Axonometric project Cross sections Dimensioning of sin Drawing objects Drawing in the Aut Test: preparation of Basics of technical Rectangular and as Dimensioning, draw Assembly drawings	mple d  oCAD pf a tec  drawir  konom  wing no	etails  program (28h hnical drawin ng: drawing f etric projections crams of techr	n); ng using the AutoC ormats, scales, typ on (European and	pes of lines and American met	d their application		3 3 3 3 3 30 2 2 2 2
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	Axonometric project Cross sections Dimensioning of sin Drawing objects Drawing in the Aut Test: preparation of Basics of technical Rectangular and an Dimensioning, draw Assembly drawings AutoCAD: basics, c	mple d oCAD pf a tec drawin xonom wing no	etails  orogram (28h hnical drawin ng: drawing f etric projections rams of techn nds, drawing	n); ng using the AutoC ormats, scales, typ on (European and	pes of lines and American met	d their application		3 3 3 3 3 30 2 2 2 2 2 6
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 Student	Axonometric project Cross sections Dimensioning of sin Drawing objects Drawing in the Aut Test: preparation of Basics of technical Rectangular and ax Dimensioning, draw Assembly drawings AutoCAD: basics, c Written test	mple d oCAD print a tector drawing not so, diagramma	etails  program (28h hnical drawing: drawing fetric projections rams of technology, drawing	n); ng using the AutoC ormats, scales, typ on (European and	pes of lines and American met	d their application		3 3 3 3 3 30 2 2 2 2 2 6
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 Student A-L-1	Axonometric project Cross sections Dimensioning of sin Drawing objects Drawing in the Aut Test: preparation of Basics of technical Rectangular and an Dimensioning, draw Assembly drawings AutoCAD: basics, c	mple d oCAD print a tector drawing now many omma	etails  program (28h hnical drawing: drawing fetric projections rams of technods, drawing	n); ng using the AutoC ormats, scales, typ on (European and nical systems, mac in a CAD program	pes of lines and American met	d their application		3 3 3 3 3 30 2 2 2 2 6 1 Number of hours
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	Axonometric project Cross sections Dimensioning of sin Drawing objects Drawing in the Aut Test: preparation of Basics of technical Rectangular and ax Dimensioning, draw Assembly drawings AutoCAD: basics, co Written test  workload - forms of	mple d  oCAD Inf a tector  drawing nowning nowning omma  fractive  ry class in the to	etails  program (28h hnical drawing: drawing fetric projections rams of technods, drawing	n); ng using the AutoC ormats, scales, typ on (European and nical systems, mac in a CAD program	pes of lines and American met	d their application		3 3 3 3 30 2 2 2 2 2 1 1 Number of hours 45
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 Student A-L-1 A-L-2	Axonometric project Cross sections Dimensioning of sin Drawing objects Drawing in the Aut Test: preparation of Basics of technical Rectangular and ax Dimensioning, draw Assembly drawings AutoCAD: basics, c Written test  workload - forms of Attending laborato Lilterature study or	mple d  oCAD Inf a tector  drawing nowning nowning omma  fractive  ry class in the to	etails  program (28h hnical drawing: drawing fetric projections rams of technods, drawing	n); ng using the AutoC ormats, scales, typ on (European and nical systems, mac in a CAD program	pes of lines and American met	d their application		3 3 3 3 3 3 30 2 2 2 2 6 1 Number of hours 45 5



Student wo	orkload	l - form	s of activity						Nur	nber o	f hours
A-W-2	Literati	ure stud	y on the topics discussed wit	hin the frame of	the lectures						8
A-W-3	Prepari	ing for to	ests								5
A-W-4	Consul	tations									2
Teaching r	nethoo	ls / tool	s								
M-1			ted by Power Point presentat	tion							
M-2			ises: manual drawing								
M-3			nethods: drawing with the use	e of a computer							
Evaluation	metho	nds (F -	progressive, P - final)	<u> </u>							
5-1	P		e: written test								
5-2	F F		al exercises: positive grade fr	rom each drawing	n made						
S-3	F F		nmed methods: positive grade			mnuter					
5-4	Р.	_	es: average grade resulting f		<u>~</u>		athods				
	'	LXCICIS	es. average grade resulting r	Tom practical ext	Telses and pro			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	Cours	e content	Teaching methods	Evaluation methods
Knowledge	9			•				•		•	•
	rs the app n, model	and simu	methods, techniques and tools ulate and perform tasks in the	MSE_1A_W05	P6S_WG 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	M-1 M-2 M-3	S-1 S-2 S-3 S-4
Skills											
	bility and		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	petend	ces									
	rstands t		for continuous vocational eld of graphical engineering	MSE_1A_K01 MSE_1A_K02 MSE_1A_K03 MSE_1A_K04 MSE_1A_K05	P6S_KK P6S_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-6	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	valuation cri	iterion					•
Knowledge	9		•								
MSE_1A_B07_	W01	2,0									
		3,0	Student has basic knowledge ab engineering graphics	out the appropriate	methods, techr	niques and tools	used to	perforr	n task in t	he field	of
		3,5	engineering graphics								
		4,0									
		4,5									
		5,0									
Skills											
MSE_1A_B07_	_002	2,0 3,0 3,5 4,0 4,5	Student performs a simple techr	nical drawing using	the Autocad pro	gram					
		5,0									
Other socia			es								
MSE_1A_B07_	K01	2,0 3,0 3,5 4,0	Student understands at the basic	c level the need for	continuous edu	cation and trair	ning in th	e field (	of graphic	al engin	eering
		4,5 5,0									
	eading		<u> </u>								



#### 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 s	tudy	Mate	rials Scienc	e and Engineerin	g				
Mode of	study	statio	onary	Level		first o	cycle	3 A / T : 1 A	C I
Graduate	e's qualification	inżyr	nier	<u>'</u>				WTil(	Lh
Fields of	science	engii	neering and	technology					_
Discipline	es of science	mate	erials engine	eering (100%)					
Education	nal profile	gene	ral academ	ic					
Module									
Course u	nit		Ci						
Code		<b>\</b>							
Field of s	pecialisation		_1A_S_C01a						
Administ	ering faculty	Depa	artment of N	lanomaterials Ph	ysicoc	hemist	ry		_
ECTS		2,0		ECTS (forms)	<u>-                                      </u>	2,0			
Form of c	course credit	exan	nination	Language		english	 1	_	
Electives		2		Elective group					
	nstruction	Cod	Semester	Hours	FC	 TS	Weight	Realization	Credit
lecture		W	2	30		,0	1,00	Keanzacion	examination
						-		K	CXAITIIIIACIOII
Leading t		1 -		wa.Borowiak-Pal a (Miroslawa.ElFr		-		ra Agnieszka	
Other tea	achers			manska@zut.edi					zut.edu.pl)
Prerequis	sites								
W-1	Knowledge of the	basic c	ourse in math	nematics, physics a	nd che	mistry a	t the elementary	/ level	
Module/c	ourse unit objectiv	es/							
C-1	The purpose of the	e cours	e is to enrich	e the students' kno	wledge	e in mair	n principle of ma	terials science an	nd engineering.
Course co	ontent divided into	vario	us forms of	instruction					Number of hours
T-W-1	Historical Perspec Materials, Modern			ce and Engineering	, Class	ification	of Materials, Ad	vanced	2
T-W-2	Atomic Structure			ding					2
T-W-3	The Structure of C	rystalli	ne Solids						2
T-W-4	Imperfections in S	olids							2
T-W-5	Diffusion in solids	cturo	o. Clasa nask	ed crystal structure	o. Dol	marnhic	em and alletrony	Dolvenystalling	2
T-W-6	materials; Anisotr		s: Close-pack	ed Crystal Structure	es; Poly	morphis	яті апо апостору	Polycrystalline	3
T-W-7	·			self-interstitials; D					2
T-W-8	microstructure in	isomorp nterme	phous alloys;	etallic material; Bin Development of mi or compounds; Eut	icrostr	ucture in	eutectic alloys;	Equilibrium	3
T-W-9	Properties and ap	plicatio	ns of metals		_	_			2
T-W-10		-		n, chemical structu	•	-			2
T-W-11	Structure-property polymer structure		nships in pol	ymeric materials: c	vervie	w of cha	iracterization me	etnods of	2
T-W-12	Introduction to po	lymer p	rocessing						2
T-W-13	·			nd nanocomposites					2
T-W-14	Selected example	s of cor	nmodity poly	mers, engineering	and hi	gh-pefor	mance		2
	workload - forms o		ity						Number of hours
A-W-1	participation in lectures 30								
A-W-2	self-study of literature 20								
A-W-3 A-W-4	Consultations preparation for ex	am							8
A-W-5	Final exam	aiii							1
M-1	lectures with pres	entatio	n						
1-1-1	lectures with hies	Circaciol	11						

Evaluation r	netho	ds (F -	progressive, P - final)								
S-1	Р	written	exam								
S-2	F	student	activity during lectures								
D	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	Course co	ntent	Teaching methods	Evaluation methods
Knowledge											
MSE_1A_C01a_\ knowledge maii		ples of m	aterials science and engineering.	MSE_1A_W03	P6S_WG P6S_WK	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	M-1	S-1 S-2
Skills											
	ite infor lear, 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-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	M-1	5-2
Social comp	etenc	es									
MSE_1A_C01a_k Is aware of the		f further s	study and systematic work.	MSE_1A_K02	P6S_KK	P6S_WK	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	M-1	S-1 S-2
Outcome	es	Grade		Е	valuation cr	iterion					
Knowledge											
MSE_1A_C01a_\	W01	2,0 3,0 3,5 4,0 4,5 5,0	positive grade of the final test (m	ore than 55% corr	ect answers)						
Skills		3,0									-
MSE_1A_C01a_U	U01	2,0 3,0 3,5 4,0 4,5 5,0	positive grade of the final test (m	ore than 55% corr	ect answers)						
Other social	com		es								
MSE_1A_C01a_k	-	2,0	positive grade of the final test (m	ore than 55% corr	ect answers)						
0495244462	Askela	nd, Prad	leep P. Fulay , Essentials of M							ISBN-1	3: 978-
2. William D.	Callist	er Jr., Ma	aterials Science and Engineer	ing: An Introduc	tion, Wiley, 19	999, ISBN-13:	9/8-04	/1320135	)		

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



Evaluation methods (F - progressive, P - final)

## Zachodniopomorski Uniwersytet Technologiczny w Szczecinie

			- <b>,</b>			- 9, -					
Field of st	udy	Mate	erials Scienc	e and Engineer	ing			]			
Mode of st	tudy	stat	ionary	Level		first o	cycle	VA/T:1/	\A/T;ICh		
Graduate'.	s qualification	inży	nier					WTil(	∟n		
Fields of s	cience	eng	ineering and	technology							
Disciplines	s of science	mat	erials engine	eering (100%)				1 I —			
Education	al profile	gen	eral academ	ic				1			
Module		1									
Course un	it										
Code		1 \	C								
Field of sp	ecialisation										
Administe	ring faculty	Dep	artment of M	laterials Techno	ology				_		
ECTS		2,0		ECTS (forms)		2,0					
Form of co	ourse credit	exa	mination	Language		english	1	1			
Electives		2		Elective group				1			
Form of in	struction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit		
lecture		W	2	30	2	,0	1,00	K	examination		
Leading te	eacher	Pasz	kiewicz San	dra (Sandra.Pas	szkiewic	7@zut.	edu.pl)				
Other tead		Garl (Ma	oiak Małgorz gdalena.Kwia	ata (Malgorzata	a.Garbia edu.pl),	k@zut. Mijows	edu.pl), Kwiatl ka Ewa (Ewa.B	kowska Magdale Borowiak-Palen@ Bagnieszka	ena 9zut.edu.pl),		
	The subject "Introd different types of m on the structure an urse unit objective of the subject aims in	nateri d pro es	als: metals, ce perties of diffe	eramics and polyr erent types of eng	mers. Th gineering	e subjec g materia	t will acquaint th	ne student with th	ne basic infomation		
C-1	vocabulary, themat			dent with the kir	owiedge	on engi			r background,		
Course co	ntent divided into								Number of hours		
T-W-1	Introduction: Histor Advanced Materials				ind Engli	neering,	Classification of	Materials,	2		
T-W-2	Atomic Structure a	nd Int	eratomic Bon	ding					2		
T-W-3	The Structure of Cr	_	ine Solids						2		
T-W-4	Imperfections in So	lids							2		
T-W-5 T-W-6	Diffusion in solids Properties and app	licatio	n of coromics						2		
T-W-7	Introduction to met				rties and	l annlica	ation of metals		3		
T-W-8	Structures of polym	ners -	classification,	chemical structu				engineering	5		
	materials (injection Introduction to com				osite tvi	nes of co	mnosite materia	als Role of			
T-W-9	matrix and reinforc	emer	nt in composite	es			•		2		
T-W-10	Types of bonding a strength	t the	interface - me	echanical, physica	al and ch	emical b	onding. Optimu	m interface bond	2		
T-W-11	Reinforcements - g carbide fibers.	lass f	ibers, carbon/	graphite fibers, a	ramid aı	nd other	organic fibers, b	oron, silicon	3		
T-W-12	Matrix materials - p	oolym	ers, metals, c	eramic					3		
Student w	orkload - forms of	activ	vity						Number of hours		
A-W-1	Participation in lect	ures.							30		
A-W-2	Getting acquainted	with	literature (ar	ticles, books, pate	ents)				20		
A-W-3	Consultations								8		
A-W-4	Final exam								2		
Teaching	methods / tools										
M-1	Informative lecture										

- progressive, P - final)								
g exam								
ons and Replies (discussion d	luring lectures)							
arning 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
f materials science and	MSE_1A_W03	P6S_WG P6S_WK	P6S_WG	C-1	T-W-2 T-W-3 T-W-4 T-W-5	T-W-7 T-W-8 T-W-9 T-W-10 T-W-11 T-W-12	M-1	S-1 S-2
from a number of sources and m; solve problems in situations of variables	MSE_1A_U10 MSE_1A_U11	P6S_UK P6S_UO P6S_UW		C-1	T-W-2 T-W-3 T-W-4 T-W-5	T-W-7 T-W-8 T-W-9 T-W-10 T-W-11 T-W-12	M-1	S-1 S-2
study and systematic work.	MSE_1A_K02	P6S_KK	P6S_WK	C-1	T-W-2 T-W-3 T-W-4 T-W-5	T-W-7 T-W-8 T-W-9 T-W-10 T-W-11 T-W-12	M-1	S-1 5-2
2	E	valuation cr	iterion					
positive grade of the final test (r	more than 55% corr	ect answers)						
positive grade of the final test (r	more than 55% corr	ect answers)						
ces								
positive grade of the final test (r	more than 55% corr	ect answers)						

- 1. William D. Callister, Fundamentals of materials science and engineering : SI version, John Wiley & Sons, Hoboken, NJ, USA, 2013
- 2. Traugott Fischer, Materials science for engineering students, Elsevier: Academic Press, Amsterdam, Netherlands, 2009
- 3. William D. Callister; David G. Rethwisch, Materials Science and Engineering, John Wiley & Sons, 2014

#### Supplementary reading

1. Gonzalez-Vinas Wenceslao, Introduction to Materials Science, Princeton University Press, USA, 2004



								]	
Field of st	study Materials Science and Engineering								
Mode of s	study	stat	ionary	Level		first o	cycle	VA/T:1/	C L
Graduate	's qualification	inży	nier					WTil(	υN
Fields of s	science	engi	ineering and	technology					
Discipline	s of science	mat	erials engine	ering (100%)				_	
Education	nal profile	gen	eral academ	ic					
Module									
Course ur	 nit	Stru	ucture of So	olids					
Code			1A S C02					\ <b>.</b>	Cil
Field of si	pecialisation								
	ering faculty	Den	artment of Ir	norganic and An	alvtical	Chemi	ietry		
ECTS	ing faculty	5,0	artificite of fi	ECTS (forms)		5,0	isti y		
		-	1:1-						
	ourse credit	cred	IITS	Language	'	english	]		
Electives				Elective group			1		
Form of in	nstruction	Cod	Semester	Hours	EC	ΓS	Weight	Realization	Credit
laborator	y course	L	3	45	4,	0	0,75	K	credits
lecture		W	3	15	1,	0	0,25	K	credits
Leading t	eacher	Tabe	ero Piotr (Pio	tr.Tabero@zut.e	du.pl)		1		
Other tea	chers	Piz I		teusz.Piz@zut.eo					pek@zut.edu.pl), pl), Tabero Piotr
Prerequis	ites								
W-1	Fundamentals of m	ather	natics, physic	and chemistry					
Module/co	ourse unit objective	es							
C-1	Consolidation of ba		ncepts conce	ning the structure	of solid	S.			
C-2	Familiarize student	s with	n methods of g	eneration and pro	perties	of X-ray	/S.		
C-3	Expanding knowled	_		•	_		•	•	• •
C-4	Teaching students literature.	how t	o use stuctura	ıl data gained fron	n diffrac	tion me	asurements, ava		
Course co	ontent divided into	vario	ous forms of	instruction					Number of hours
T-L-1	Identification of ch	emica	I compounds,	metals, alloys and	I their m	ixtures.	•		5
T-L-2	XRD quantitative p								5
T-L-3	Construction of pha		-						5
T-L-4	X-ray high-tempera of thermal expansi	ature i on. In	measurement: vestigations o	s. Determination o f polymorphic pha	it coeffic se trans	ıents of itions.	thermal expans	ion. Anisotropy	5
T-L-5	Structure solution f								5
T-L-6	Application of XRD	meth	od to verify H	ume-Rothery rule	and Veg	ard's la	w for solid solution	ons.	5
T-L-7	Indexation of powd Rentgenographic d			rns. Lattice param	eter de	ermina	tion. Measureme	nt of density.	5
T-L-8	Determination of g	rain s	ize, internal st	ress and lattice di	stortion	5.			5
T-L-9	Aplication of the SA	AXS m	ethod.						5
T-W-1	Basic definitions in	-							3
T-W-2	Crystal systems an International Table	s for (	Crystallograph	y.					3
T-W-3	Coordination polyhedra. Simple structures of elements and compounds: SC, BCC, FCC and HCP lattices.  Types of phase diagrams.								
1-00-3	Types of phase dia		5.				s: SC, BCC, FCC a		2
T-W-4	Types of phase dia  Defects in crystal s	tructu	s. ıre. Solid solut	ions.					2
	Types of phase dia Defects in crystal s Generation and pro	tructu perti	s. ure. Solid solut es of X-rays. Ir	ions. nteraction of X-ray	s with m	natter.	X-rays diffractior	on solids.	
T-W-4	Types of phase dia  Defects in crystal s	tructu pertie	s. ure. Solid solut es of X-rays. Ir on of size of cr	ions. nteraction of X-ray	s with m	natter.	X-rays diffractior	on solids.	2
T-W-4 T-W-5 T-W-6	Types of phase dia Defects in crystal s Generation and pro Bragg's Law. Inves	tructu pertie tigation amete	s. ure. Solid solut es of X-rays. Ir on of size of cr	ions. nteraction of X-ray	s with m	natter.	X-rays diffractior	on solids.	2 2
T-W-4 T-W-5 T-W-6	Types of phase dia Defects in crystal s Generation and pro Bragg's Law. Investof the unit cell para	tructu pertication igation amete	s.  ure. Solid solutes of X-rays. Iron of size of cress.  vity	ions. nteraction of X-ray	s with m	natter.	X-rays diffractior	on solids.	2 2 3



			Faculty of Chemi	cal Techn	ology an	d Engine	eerir	<u>ıg</u>			
Student wo	rkload	d - form	s of activity						Nur	nber o	f hours
A-L-3	Prepar	ing for la	aboratory exercises								20
A-L-4	Consul	tations									10
A-W-1	Partici	pation in	lectures								15
A-W-2	Consul	tations									2
A-W-3	Self-st	udy of th	e literature								12
A-W-4	Final w	ritten te	st								2
Teaching n	nethod	ls / tool:	s								
M-1			tures with multimedia instrun	nents, explanati	on						
M-2			puters and dedicated softwa	•							
Evaluation	metho	ods (F -	progressive, P - final)								
S-1	Р		ritten test.								
S-2	Р	written	reports								
	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	Evaluation methods
Knowledge	ı			1	'						
MSE_1A_C02_\ Student know knows measur	s funda	mental co nniques us	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					•			•		-	•
	le to sel nvestiga	te given p	priate diffraction measuring property of material and interpret	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	peten	ces									
MSE_1A_C02_l Student knows understands in personal comp	s safety mportan	ce 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	ı										
MSE_1A_C02_\		2,0									
			Student will be able to present be diffraction.	asic concepts of cr	ystallography ar	nd describe basi	c measu	ring me	thods ap	plying X-	ray
		3,5	diffaction.								
		4,0									
		4,5									
		5,0									
Skills											
MSE_1A_C02_	U01	2,0	Charles to Miller able to a cleat and	VDD			l			bta	•
			Student will be able to select app crystalline solid	proprate XKD mea	suring techniqu	e to solve simpl	ie proble	em cond	terning a	naiysis o	Т
		3,5									
		4,0									
		4,5 5,0									
Other socia	al com		<u> </u>								
MSE_1A_C02_I		2,0									
. 10=_=1			Student knows and understands	safety procedures	for x-ray equipn	nent					
		4,0				·	<u></u>				<u></u>
		4,5 5,0									

#### Required reading

1. C. Giacovazzo, H. Z. Monaco, D. Biterbo, F. Scordari, G. Gilli, G. Zanotti, M. Catti,, Fundamentals of Crystallography, IUCR, Oxford University Press, Oxford, 2000



#### 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,
- 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 st	udy	Mate	erials Scienc	e and Engineeri	ng					
Mode of s	tudy	stat	ionary	Level	fi	rst cycle	\ / <del></del>	C I		
Graduate'	s qualification	inży	nier	'	•		WTil(	Lh		
Fields of s	cience	engi	ineering and	technology				_		
Disciplines	s of science	mat	erials engine	ering (100%)						
Education	al profile	gen	eral academ	ic						
Module				†						
Course un	it	Intro to Materials Synthesis and Products Analysis								
Code		MSE	1A S C03			<del>-</del>	1 \	CIL		
Field of sp	ecialisation									
	ring faculty		_							
ECTS		7,0		ECTS (forms)	7,0					
Form of co	ourse credit	exai	mination	Language	enc	ılish	1			
Electives				Elective group			1			
Form of in	struction	Cod	Semester	Hours	ECTS	Weight	Realization	Credit		
lecturing of	course	Α	3	30	2,0	0,25	K	credits		
laboratory		L	3	30	3,0	0,50	K	credits		
lecture		W	3	30	2,0	0,25	K	examination		
Leading to	nachor			acek.Sosnicki@z		3,23		- CAGAMATA CATA		
Prerequisi W-1  Module/co		(Jace Ann orga	ek.Sosnicki@ a (Anna.Szad	ozut.edu.pl), Stru dy@zut.edu.pl),	uk Łukasz (	owski@zut.edu.pl) (Lukasz.Struk@zu ka Elwira (Elwira.V	t.edu.pl), Šzady	-Chełmieniecka		
C-1	The student knows	how	to carry out a	basic literature se	arch based	on databases and s	cientific literature			
C-2	their analysis and o	an pr	epare the rep	ort.		ompound/material a				
C-3	improvement of the			e of the knowledg	- acquired i	Within the Subject to	i developement d	r science and for		
Course co	ntent divided into							Number of hours		
T-A-1	Exercises in planning transformations with				ex organic r	nolecules through fu	ınctional group	15		
T-A-2	Exercises in determ				unds by IR,	NMR, MS methods.		15		
T-L-1	Regulations and sa	fety r	ules in the lab	oratory of organic	synthesis.			2		
T-L-2	(Sample preparatio	n, sel	ection of purif	ication method ar	nd measurer	MR) of organic com nent conditions, etc		5		
T-L-3	Building a carbon s Eg. Application of S properly selected n	onog	ashira reactio	n in the preparation	n of alkyne	. Purification of the poods (IR, MS, NMR).	product with a	18		
T-L-4		dete	rmination of C	C, N and S in orga	nic material	s, microwave miner	alization and	5		
T-W-1	Databases and scie					erial synthesis.		1		
T-W-2	Principles of planni	-	-		_			1		
T-W-3	Functional group transformations – an introduction to the synthesis of complex organic compounds an organic materials (e.g. based on coupling, condensation, addition, substitution and elimination reactions)							6		
T-W-4	The synthesis of fur compounds.	nctior	nalized arenes	, heteroarenes as	well as othe	er carbo- and hetero	cyclic	4		
T-W-5	The synthesis of fu	nctior	nalized monon	ners based on org	anometallic	chemistry.		3		
T-W-6	Isolation and separ		<u> </u>	· ·				2		
T-W-7					-	f organic compound		8		
T-W-8	I Analysis of the elen	nenta	u composition	of organic materia	ais (element	tal analyzore C N C	ICID and VDE			

					· · J, ·							
Student wo	orkload	d - forms	s of activity						Nur	nber of	f hours	
A-A-1	Particip	oation in	recitations							30		
A-A-2	Self-im	proveme	ent by solving additional prob	olems.							26	
A-A-3	Face to	face dis	scussion.								4	
A-L-1	Particip	oation in	the laboratory classes.								30	
A-L-2	Self-stu	udy of re	comended literature.								26	
A-L-3	Face to	face dis	scussion.								4	
A-L-4	Theore	neoretical preparation to the laboratory classes.										
A-L-5	Prepara	ation of v	written reports.								10	
A-W-1	Particip	oation 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 r	nethoa	ls / tools	 S						<u> </u>			
M-1	Lecture	e with dis	scussion.									
M-2	Classes	s with dis	scussion.									
M-3	Labora	tory exe	rcises.									
Evaluation	metho	ods (F -	progressive, P - final)									
S-1	F		ous assessment: laboratory i	reports and activ	ity.							
S-2	Р	Exam.										
S-3	Р	Final te	st.									
	Designed learning outcomes    Reference to the learning outcomes designed for the fields of study   Reference to Learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering engineering competences   Course Designeering							Cours	e content	Teaching methods	Evaluation methods	
Knowledge	<u>,</u>				ļ.	l		1				
simple organi	is basic k c compoi	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	P6S_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												
	able to p	e basis of	perform basic synthetic informations taken from re.	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		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 com	petend	ces								•	•	
MSE_1A_C03_ The student is life and science	aware c	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	
Outcom	nes	Grade		E	valuation cr	iterion						
Knowledge	·											
MSE_1A_C03_	W01	2,0 3,0 3,5 4,0 4,5 5,0	Positive grade of the final test ar	nd exam (more than	n 55% correct a	nswers)						
Skills		5,0										
MSE_1A_C03_	U01	2,0										
			Positive grade of the final test (m	nore than 55% corr	ect answers)							
		3,5			· ·							
		4,0										
		4,5										
		5,0										



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 con	npetenc	res
MSE_1A_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 readin	ng	
1 John McMurry	Organic (	Chamietry Production 2012 90

- 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



1								1						
Field of st	udy	Mate	erials Scienc	e and Engineeri	ng									
Mode of st	tudy	stati	onary	Level		first o	cycle	AA/TELA	~ I_					
Graduate'.	s qualification	inży	nier			'		WTil(	Jn					
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	nit		Cil											
Code		\ <b>.</b>												
Field of sp	MSE_1A_S_C04 specialisation													
	ring faculty	Depa	artment of P	olymer and Bior	nateria	als Scier	nce							
ECTS		6,0												
	ourse credit	cred	its	Language		english								
Electives				Elective group										
Form of in	struction	Cod	Semester	Hours	EC	ETS	Weight	Realization	Credit					
lecturing of		Α	3	15		,5	0,25	K	credits					
laboratory		L	3	15		,5	0,25	K	credits					
lecture	· <del>-</del>	W	3	30		,0	0,50	K	credits					
Leading te	aschor			a (Miroslawa.ElF					Creares					
Other tead	chers	(Woj	ciech.lgnacz ieszka.Koch	a (Miroslawa.EIF zak@zut.edu.pl) manska@zut.ed x (Jacek.Przepior	, Kochr lu.pl), I	nańska Kowalcz	Agnieszka yk Krzysztof (k	rzysztof.Kowal	czyk@zut.edu.pl),					
Prerequisi														
W-1	Basics of chemistry	and p	ohysics											
Module/co	ourse unit objective	es												
C-1	To gain the knowle	dge, s	kills and com	petences in the fie	eld of pi	rocessing	g of various engi	neering materials	;					
Course co.	ntent divided into	vario	us forms of	instruction					Number of hours					
T-A-1	Calculations of hea	t tran	sfer and rheol	ogical parameters	underl	ying the	processing of m	aterials	5					
T-A-2	Mesoporous silica r		als characteri	zation methods - j	ournal	club			5					
T-A-3	Exercises on castin								3					
T-A-4		-	of thormonlas	tic materials (extr			Exercises on welding							
T-L-1	Frinciples of proces	Principles of processing of thermoplastic materials (extrusion and thermoforming) (3h)												
	Injection moulding of polymeric materials (2h)  Electrospinning of polymer nanofibres								5					
T-L-2	Electrospinning of	oolym	ymeric mater er nanofibres	ials (2h)	usion a	nd therm	noforming) (3h)							
T-L-3	Electrospinning of particular Synthesis (fabrication)	oolym ion) of	ymeric mater er nanofibres MCM-41 mat	ials (2h)	usion a	nd therm	noforming) (3h)		5 5 5					
T-L-3 T-W-1	Electrospinning of p Synthesis (fabrication Principles of polym	oolym ion) of er me	ymeric mater er nanofibres MCM-41 mat It rheology	ials (2h) erial					5 5 5 3					
T-L-3 T-W-1 T-W-2	Electrospinning of p Synthesis (fabrication Principles of polym Introduction to polym	oolym ion) of er me /mer p	ymeric mater er nanofibres MCM-41 mat It rheology	ials (2h) erial				ng)	5 5 5 3 4					
T-L-3 T-W-1 T-W-2 T-W-3	Electrospinning of p Synthesis (fabrication Principles of polyman Introduction to polyman Processing of rubbe	oolym ion) of er me /mer p	ymeric mater er nanofibres MCM-41 mat It rheology processing (ex	ials (2h) erial				ng)	5 5 5 3 4 1					
T-L-3 T-W-1 T-W-2 T-W-3 T-W-4	Electrospinning of p Synthesis (fabrication Principles of polym Introduction to polym Processing of rubbe Fibres and non-wow	oolym ion) of er me /mer p ers /ens to	ymeric mater er nanofibres MCM-41 mat It rheology processing (ex	erial etrusion, injection				ng)	5 5 5 3 4 1 2					
T-L-3 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5	Electrospinning of p Synthesis (fabrication Principles of polym Introduction to polym Processing of rubbe Fibres and non-wow Ceramic materials	oolymion) of er me ymer pers	ymeric mater er nanofibres MCM-41 mat It rheology processing (ex	erial  strusion, injection  synthesis routes				ng)	5 5 5 3 4 1 2 3					
T-L-3 T-W-1 T-W-2 T-W-3 T-W-4	Electrospinning of payments of polyments of	coolymicon) of er me ymer pers yens to appl	ymeric mater er nanofibres MCM-41 mat It rheology processing (ex echnologies ications and s ications and s	erial  Atrusion, injection  Synthesis routes Synthesis routes				ng)	5 5 5 3 4 1 2					
T-L-3 T-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6	Electrospinning of p Synthesis (fabrication Principles of polym Introduction to polym Processing of rubbe Fibres and non-wow Ceramic materials	oolym ion) of er me ymer p ers yens te appl apporou	ymeric mater er nanofibres if MCM-41 mater theology processing (exechnologies ications and sications are sications and sications are sications and sications and sications and sications and sications and sications are sications and sications and sications and sications and sications are sications and sications and sications and sications are sications and sications and sications and sications are sications and sications and sications and sications and sications and sications and sications are sications	erial  Atrusion, injection  Synthesis routes Synthesis routes Synthesis routes Synthesis routes	mouldii	ng, thern	noforming, castii		5 5 5 3 4 1 2 3 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	Electrospinning of p Synthesis (fabrication of polyments) introduction to polyments of polyments	poolym ion) of er me ymer p ers yens to appl appl porou s of me	ymeric mater er nanofibres f MCM-41 mat It rheology processing (executions and sications and sications and sications and secutions are secutions.	erial  Atrusion, injection  Synthesis routes Synthesis routes ials als (hot working, c	mouldii	ng, thern	noforming, casting	rusion, drawing)	5 5 5 3 4 1 2 3 2 5					
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	Electrospinning of p Synthesis (fabrication Principles of polyman Introduction to polyman Processing of rubbe Fibres and non-wow Ceramic materials Ceramic materials Production of meson	poolym ion) of er me ymer p ers yens to appl appl porou s of me	ymeric mater er nanofibres f MCM-41 mat It rheology processing (executions and sications and sications and sications and secutions are secutions.	erial  Atrusion, injection  Synthesis routes Synthesis routes ials als (hot working, c	mouldii	ng, thern	noforming, casting	rusion, drawing)	5 5 5 3 4 1 2 3 2 5 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	Electrospinning of participation of participation of polyments of poly	oolym ion) of er me ymer p ers yens tr - appl - appl pporou s of me ng, di	ymeric mater er nanofibres f MCM-41 mat It rheology processing (exechnologies ications and sications and sications and second second for the	erial  ctrusion, injection  synthesis routes synthesis routes ials als (hot working, c	mouldii	ng, thern	noforming, casting	rusion, drawing)	5 5 5 3 4 1 2 3 2 5 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	Electrospinning of p Synthesis (fabrication of polyments) of polyments	oolym ion) of er me ymer p ers yens tr - appl - appl pporou s of me ng, di	ymeric mater er nanofibres f MCM-41 mat It rheology processing (exechnologies ications and sications and sications and second second for the	erial  ctrusion, injection  synthesis routes synthesis routes ials als (hot working, c	mouldii	ng, thern	noforming, casting	rusion, drawing)	5 5 5 3 4 1 2 3 2 5 2 2 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	Electrospinning of participation of participation of polyments of poly	oolym ion) of er me ymer p ers yens to appl approu of of me ng, di d there	ymeric mater er nanofibres f MCM-41 mater theology processing (exechnologies ications and sications and sications and second filliant material exasting, investing, investing mo-chemical from the second filliant	erial  ctrusion, injection  synthesis routes synthesis routes ials als (hot working, c	mouldii	ng, thern	noforming, casting	rusion, drawing)	5 5 5 3 4 1 2 3 2 5 2 2 2 2					



			raculty of Chemi	cai reciiii	ology all	u Engine	eerin	19				
Student wo	orkload	d - forms	of activity						Nun	nber o	f hours	
A-A-2	self-stu	udy of the	literature							20		
A-A-3	prepar	ation of re	eports								10	
A-L-1	partici	pation in I	aboratory exercises							15		
A-L-2	self-stu	udy of lite	rature							20		
A-L-3	prepar	ation of w	ritten reports				10					
A-W-1	partici	pation in l	ectures						30			
A-W-2	self-stu	udy of lite	rature							30		
A-W-3	consul	tations									10	
A-W-4	prepar	ing for the	e exam								20	
Teaching n	nethod	ls / tools										
M-1	Lecture	e										
M-2	Labora	tory exer	cises									
M-3	Classe	s with disc	cussion									
Fvaluation	metho	nds (F - p	rogressive, P - final)									
S-1	F		us assessment: laboratory r	eports and activ	ritv							
<b>5-2</b>	Р	Final 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							Cours	se content	Teaching methods	Evaluation methods	
Knowledge	<u>.</u>						1	•				
MSE_1A_C04_ The student h methods of er	as the k		f common aspect of processing s	MSE_1A_W02 MSE_1A_W07	P6S_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-10 T-W-11 T-W-12	M-1 M-2 M-3	S-1 S-2	
Skills												
MSE_1A_C04_ The student h target engined	as skills		n of appropriate methods for cessing	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-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					•	•				
MSE_1A_C04_ The student u engineering m	nderstar	nds the imp for practica	ortance of processing of al applications	MSE_1A_K02	P6S_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-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	
Outcom	nes	Grade		E	valuation cr	iterion	•	•		•	•	
Knowledge		<u> </u>		<u> </u>								
MSE_1A_C04_		2,0 3,0 T 3,5 4,0 4,5 5,0	he student knows the fundamer	ntals aspects of pro	ocessing of engi	neering materia	ıls					



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 Han	, 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, Steels: Processing, Structure, and Performance, ASM International, Materials Park, 2005
- 4. M. Ashby, K. Johnson, Materials 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



Field of stu	dy	Mate	erials Scienc	e and Engineeri	ng				
Mode of stu	ıdy	stati	onary	Level		first o	cycle	\	C I
Graduate's	qualification	inżyı	nier			•		WTil	un
Fields of sc	ience	engi	neering and	technology					_
Disciplines	of science	mate	erials engine	ering (100%)				I _	
Educationa	l profile	gene	eral academ	ic					
Module									
Course unit	t	Surf	ace Scienc	e and Interfac	ial Ph	enome	na		Cil
Code		MSE	1A S C05					\ <b>.</b>	
Field of spe	ecialisation								
Administer		Depa Envi	artment of Ir	norganic Chemic	al Tec	hnology	and and		
ECTS		5,0		ECTS (forms)		5,0			
Form of cou	urse credit	cred	its	Language		english	 		
Electives				Elective group					
Form of ins	truction	Cod	Semester	Hours	FC	 CTS	Weight	Realization	Credit
lecturing co		A	3	15		,0	0,25	Keanzacion	credits
						-	-		credits
laboratory	Course	L	3	30		,0	0,50	K	
lecture		W	3	15		,0	0,25	K	credits
Leading tea	acher		-	sz (Dariusz.Mos			•		
Other teach	hers	Koch	ımańska Agı	(Xuecheng.Chei nieszka (Agniesz ski@zut.edu.pl)	zka.Ko	chmans	ka@zut.edu.pl)	, Moszyński Da	
Prerequisit	es	•							
W-1	none								
Module/cou	ırse unit objective	es							
C-1	Student knows the	struct	ure of surface	es and interfaces.					
C-2	Student knows fund	damer	ntal laws appl	icable to the proce	esses p	erformed	l on interfaces		
	Student knows the respective experim		experimental	methods applied	to eval	uate the	properties of int	erfaces and is ab	le to perform
Course con	tent divided into	vario	us forms of	instruction					Number of hours
T-A-1	Physics of Surfaces	- calc	ulations						2
T-A-2	Adsorption at Interf	faces -	- calculations						3
	Calculations using t			<u> </u>					2
	Predicting the prod								3
	Simulation of React								5
	Monolayers observe								3
	Adsorption/desorpt								4
	Determination of so		_				_		3
	measurements by t				race an	a miceria	ciai (iiqaia/iiqaia	, tension	4
	Measurements of e				e force	n galvan	ic and concentra	ition cells.	3
	The phenomenon o	f pola	rization in Da	niella's cell.					3
	Passivity of metals			-£				the end of the	4
	Determination of su electron microscop		morphology	oi metais, metailio	and Ce	eramic ai	lloys and compos	sites with	3
T-L-9	Elemental contrast	and e	nergy dispers	sive spectroscopy	as a to	ols for ele	emental mapping	9	3
T-W-1	The Physics of Surf	aces							2
	Structure, surface r		ology of meta	als, metallic and c	eramic	alloys an	d composites		1
	Adsorption at Interf								2
	Properties of Monol								1
T-W-5	Electrostatic Pheno	mena							2

			to various forms of instru	ıction					Nu	mber o	f hours		
T-W-6			nd laws of electrochemistry						1				
T-W-7			otential. galvanic (contact) c								1		
T-W-8			n of polarization. The pheno								1		
T-W-9			n resistance of metallic and	ceramic materia	als						1		
T-W-10			heir effect on the interfaces								3		
Student w									Nu	mber o			
A-A-1			ecitations							15			
A-A-2	self-stu										15		
A-L-1			aboratory exercises								30		
A-L-2	_	is of data									30		
A-W-1		pation in I									15		
A-W-2			literature								30		
A-W-3	1	ing for tes	sts ———————————————————————————————————								15		
Teaching r													
M-1		ative lect											
M-2		d of cases											
M-3		tory exer	cises										
M-4	case st	tudies											
Evaluation	metho	ods (F - p	rogressive, P - final)										
S-1	F	laborato	ry reports										
S-2	F	Passing											
	Desigr	ned learr	ing 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	е												
MSE_1A_C05_ knows issues their structure	concerni		ace and interphase phnomena, perties	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	T-W-6 T-W-7 T-W-8 T-W-9 T-W-1(	M-1	5-2		
Skills													
MSE_1A_C05_ is able to use science and in	knowled		problems conserning surface ena	MSE_1A_U01	P6S_UW	P6S_UW	C-3	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 T-L-7 T-L-8 T-L-9	M-2 M-3 M-4	S-1 S-2		
Social com	npeten	ces											
MSE_1A_C05_ is able to criti literature		ess the kno	owledge and content 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		•			•		
Knowledge	 e												
MSE_1A_C05_	_W01	2,0 3,0 k 3,5 4,0 4,5 5,0	inows a basic informations about	t surface science a	nd interfacial pl	nenomena							



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 com	petenc	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 reading	9	
1. G.A. Somorjai, Ir	ntroducti	on to surface chemistry and catalysis, Wiley, 1994
Supplementary r	eading	
1. Luigi Pasqua, Up	date on	Silica-based Mesoporous Materials for Biomedical Applications, smithersrapra.com, 2011



Field of st	tudy								
Mode of s	tudy	stati	onary	Level		first c	ycle	VA/T:1/	~ I_
Graduate'	's qualification	inży	nier	•		,		WTil(	_n
Fields of s	science	engi	neering and	technology					_
Discipline	s of science	mate	erials engine	ering (100%)					
Education	nal profile	gene	eral academ	ic					
Module									
Course un	nit	The	rmodvnam	ic of Materials					
Code	· ·		1A S C06					\ <b>E</b>	
	pecialisation								
Administe	ering faculty		artment of C erials	rganic Chemica	l Tech	nology a	and Polymer		_
ECTS		5,0		ECTS (forms)		5,0			
Form of co	ourse credit	cred	its	Language		english			
Electives				Elective group					
Form of in	nstruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
lecturing		Α	3	15		,0	0,25	K	credits
laboratory		L	3	30		,0	0,50	K	credits
lecture	y course	W	3	15		,0	0,25	K	credits
							<u> </u>	IX.	Credits
Other tea		Kow Pieg	alczyk Krzys at Agnieszka	ztof (Krzysztof.k ztof (Krzysztof.k a (Agnieszka.Pie icz@zut.edu.pl)	Cowalc	zyk@zut	t.edu.pl), Pelka		lka@zut.edu.pl),
Prerequisi	ites								
W-1	Fundamentals of m	athen	natics and phy	ysics.					
Module/co	ourse unit objective	es							
C-1	To gain the knowle type materials	dge, s	kills and com	petences in the fie	eld of fu	ndament	tal laws and relat	ions for gaseous	, liquid and solid-
Course co	ntent divided into	vario	us forms of	instruction					Number of hours
T-A-1	Conversions of the	rmody	namic SI unit	S.					2
T-A-2	Thermodynamic ca				state-t	ype mate	erials. Thermody	namic	8
T-A-3	calculations in related Thermodynamics o		-						1
T-A-4	Electrochemical eq								2
T-A-5	Thermodynamic ca								2
T-L-1	Measurement of sp	ecific	heat capacity	by the DSC meth	od.				5
T-L-2	Study of nanocrysta	alline	metals by che	emical potential pr	ogramı	ned reac	tion method.		5
T-L-3	Measurement of th	e Curi	e temperatur	e.					5
T-L-4	Measurement of en	thalp	y of selected (	chemical reactions	by the	DSC me	thod.		5
T-L-5	Measurement of co	mbus	tion heat of s	olids.					5
T-L-6	Determination of co	rvetall	ization phace	411-4-4-4					
T 1/1 1									5
T-W-1	Fundamental defini	itions	of thermodyn	amics and physica					2
T-W-2	Fundamental defini The zeroth, the firs	itions t, the	of thermodyn second and th	amics and physica	rmodyr	amics. D	efinitions and te	•	
T-W-2 T-W-3	Fundamental defini The zeroth, the firs The perfect, semi-properties of fluids.	itions t, the erfect	of thermodyn second and the t and real gas and heat. He	amics and physica ne third law of the es. Laws for gases eat capacity	rmodyr s. Equat	amics. D	efinitions and te	dynamic	2 5 2
T-W-2 T-W-3 T-W-4	Fundamental defini The zeroth, the firs The perfect, semi-properties of fluids. Phase equilibria (va Thermodynamics o	t, the perfect Work apor-li f mixt	of thermodyn second and the t and real gase and heat. He quid equilibria cures. Chemica	amics and physica ne third law of the es. Laws for gases eat capacity a, liquid-liquid equ al reactions. Electi	rmodyr s. Equat ilibria, s rochem	amics. Dions of solid-liquical equil	pefinitions and te tate and thermod id and solid-solid ibria.	dynamic equilibria).	2 5 2 3
T-W-2 T-W-3 T-W-4 T-W-5	Fundamental defini The zeroth, the firs The perfect, semi-properties of fluids. Phase equilibria (validation of fuel in thermodynamic cycle)	itions t, the perfect Work apor-li f mixt mater cles (C	of thermodyn second and the tand real gas and heat. He quid equilibria tures. Chemica ials to mecha Carnot,Otto, D	amics and physica ne third law of the es. Laws for gases eat capacity a, liquid-liquid equ al reactions. Electi nical energy, heat	rmodyr s. Equat ilibria, s rochem	amics. Dions of solid-liquical equil	pefinitions and te tate and thermod id and solid-solid ibria.	dynamic equilibria).	2 5 2 3 3
T-W-2 T-W-3 T-W-4 T-W-5 Student w	Fundamental definition The zeroth, the first The perfect, semi-properties of fluids. Phase equilibria (variety Thermodynamics of Conversion of fuel of thermodynamic cyclorkload - forms of the product of the conversion of the cyclorkload - forms of the cyclorkload	t, the perfect. Work apor-lif mixt mater cles (C	of thermodyn second and the t and real gase and heat. He quid equilibria cures. Chemica ials to mecha Carnot,Otto, D	amics and physica ne third law of the es. Laws for gases eat capacity a, liquid-liquid equ al reactions. Electi nical energy, heat	rmodyr s. Equat ilibria, s rochem	amics. Dions of solid-liquical equil	pefinitions and te tate and thermod id and solid-solid ibria.	dynamic equilibria).	2 5 2 3
T-W-2 T-W-3 T-W-4 T-W-5 Student w A-A-1	Fundamental definition The zeroth, the first The perfect, semi-properties of fluids. Phase equilibria (var Thermodynamics of Conversion of fuel of thermodynamic cyclorkload - forms of Participation in recipies.	t, the perfect. Work apor-lif mixt mater cles (Contraction)	of thermodyn second and the t and real gase and heat. He quid equilibria cures. Chemica ials to mecha Carnot,Otto, D	amics and physica ne third law of the es. Laws for gases eat capacity a, liquid-liquid equ al reactions. Electi nical energy, heat	rmodyr s. Equat ilibria, s rochem	amics. Dions of solid-liquical equil	pefinitions and te tate and thermod id and solid-solid ibria.	dynamic equilibria).	2 5 2 3 3 Number of hours 15
T-W-2 T-W-3 T-W-4 T-W-5 Student w	Fundamental definition The zeroth, the first The perfect, semi-properties of fluids. Phase equilibria (variety Thermodynamics of Conversion of fuel of thermodynamic cyclorkload - forms of the product of the conversion of the cyclorkload - forms of the cyclorkload	t, the perfect. Work apor-lif mixt mater cles (Cactivitation work	of thermodyn second and the t and real gas and heat. He quid equilibria ures. Chemica ials to mecha Carnot,Otto, D	amics and physica ne third law of the es. Laws for gases eat capacity a, liquid-liquid equ al reactions. Electr nical energy, heat iesel, Sabathe)	rmodyr s. Equat ilibria, s rochem	amics. Dions of solid-liquical equil	pefinitions and te tate and thermod id and solid-solid ibria.	dynamic equilibria).	2 5 2 3 3 Number of hours



					· · · · · · · · · · · · · · · · · · ·	·		<del></del>				
Student wor	rkload	- form	s of activity						Nur	nber o	f hours	
A-L-2	nstructi	ions rea	ading, literature review							20		
A-L-3 F	Preparir	ng lab r	eports								10	
<i>A-W-1</i> F	Participa	ation in	lectures							15		
A-W-2	Addition	al stud	lent work. Literature review.								45	
Teaching m	ethods	/ tool	'S									
	ecture											
M-2	Auditori	um exe	ercises									
M-3 L	_aborate	ory exe	ercises									
Evaluation i	method	ds (F -	progressive, P - final)									
<i>S-1</i>		Reports										
5-2		Exam	-									
2	Designe	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	Cours	e content	Teaching methods	Evaluation methods	
Knowledge												
	s the kno		of common thermodynamic laws	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	S-2	
Skills												
	s skills o		ation 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	etence	es										
	derstand		nportance of known gaseous, liquid and solid state	MSE_1A_K01 MSE_1A_K02	P6S_KK	P6S_WK	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 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	The student knows the fundamen	itals laws for gased	ous, liquid and s	solid state mater	rials					
		3,5										
		4,0										
		<i>4,5 5,0</i>										
Skills		3,0										
MSE_1A_C06_U	01	2.0	I									
M3L_1A_C00_0	<sup>01</sup>	2,0 3,0	The student can calculate the fun	damentals therms	dynamic naram	notors for gason	us liquid	l and co	lid state i	matorials		
		3,5	The student can calculate the full	idamentais thermo	dynamic param	leters for gaseo	us, iiquic	and so	iiu state i	nateriais		
	-	4,0										
		4,5										
	F	5,0										
Other social	l comp		es									
MSE_1A_C06_K		2,0						-				
	-		Students knows the fundamental	s importance of the	ermodvnamic la	aws						
	+	3,5		p :	,	-						
	+	4,0										
		4,5										
	ļ	5,0										
Required re	ading											

1. John Rankin, Themical thermodynamics: theory and applications,, RC Press/Taylor & Francis, Boca Raton, 2020



#### Required reading

- 2. G.Price, Thermodynamics of chemical processes,, Oxford University Press, Oxford, 2019
- 3. T. Matsushita, K. Mukai,, Chemical thermodynamics in materials science: from basic to practical applications,, Springer, Singapore, 2018
- 4. 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	study	Mate	erials Scienc	e and Engineeri	ng			
Mode of	study	stat	ionary	cycle				
Graduat	te's qualification	inży	nier	L	<u> </u>		WTil	.h
	f science	ļ -		l technology				
	nes of science	<b>├</b>		eering (100%)				_
		-						
	onal profile	gen	eral academ	IIC				
Module					- 10 - 1 - 0 - 1 -	<u> </u>		
Course (	unit		nputationa Ilysis	l Methods in M	atSci: Data	Science and		
Code		MSE	_1A_S_C08a	1				
Field of	specialisation							<del>-</del>
	tering faculty	1 -	artment of (	Chemical and Pro		ering		
ECTS		5,0		ECTS (forms)	5,0			
Form of	course credit	cred	lits	Language	englisl	h		
Elective.	S	3		Elective group				
Form of	instruction	Cod	Semester	Hours	ECTS	Weight	Realization	Credit
laborato	ory course	L	4	45	3,0	0,50	К	credits
lecture		W	4	30	2,0	0,50	К	credits
Leadina	teacher	Rak	oczv Rafał (I	 Rafal.Rakoczy@z	ut.edu.pl)			ı
Other te		Kiełl	basa Karolin	a (Karolina.Kielb	asa@zut.edu	.pl), Rakoczy Ra	afał (Rafal.Rakoc	zy@zut.edu.pl),
Drorogu	initan	VVIO	bei Katar (K	afal.Wrobel@zut	.eau.pi)			
Prerequi W-1	No prerequisites							
	course unit objectiv							
C-1	Gaining knowledge		<u> </u>				and analytical too	ols
C-2	Student is able to u	ıse so	oftware to cha	racterize data taki	ng into accoun	t e. g. statistics		
Course o	content divided into	vario	ous forms of	instruction				Number of hours
T-L-1	A discovery oriente	ed ana	alysis of scien	tific datasets - 1st	part			5
T-L-2	A discovery oriente	ed ana	alysis of scien	tific datasets - 2nd	part			5
T-L-3	Exploring data tech		-					5
T-L-4	Python environmer	nt for	modelling – e	xercises				5
T-L-5	Modelling of ideal of	gases	based on kine	etic gas theory				10
T-L-6	Application of Stati	stica i	in technical ca	alculation				10
T-L-7	Application of Matle	ab in t	technical calc	ulation				5
T-W-1	Fundamental of dig			nd analysis				5
T-W-2	Data processing ar							5
T-W-3	Python programmi			= ' '				5
T-W-4	Modelling phenome			etic gas theory				5
T-W-5	Statistical analysis							5
T-W-6	Design of experime	ents (I	DOE)					5
Student	workload - forms of	activ	vity				1	Number of hours
A-L-1	Attendind classes				·			45
A-L-2	Individual consulta	tions						6
A-L-3	Preparing for tests							9
A-L-4	self-study of literat	ure						30
A-W-1	Attending classes							30
A-W-2	Individual consulta	tions						6
A-W-3	Preparing for tests							24
Teachin	g methods / tools							

Teaching m	nethod	ds / tool	S								
M-1	Lectur	e									
M-2	Labora	itory									
Evaluation i	metho	ods (F -	progressive, P - final)								
S-1	Р	passing	· •								
S-2	F		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	Cours	e content	Teaching methods	Evaluatio methods
Knowledge						,					
MSE 1A C08a	ciples c	of 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. st	to use	software	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 comp	peten	ces									
MSE_1A_C08a_ Student is able	_K01 e to disc	uss progr	ramming problem in the team.	MSE_1A_K02	P6S_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
Outcome	es	Grade		E	valuation cr	iterion		•			•
Knowledge											
MSE_1A_C08a_	_W01	2,0 3,0 3,5 4,0 4,5 5,0	Student describes selected issues	s at a basic level (	score => 50%)						
Skills											
MSE_1A_C08a_	U01	2,0 3,0 3,5 4,0 4,5 5,0	Student solves selected issues a	t a basic level(scor	re => 50%)						
Other social	l com		es								
MSE_1A_C08a_		2,0	Student solves selected issues a	t a basic level(scor	re => 50%)						
Required re	eading		<u>I</u>								
			gramming: An Introduction to	Computer Scien	nce. 2002						
Supplement			and Al Diale - Literate At	dalik Deskie C	العادية من العاد	Camanustas A	- 1004				
I. A.M. Starfi	ieia, K.	A. Smith	, and A.L. Bleloch, How to Mo	aei it: Problem S	olving for the	Computer Ag	е, 1994				



Field of s	tudy	Mate	erials Scienc	e and Engineerii	ng				
Mode of s	study	stationary Level first cycle						C.I.	
Graduate	e's qualification	inżyi	nier					WTil	Ch
Fields of		+ -		technology					
Discipline	es of science	mate	erials engine	eering (100%)					
Education	nal profile	gene	eral academ	ic					
Module	,								
Course u	nit	Com	putationa	Methods in M	atSci:	Simula	ation and		
	THE		leling					\	C
Code		MSE.	_1A_S_C08b	1					
	pecialisation								
	ering faculty		artment of C	Catalytic and Sor			Engineering		
ECTS		5,0		ECTS (forms)		5,0			
Form of c	course credit	cred	its	Language		english			
Electives		3		Elective group					
Form of i	nstruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
laborator	y course	L	4	45	3,	0	0,50	K	credits
lecture		W	4	30	2,	0	0,50	K	credits
Leading t	teacher	Wról	bel Rafał (Ra	afal.Wrobel@zut	.edu.pl)				•
Other tea	achers	Kiełk	asa Karolin	a (Karolina.Kielb	asa@zı	ıt.edu.p	ol), Rakoczy Ra	ıfał (Rafal.Rakı	oczy@zut.edu.pl),
Dua na avvia	-14	IOIVV	bei Kalaf (Ka	afal.Wrobel@zut	.eau.pi)				
Prerequis W-1	No prerequisites								
Module/c C-1	ourse unit objectiv		a accumption	as of Langmuir is a	thorm				
C-1 C-2	Student is able to Student is able to					n			
C-3	Student is able to						omena		
Course co	ontent divided into								Number of hours
T-L-1	Application of Mat								10
T-L-2	Application of Stat								5
T-L-3	Python environme	nt for r	nodelling - ex	xercises					5
T-L-4	Modelling of gas a	dsorpti	on on solids						5
T-L-5	Modelling of gas s	olid rea	action						5
T-L-6	When is modeling		•	•					5
T-L-7	When is modeling			-					5
T-L-8	Computer-aided d								5
T-W-1 T-W-2	Applications using Various methods,					smoothi	ing		5
T-W-3	Statistical analysis			on complex equa	ation				5
T-W-4	Design of experim								5
T-W-5	Modelling of gas a								5
T-W-6	Modelling of gas se								5
Student v	11 1 6	f activ	ity						Number of hours
	Norkioad - forms o		II V						1.14
A-L-1	workload - forms of Participation in lab								45
A-L-1 A-L-2		orator	y exercises						45 40
	Participation in lab	orator	y exercises						_
A-L-2	Participation in lab	orator	y exercises						40
A-L-2 A-L-3	Participation in lab Solving programm Consultations	orator	y exercises						40 5
A-L-2 A-L-3 A-W-1	Participation in lab Solving programm Consultations participation in lec	orator	y exercises						40 5 30

Teaching m	ethod	ls / too	ls											
M-1 L	Lectur	e												
M-2 L	Labora	itory												
Evaluation r	meth	nds (F -	progressive, P - final)											
S-1	P	Zalicze	<u> </u>											
5-2	F.		aktywności											
J-2	'	Oceria	aktywności	T	T		<u> </u>	T						
С	Desigr	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	Evaluation methods				
Knowledge														
MSE_1A_C08b_\ Student knows	W01 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	W02		ps in gas-solid reaction	MSE_1A_W01	P6S_WG P6S_WK	P6S_WG	C-2		M-1	S-1				
Skills				1	_	l		4						
MSE_1A_C08b_0 Student is able gas adsorption	to mod	del in pyt ne surfac	hon programming language the e of solids	MSE_1A_U02	P6S_UW		C-3	T-L-3 T-L-4	M-2	S-1				
Social comp				1				-						
MSE 1A C08b I	K01		ramming problem in the team.	MSE_1A_K03	P6S_KO	P6S_WK	C-3	T-L-3 T-L-4	M-2	S-2				
Outcome		Grade		E	valuation cr	iterion		1. 2 .						
Knowledge														
MSE_1A_C08b_v	W01	2,0												
		3,0	Student is able to describe assu	mptions of Langmu	r isotherm									
		3,5												
		4,0												
		4,5												
MSE_1A_C08b_V	W02	5,0 2,0												
MSL_IA_COOD_	**02	3,0												
		3,5	Stadent describes selected issue	at a basic level(c	zam score -	30,0,								
		4,0												
		4,5												
		5,0												
Skills		•	•											
MSE_1A_C08b_U	U01	2,0												
	•	3,0	Student is able to write a progra	m in Python langua	ge modelling ac	Isorption pheno	menon							
		3,5	. 3	, ,	<u> </u>									
		4,0												
		4,5												
		5,0												
Other social	l com	petenc	es											
MSE_1A_C08b_l		2,0												
	•	3,0	Student is able to explain the pr	ogramming solution	n to the other m	embers of the g	roup							
		3,5	F. S. P.											
		4,0												
		4,5												
		5,0												
Required re	adina		•											
-			ogramming: An Introduction t	n Computer Scien	nce 2002									
1. JOHN 191. ZE	с, г у		January, An incroduction t	o compater sciel	100, 2002									



Field of st								
	tudy	Mate	erials Scienc	e and Engineeri	ng			
Mode of s	study	stati	onary	Level	first	cycle		0.1
Graduate	's qualification	inży	nier	I			WTil(	Ch
Fields of s	<u> </u>			l technology				
	es of science	-		eering (100%)				_
Education			eral academ				-   -	
	iai prome	gene	erar academ	IC .			-	
Module		Intr	o to Evnori	mental Metho	dei Nanomai	torials	- 1	
Course ur	nit		o to Experi phasis	illental Metho	us. Nanoma	Leriais		C
Code		MSE	_1A_S_C09a	1				
Field of sp	pecialisation							
Administe	ering faculty	Dep	artment of N	lanomaterials P	hysicochemist	ry		
ECTS		4,0		ECTS (forms)	4,0			
Form of c	ourse credit	cred	its	Language	english	า		
Electives		4		Elective group				
Form of ir	nstruction	Cod	Semester	Hours	ECTS	Weight	Realization	Credit
laboratory	y course	L	4	45	3,0	0,50	К	credits
lecture		W	4	15	1,0	0,50	K	credits
Leading to	eacher	Mijo	wska Ewa (E	wa.Borowiak-Pa	len@zut.edu.	pl)		
Other tea		Paw	eł (Pawel.Ko	ny@zut.edu.pl), ochmanski@zut.o a (Agnieszka.Pie	edu.pl), Mijow:	ska Ewa (Ewa.I		u.pl), Kochmański @zut.edu.pl),
Prerequisi W-1	Knowledge of the b	acic c	aurea in math	nomatics physics	and chamistry	at the elementar	v lovol	
			ourse in mau	lematics, physics	and Chemistry a	at the elementar	y level	
	ourse unit objective							
C-1	The purpose of the	COISE		ha ctudonto! know	dadaaand ckilla	in avnarimental	nanamatarials in	cluding the main
	groups of enginerin	ig ma	is to enrich t terials	he students' know	rledgeand skills	in experimental	nanomaterials in	cluding the main
Course co	groups of enginerin		terials		rledgeand skills	in experimental	nanomaterials inc	Number of hours
Course co T-L-1	10 .	vario	terials us forms of	instruction		· 	nanomaterials ind	-
	ontent divided into	<i>vario</i> nt nar	terials ous forms of nofillers on rh	instruction eological propertion	es of monomer (	dispersions.		Number of hours
T-L-1	ontent divided into	variont nar	terials ous forms of nofillers on rho nanocompos	instruction eological propertion ites (tensile prope	es of monomer o	dispersions.		Number of hours
T-L-1 T-L-2	Influence of different Mechanical propert	variont naries of ies of	terials  fus forms of  nofillers on rho  nanocompos  nanocompos	instruction eological propertion ites (tensile prope ites (bending and	es of monomer or rties as a functi compression te	dispersions. ion of temperatu sts).		Number of hours 5
T-L-1 T-L-2 T-L-3 T-L-4 T-L-5	Influence of differer Mechanical propert Mechanical propert	variont nare ies of ies of nance	terials  The second sec	instruction eological propertic ites (tensile prope ites (bending and presence of three	es of monomer or rties as a functi compression te	dispersions. ion of temperatu sts).		Number of hours 5 5 5
T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6	Influence of differer Mechanical propert Mechanical propert Synthesis of carbon Purification process Microscopic observa	variont naries of ies of nances of otation	terials  fus forms of nofillers on the nanocompose or tubes in the obtained carbo of purified ca	instruction eological propertie ites (tensile prope ites (bending and presence of three on material rbon nanotubes. E	es of monomer orties as a functi compression te different metall	dispersions. ion of temperatu sts). lic catalysts	re).	Number of hours  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 different Mechanical propert Synthesis of carbon Purification process Microscopic observation	varion nt nar ies of ies of nanc ies of okation ies te	terials  fus forms of nofillers on rhe nanocompos nanocompos otubes in the otained carbo of purified ca sting of nano	instruction eological propertie ites (tensile prope ites (bending and presence of three on material rbon nanotubes. E	es of monomer or rties as a functi compression te different metall Elemental analys	dispersions. ion of temperatu sts). lic catalysts sis of the sample	re).	Number of hours
T-L-1 T-L-2 T-L-3 T-L-4 T-L-5 T-L-6 T-L-7 T-W-1	Influence of different Mechanical propert Synthesis of carbon Purification process Microscopic observations Mechanical propert Nanocarbons: Grap	varion name of the second of t	terials  aus forms of nofillers on rhe nanocompos nanocompos otubes in the otained carbo of purified ca sting of nano fullerenes, ca	instruction eological propertie ites (tensile prope ites (bending and presence of three on material rbon nanotubes. E	es of monomer or rties as a functi compression te different metall Elemental analys	dispersions. ion of temperatu sts). lic catalysts sis of the sample	re).	Number of hours
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	Influence of differer Mechanical propert Mechanical propert Synthesis of carbon Purification process Microscopic observa Mechanical propert Nanocarbons: Grap Functionalized/mod	variont naries of ies of obation ies te hene, lified	terials  aus forms of nofillers on rhe nanocompos nanocompos otubes in the otained carbo of purified ca sting of nano fullerenes, ca	instruction eological propertie ites (tensile prope ites (bending and presence of three on material rbon nanotubes. E	es of monomer or rties as a functi compression te different metall Elemental analys	dispersions. ion of temperatu sts). lic catalysts sis of the sample	re).	Number of hours
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	Influence of different Mechanical propert Mechanical propert Synthesis of carbon Purification process Microscopic observed Mechanical propert Nanocarbons: Grap Functionalized/mod Carbon in Polymers	variont naries of ies of okation ies te hene,	terials  fus forms of nofillers on rho nanocompos nanocompos otubes in the otained carbo of purified ca sting of nanor fullerenes, ca nanocarbons	instruction eological propertie ites (tensile prope ites (bending and presence of three on material rbon nanotubes. E	es of monomer or rties as a functi compression te different metall Elemental analys	dispersions. ion of temperatu sts). lic catalysts sis of the sample	re).	Number of hours
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	Influence of differer Mechanical propert Mechanical propert Synthesis of carbon Purification process Microscopic observa Mechanical propert Nanocarbons: Grap Functionalized/mod Carbon in Polymers Nanoparticle Dispen	variont narries of observation ies te hene, lified is resions	terials  fus forms of the process of the prified casting of nanocarbons  and the process of the prified casting of nanocarbons	instruction eological propertie ites (tensile prope ites (bending and presence of three on material rbon nanotubes. E materials arbon nanotubes,	es of monomer or rties as a functi compression te different metall Elemental analys	dispersions. ion of temperatu sts). lic catalysts sis of the sample	re).	Number of hours
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	Influence of different Mechanical propert Mechanical propert Synthesis of carbon Purification process Microscopic observation Mechanical propert Nanocarbons: Grap Functionalized/mod Carbon in Polymers Nanoparticle Dispensional Evaluation of mechanical propert Nanoparticle Dispensional Polymers Nanoparticle Polymers Nanoparticle Dispensional Polymers Nanoparticle Polymers Nanoparticle Polymers Nanoparticle Polymers Nanoparticle Polymers Nanoparticle Polymers Nanoparti	variont narries of ies of obation ies te hene, lified is anica	terials  fus forms of the properties of the prop	instruction eological propertie ites (tensile prope ites (bending and presence of three on material rbon nanotubes. E materials arbon nanotubes,	es of monomer or rties as a functi compression te different metall Elemental analys	dispersions. ion of temperatu sts). lic catalysts sis of the sample	re).	Number of hours  5 5 5 5 5 15 3 2 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-W-1 T-W-2 T-W-3 T-W-4 T-W-5 Student w	Influence of differer Mechanical propert Mechanical propert Synthesis of carbon Purification process Microscopic observed Mechanical propert Nanocarbons: Grap Functionalized/mod Carbon in Polymers Nanoparticle Dispert Evaluation of mechanical propert	variont narries of observation ies te hene, lified is arrivaria activ	terials  fus forms of the properties of the prop	instruction eological propertie ites (tensile prope ites (bending and presence of three on material rbon nanotubes. E materials arbon nanotubes,	es of monomer or rties as a functi compression te different metall Elemental analys	dispersions. ion of temperatu sts). lic catalysts sis of the sample	re).	Number of hours  5  5  5  5  5  15  3  2  3  2  Number of hours
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 Student w	Influence of different Mechanical propert Mechanical propert Synthesis of carbon Purification process Microscopic observed Mechanical propert Nanocarbons: Grap Functionalized/mod Carbon in Polymers Nanoparticle Dispensive Evaluation of mechanical propert Information of Mechanical propert Nanoparticle Dispensive Nanop	variont narries of ies of okation ies te hene, lified is anica activorator	terials  fus forms of positive in an occumpos of the positive in the positive in the positive in an occur in an oc	instruction eological propertie ites (tensile prope ites (bending and presence of three on material rbon nanotubes. E materials arbon nanotubes,	es of monomer or rties as a functi compression te different metall Elemental analys	dispersions. ion of temperatu sts). lic catalysts sis of the sample	re).	Number of hours
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 Student w A-L-1 A-L-2	Influence of different Mechanical propert Mechanical propert Synthesis of carbon Purification process Microscopic observation Mechanical propert Nanocarbons: Grap Functionalized/mod Carbon in Polymers Nanoparticle Dispert Evaluation of mechanical propert Nanoparticle Dispert Nanopa	variont narries of ies of obation ies te hene, lified is anica activorator orator	terials  fus forms of positive in an occumpos of purified casting of nanocarbons of properties of pr	instruction eological propertie ites (tensile prope ites (bending and presence of three on material rbon nanotubes. E materials arbon nanotubes,	es of monomer or rties as a functi compression te different metall Elemental analys	dispersions. ion of temperatu sts). lic catalysts sis of the sample	re).	Number of hours
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 Student w A-L-1 A-L-2 A-L-3	Influence of differer Mechanical propert Mechanical propert Synthesis of carbon Purification process Microscopic observat Mechanical propert Nanocarbons: Grap Functionalized/mod Carbon in Polymers Nanoparticle Dispert Evaluation of mech	variont narries of ies of obation ies te hene, lified is anica activorator orator	terials  fus forms of positive in an occumpos of purified casting of nanocarbons of properties of pr	instruction eological propertie ites (tensile prope ites (bending and presence of three on material rbon nanotubes. E materials arbon nanotubes,	es of monomer or rties as a functi compression te different metall Elemental analys	dispersions. ion of temperatu sts). lic catalysts sis of the sample	re).	Number of hours
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 Student w A-L-1 A-L-2 A-L-3 A-L-4	Influence of different Mechanical propert Mechanical propert Synthesis of carbon Purification process Microscopic observed Mechanical propert Nanocarbons: Grap Functionalized/mod Carbon in Polymers Nanoparticle Dispension Evaluation of mechanical propert Influence Dispension of Mechanical propert Nanoparticle Dispension of Mechanical preparation of mechanical preparation for labor preparation of report preparing for tests	variont narries of ies of obation ies te hene, lified is anica activorator orator	terials  fus forms of positive in an occumpos of purified casting of nanocarbons of properties of pr	instruction eological propertie ites (tensile prope ites (bending and presence of three on material rbon nanotubes. E materials arbon nanotubes,	es of monomer or rties as a functi compression te different metall Elemental analys	dispersions. ion of temperatu sts). lic catalysts sis of the sample	re).	Number of hours
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 Student w A-L-1 A-L-2 A-L-3 A-L-4 A-L-5	Influence of differer Mechanical propert Mechanical propert Synthesis of carbon Purification process Microscopic observed Mechanical propert Nanocarbons: Grap Functionalized/mod Carbon in Polymers Nanoparticle Dispert Evaluation of mech Workload - forms of participation in labor preparation for labor preparation of repo preparing for tests Consultations	variont narries of ies of obation ies te hene, lified is anica activorator orator	terials  fus forms of positive in an occumpos of purified casting of nanocarbons of properties of pr	instruction eological propertie ites (tensile prope ites (bending and presence of three on material rbon nanotubes. E materials arbon nanotubes,	es of monomer or rties as a functi compression te different metall Elemental analys	dispersions. ion of temperatu sts). lic catalysts sis of the sample	re).	Number of hours
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 Student w A-L-1 A-L-2 A-L-3 A-L-4	Influence of different Mechanical propert Mechanical propert Synthesis of carbon Purification process Microscopic observed Mechanical propert Nanocarbons: Grap Functionalized/mod Carbon in Polymers Nanoparticle Dispension Evaluation of mechanical propert Influence Dispension of Mechanical propert Nanoparticle Dispension of Mechanical preparation of mechanical preparation for labor preparation of report preparing for tests	variont narries of observation ies te hene, lified orator	terials  fus forms of positives in the potained carbo of purified casting of nanocarbons of properties of properti	instruction eological propertie ites (tensile prope ites (bending and presence of three on material rbon nanotubes. E materials arbon nanotubes,	es of monomer or rties as a functi compression te different metall Elemental analys	dispersions. ion of temperatu sts). lic catalysts sis of the sample	re).	Number of hours



Teaching m	nethods	/ tool	s								
M-1	lectures	with p	resentation								
M-2	subject	discuss	ion during lectures and labo	ratories							
M-3	self stud	lies									
Evaluation	method	ds (F -	progressive, P - final)								
S-1	Р	written	completion of lectures and l	aboratories							
S-2	F I	aborate	ory reports								
S-3	F s	student	activity during laboratories								
]	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 content		Teaching methods	Evaluation methods
Knowledge											
MSE_1A_C09a_ basic knowledg main groups of	ge in exp	erimenta ing mate	al nanomaterials including the erials	MSE_1A_W03	P6S_WG P6S_WK	P6S_WG	C-1		T-W-3 T-W-4	M-1 M-3	S-1
Skills				•			•				
	sis and c		rization of nanomaterials	MSE_1A_U07	P6S_UW	P6S_UW	C-1	T-L-1 T-L-2	T-L-3	M-2 M-3	S-2 S-3
Social comp	petence	: ::S			!	1		,		!	,
MSE_1A_C09a_ The student un application of e	derstand		portance of fabrication and materials	MSE_1A_K02	P6S_KK	P6S_WK	C-1			M-1 M-2 M-3	S-1 S-2
Outcom	es (	Grade			valuation cr	iterion	!			<u>'</u>	<u>'</u>
Knowledge											
MSE_1A_C09a_		2,0									
			from 50 to 55% of percentage p	oints							
		3,5									
		4,0									
		4,5									
G1 '''		5,0									
Skills											
MSE_1A_C09a_	_001	2,0									
		- , -	from 50 to 55% of percentage p	oints							
		3,5									
		4,0									
		4,5									
		$r \sim$									
		5,0									
	-	etence	25								
	-	etence 2,0									
	-	etence 2,0 3,0	es from 50 to 55% of percentage p	points							
	-	etence 2,0		points							
Other socia MSE_1A_C09a_	-	etence 2,0 3,0		points							
Other socia MSE_1A_C09a_	-	etence 2,0 3,0 3,5		points							

#### Required reading

- 1. Daniel Schodek Paulo Ferreira Michael Ashby, Nanomaterials, Nanotechnologies and Design, Butterworth-Heinemann, 2009, ISBN: 9780750681490
- 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



#### **Faculty of Chemical Technology and Engineering**

Field of st	tudy	Mate	erials Scienc	e and Engineeri	ing				
Mode of s	tudy	stat	ionary	Level		first	cycle		C.I
Graduate	's qualification	inży	nier	l .				WTil	Ch
Fields of s		1	ineering and	technology					
Discipline	s of science	<u> </u>		eering (100%)					
Education		_	eral academ					-	
Module	iai prome	gen	crai acaaciii						
		Intr	o to Experi	mental Metho	ds: Ri	omatei	rials		
Course ur	nit 		phasis						CIL
Code		MSE	_1A_S_C09b						
Field of sp	pecialisation							_	<del></del>
Administe	ering faculty	Dep	artment of P	olymer and Bio	materi	als Scie	nce		
ECTS		4,0		ECTS (forms)		4,0			
Form of c	ourse credit	crec	lits	Language		english	า		
Electives		4		Elective group					
Form of ir	nstruction	Cod	Semester	Hours	E	CTS	Weight	Realization	Credit
laboratory		L	4	45		3,0	0,50	K	credits
lecture	,	W	4	15		.,0	0,50	K	credits
Leading to	oachor		-	a (Miroslawa.Elf				1	1 2. 24.65
Other tea		(Mir Paw	oslawa.ElFra eł (Pawel.Ko	nta (Jolanta.Bar y@zut.edu.pl), chmanski@zut. a (Agnieszka.Pie	Fryska edu.pl)	Sebast , Mijows	ian (Sebastian. ska Ewa (Ewa.I	Fryska@zut.ed	u.pl), Kochmański @zut.edu.pl),
Prerequis									
W-1	Knowledge of the b	asic o	course in math	nematics, physics	and ch	emistry a	at the elementar	y level	
Module/co	ourse unit objective								
C-1	The purpose of the groups of enginering			he students' knov	vledgea	nd skills	in experimental	biomaterials incl	uding the main
Course co	ontent divided into			instruction					Number of hours
T-L-1	Viscosity Measuren	nent l	Jsing a Brookf	ield Viscometer					5
T-L-2	Refractive index of				during c	rystalliza	ation		5
T-L-3	Mechanical propert	ies of	biomaterials	(tensile propertie	s as a f	unction o	of temperature)		5
T-L-4	Acid and alkaline h	ydroly	ysis of biocellu	ılose.					5
T-L-5	Functionalization o	f bioc	ellulose by me	etal oxide nanopa	rticles.				5
T-L-6	Morphology charac	terisa	ition of synthe	sized samples.					5
T-L-7	Mechanical propert	ies te	esting of bioma	aterials					15
T-W-1	Nanoceramics: Nar	nocrys	stalline Function	onal Oxide Materia	als, Con	npound (	Crystals		3
T-W-2	Organic Nanomate	rials							2
T-W-3	Evaluation of mech	anica	I properties of	f biomaterials					5
T-W-4	Nanocomposites as	s Impl	ant Materials						3
T-W-5	Nanofiber Biomate	rials							2
Student w	vorkload - forms of	activ	vity						Number of hours
A-L-1	Participation in lect	ures							45
A-L-2	individual literature	stud	ies						35
A-L-3	consultations								10
A-W-1	Participation in lect	ures							15
A-W-2	Individual literature	stud	ies						5
A-W-3	preparing for tests								10
Teaching	methods / tools								
M-1	lectures with prese	ntatio	n						
	<del>                                     </del>								

subject discussion during lectures and laboratories

								<u> </u>			
Teaching	method	ds / tool:	S								
M-3	self st	udies									
Evaluation	n meth	ods (F -	progressive, P - final)								
S-1	Р	written	completion of lectures and la	aboratories							
S-2	F	laborate	ory reports								
S-3	F	student	activity during laboratories								
	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	Course	content	Teaching methods	Evaluation methods
Knowledg	e			1							
MSE 1A C09	b_W01 dge in ex	operimenta materials	al bioomaterials including various	MSE_1A_W02 MSE_1A_W07	P6S_WG	P6S_WG	C-1		T-W-4 T-W-5	M-1 M-2	S-1 S-2
Skills											
MSE_1A_C09 skills in synth various group	nesis and	character	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	understa		nportance of fabrication and naterials	MSE_1A_K02	P6S_KK	P6S_WK	C-1	T-L-2 T-L-3	T-W-2 T-W-3 T-W-4 T-W-5	M-1 M-2	S-1 S-2
Outcor	nes	Grade		Е	valuation cr	iterion					
Knowledg	e	'									
MSE_1A_C09	5_₩01	2,0 3,0 3,5 4,0 4,5 5,0	from 50 to 55% of percentage po	pints							
Skills		3,0									
MSE_1A_C09	b_U01	2,0 3,0 3,5 4,0 4,5 5,0	from 50 to 55% of percentage po	pints							
Other soci	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 po	pints							
Required	reading		<u> </u>								
•			-Zhen Yu, Polymer nanocomp	osites, Woodhea	d Publishing Ir	nc., 2006					
2. Robert V	ajtai Ed	., Springe	er Handbook of Nanomateria	ls, Springer, 201	3						
3. Mahmoo	d Aliofk	hazraei,	Handbook of Nanoparticles, S	Springer, 2016							
4. Kantesh	Balani,	BIOSURF	ACES A Materials Science an	d Engineering Pe	rspective, Wil	ey, 2015		<u> </u>			



Field of s	study	Mate	erials Scienc	e and Engineeri	ing				
Mode of	study	stati	onary	Level		first o	cycle	3 A /	C I
Graduate	e's qualification	inży	nier	l				WTil	Ch
Fields of		engi	neering and	l technology					
	es of science	+ -		eering (100%)					
-	nal profile	+	eral academ					-	
Module	mai prome	gene	erar academ						
	,	-						-	
Course u	init	_		perties of Mat	terials				Ci
Code		MSE	_1A_S_C10					- \ ■	
Field of s	specialisation								
Administ	tering faculty	Dep	artment of N	Nanomaterials P	hysico	hemist	ry		
ECTS		6,0		ECTS (forms)		6,0			
Form of c	course credit	exar	mination	Language		english	ı		
Electives	form of instruction ecturing course aboratory course ecture			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
laborator	ry course	L	4	30	2	,0	0,30	К	credits
lecture	<u>-</u>	w	4	30		,0	0,40	K	examination
	teacher	Miio	wska Fwa (F	 Ewa.Borowiak-Pa					
I eading i	ccacrici	_						ka Ewa (Ewa.B	orowiak-
Leading t		Kusi	ak-Nelman i	Ewelina (Ewelina		K(WZULLE			
Leading t Other tea				ol), Wilpiszewska					
	achers								
Other tea	achers	Pale	n@zut.edu.¡	ol), Wilpiszewski	a Katar	zyna (K	atarzyna.Wilpi	iszewska@zut.e	
Other tea Prerequis W-1	achers sites	Pale pasic c	n@zut.edu.¡	ol), Wilpiszewski	a Katar	zyna (K	atarzyna.Wilpi	iszewska@zut.e	
Other tea Prerequis W-1	achers sites Knowledge of the b	Pale pasic c es rse is	n@zut.edu.pcourse in math	nematics, physics	a Katar and che	emistry a	atarzyna.Wilpi	iszewska@zut.6 ry level	edu.pl)
Other tea Prerequis W-1 Module/c C-1	sites  Knowledge of the could be a few forms and the could be a	Pale pasic of es rse is ty. The	n@zut.edu.p course in math to gain the st e students wil	nematics, physics udents' knowledg I have competenc	a Katar and che	emistry a	atarzyna.Wilpi	iszewska@zut.6 ry level	edu.pl)
Other tea Prerequis W-1 Module/c C-1	sites  Knowledge of the becourse unit objective  The aim of the cou	Pale pasic consists of the pasic consists of	n@zut.edu.p course in math to gain the st e students wil	nematics, physics udents' knowledg I have competenc	and che e and sl es of te	emistry a	atarzyna.Wilpi It the elementar e understanding in the lab.	iszewska@zut.6 ry level	materials in terms
Other tea Prerequis W-1 Module/c C-1 Course co	sites  Knowledge of the important of their functionality content divided into	Pale pasic consists of the constant of the con	n@zut.edu.p course in math to gain the st e students will ous forms of of Functional N	nematics, physics udents' knowledg I have competence instruction Materials - student	and chees and skes of te	emistry a kills in th am work	atarzyna.Wilpi It the elementar e understanding in the lab.	iszewska@zut.6 ry level	materials in terms  Number of hours
Other tea  Prerequis W-1  Module/c C-1  Course co	sites  Knowledge of the transport of the course unit objective of the course the course of their functionality ontent divided into Current state of the course of the cour	Pale  pasic constraints  es  rse is ty. The various art constraints  e art constraints	to gain the ste students will our forms of Functional Nuctors: Calcu	nematics, physics udents' knowledge I have competence instruction Materials - student	and chee and shes of te	zyna (K emistry a kills in th am work entations	atarzyna.Wilpi It the elementar e understanding in the lab.	iszewska@zut.6 ry level	materials in terms  Number of hours
Other tea  Prerequis W-1  Module/c C-1  Course co T-A-1 T-A-2 T-A-3 T-A-4	sites  Knowledge of the becourse unit objective The aim of the courd of their functionality content divided into  Current state of the Band theory of sen	Pale  pasic constraints  es  rse is  ty. The  vario  e art constraints  photo	to gain the ste students will bus forms of functional Nuctors: Calculocatalytic active.	nematics, physics udents' knowledg I have competence instruction Materials - student lations of band ga	and chee and shes of te	zyna (K emistry a kills in th am work entations	atarzyna.Wilpi It the elementar e understanding in the lab.	iszewska@zut.6 ry level	materials in terms  Number of hours  10 4 4 1
Other tea  Prerequis W-1  Module/C C-1  Course CC T-A-1 T-A-2 T-A-3 T-A-4 T-A-5	sites  Knowledge of the countent divided into have current state of the hand theory of sen hand theory of sen had calculations of the had been calculations of rea had been been been been been been been bee	Pale  pasic c  es  rse is ty. The  vario e art c  nicond photo ction r  mer de	to gain the ste students will sus forms of functional Nuctors: Calculocatalytic activates and kine egradation and	nematics, physics udents' knowledge I have competence instruction Materials - student lations of band ga vity and quantum etics d depolymerizatio	and chee e and shees of te	zyna (K emistry a kills in th am work entations	atarzyna.Wilpi It the elementar e understanding in the lab.	iszewska@zut.6 ry level	materials in terms  Number of hours  10 4 4
Other tea  Prerequis W-1  Module/c C-1  Course co T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6	sites  Knowledge of the becourse unit objective  The aim of the cour of their functionality  content divided into  Current state of the Band theory of sent Calculations of the Calculations of real Evaluation of polyry thermal degradations.	Pale  pasic content  es  rse is  ty. The  vario  e art content  photo  ction r  mer de  on tech	to gain the ste students will us forms of functional Nuctors: Calculocatalytic activates and kine egradation and hiniques for st	nematics, physics udents' knowledge I have competence instruction Materials - student lations of band ga vity and quantum etics d depolymerizatio	and chee e and shees of te	zyna (K emistry a kills in th am work entations	atarzyna.Wilpi It the elementar e understanding in the lab.	iszewska@zut.6 ry level	materials in terms  Number of hours  10 4 4 1 3 3
Other tea  Prerequis W-1  Module/C C-1  Course CC T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6 T-A-7	sites  Knowledge of the transport of their functionality content divided into Current state of the Band theory of sen Calculations of rea Evaluation of polyr thermal degradation Modelling of thems	Pale  pasic constant of the co	to gain the ste students will ourse forms of functional Nuctors: Calculocatalytic activates and kine egradation and hiniques for steradation	nematics, physics udents' knowledge I have competence instruction Materials - student lations of band ga vity and quantum etics d depolymerizatio	and chee e and shees of te	zyna (K emistry a kills in th am work entations	atarzyna.Wilpi It the elementar e understanding in the lab.	iszewska@zut.6 ry level	materials in terms  Number of hours  10 4 4 1 3 3 3 3
Other teal Prerequis W-1  Module/C C-1  Course CC T-A-1 T-A-2 T-A-3 T-A-4 T-A-5 T-A-6 T-A-7 T-A-8	sites  Knowledge of the	Pale  pasic c  es  rse is  ty. The  vario  e art c  nicond  photo  ction r  mer de  on tecl  al deg  ssing t	to gain the steestudents will to set under the students will the set under the set und	nematics, physics udents' knowledg I have competence instruction Materials - student lations of band ga vity and quantum etics d depolymerizatio ability testing	and chee and shes of te	emistry a  kills in the am work entations  By cy	atarzyna.Wilpi It the elementar e understanding in the lab.	iszewska@zut.6 ry level	materials in terms  Number of hours  10  4  1  3  3  3  2
Other teal Prerequis W-1 Module/C C-1 Course CC 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	sites  Knowledge of the becourse unit objective The aim of the cour of their functionality Content divided into Current state of the Band theory of sent Calculations of the Calculations of reat Evaluation of polyry thermal degradation Modelling of therm participation in passibles.	Pale  pasic construction representation reclaid degrees to to construction reclaid degrees to to construct the construction reclaims recla	to gain the ste students will bus forms of functional National States and kine egradation and iniques for stardation est allytic remova	nematics, physics udents' knowledg I have competence instruction Materials - student lations of band ga vity and quantum etics d depolymerizatio ability testing	and chee and shes of te	emistry a  kills in the am work entations  By cy	atarzyna.Wilpi It the elementar e understanding in the lab.	iszewska@zut.6 ry level	materials in terms  Number of hours  10 4 4 1 3 3 3 3 2 5
Other tea  Prerequis W-1  Module/C C-1  Course CC 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	sites  Knowledge of the	Pale  pasic construction reproduction reconstruction technical degrees and the construction reconstruction reco	to gain the ste students will bus forms of functional Nuctors: Calcubrates and kine egradation and iniques for students alytic removaterials for air products of the students and the students and the students are students alytic removaterials for air products.	nematics, physics udents' knowledg I have competence instruction Materials - student lations of band ga vity and quantum etics d depolymerizatio ability testing	and chee and shes of te	emistry a  kills in the am work entations  By cy	atarzyna.Wilpi It the elementar e understanding in the lab.	iszewska@zut.6 ry level	materials in terms  Number of hours  10 4 4 1 3 3 3 2 5 5
Other tea  Prerequis W-1  Module/C C-1  Course CC 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	sites  Knowledge of the	Pale  pasic constraints  pasic constraints  various  e art constraints  photo ction reclaid degrees  as legges  ssing totocat  otocat  on man	to gain the stee students will bus forms of functional Nuctors: Calculocatalytic activates and kine egradation and hniques for students alytic removaterials for air presents.	nematics, physics udents' knowledg I have competence instruction Materials - student lations of band gar vity and quantum etics d depolymerizatio ability testing	and chee and shes of te	emistry a  kills in the am work entations  By cy	atarzyna.Wilpi It the elementar e understanding in the lab.	iszewska@zut.6 ry level	materials in terms  Number of hours  10  4  1  3  3  3  5  5  5
Other tea  Prerequis  W-1  Module/c  C-1  Course cc  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	sites  Knowledge of the becourse unit objective The aim of the cour of their functionality ontent divided into Current state of the Band theory of sent Calculations of the Calculations of reat Evaluation of polyry thermal degradation Modelling of thermal participation in passes Adsorption and phe Photoactive building Plasticizing of biop Water soluble poly	Pale  pasic construction recommended by the construction of the construction recommended by th	to gain the state students will bus forms of functional fuctors: Calcubrates and kine egradation and iniques for states alytic removations for air present for technical after	nematics, physics udents' knowledget have competence instruction Materials - student lations of band gavity and quantum setics d depolymerization ability testing	and chee e and shes of te	emistry a kills in th am work entations by ccy	atarzyna.Wilpi	iszewska@zut.6 ry level	materials in terms  Number of hours  10 4 4 1 3 3 3 2 5 5 5
Other tea  Prerequis W-1  Module/C C-1  Course CC 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	sites  Knowledge of the becourse unit objective The aim of the course their functionality content divided into Current state of the Band theory of sen Calculations of rea Evaluation of polyr thermal degradation Modelling of therm participation in pass Adsorption and phe Photoactive buildir Plasticizing of biop Water soluble poly Synthesis of porou	Pale  pasic construction reproduction reconstruction technical degree sing the contraction reconstruction recon	to gain the ste students will bus forms of functional Nuctors: Calculocatalytic activates and kine egradation and iniques for step alytic removaterials for air preservations of technical accular structu	nematics, physics udents' knowledget have competence instruction Materials - student lations of band gaterials and quantum settics depolymerization ability testing ul of air and water purification application res with different	and chee e and shes of te	emistry a  kills in th am work  entations by cy  hts	atarzyna.Wilpi	iszewska@zut.6 ry level	materials in terms  Number of hours  10 4 4 1 3 3 3 2 5 5 5 5 5
Other teal Prerequis W-1  Module/C C-1  Course CC 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	sites  Knowledge of the course the knowledge of the hard theory of send and theory of send calculations of the Calculations of read Evaluation of polymous thermal degradation of the hotoactive building participation in passible polymous course of the polymous course of the polymous synthesis of porous adsorption propertive.	Pale  pasic construction results of the construction recording the construction recording material degrees from the construction recording record	to gain the state students will bus forms of functional Nuctors: Calculocatalytic activates and kine egradation and hiniques for state alytic removations for air process for technical accular structulorous molecular structulocatalytic removations for air process for technical accular structulorous molecular structulorous molecular structulocatal structulorous molecular structulorous mole	nematics, physics udents' knowledg I have competence instruction Materials - student lations of band gas vity and quantum etics d depolymerizatio ability testing ul of air and water purification res with different cular structures wi	and che e and shes of te t's prese ap energ efficien n pollutar porous of	emistry a kills in tham work entations by cy distribution	atarzyna.Wilpi	iszewska@zut.6 ry level	materials in terms  Number of hours  10 4 4 1 3 3 3 2 5 5 5 5 5
Other teal Prerequis W-1 Module/C C-1 Course CC 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	sites  Knowledge of the becourse unit objective The aim of the count of their functionality ontent divided into Current state of the Band theory of sent Calculations of the Calculations of reat Evaluation of polyrethermal degradation Modelling of therm participation in passes Adsorption and phe Photoactive building Plasticizing of biop Water soluble poly Synthesis of porous Adsorption property Fundamental Property	Pale  pasic co es rse is ty. The vario e art co nicond photo ction r mer de on tecl ial deg ssing t otocat ng mat olyme mers f s mole cites of erties	to gain the state students will bus forms of functional fuctors: Calcubrates and kine egradation and the students for students for air particular structures and ceular structures of Functional	nematics, physics udents' knowledget have competence instruction Materials - student lations of band gavity and quantum setics d depolymerization ability testing all of air and water purification res with different cular structures with Materials: Genera	and che e and shes of te t's prese ap energ efficien n pollutar porous of	emistry a kills in tham work entations by cy distribution	atarzyna.Wilpi	iszewska@zut.6 ry level	materials in terms  Number of hours  10  4  1  3  3  3  2  5  5  5  5  4
Other tea  Prerequis W-1  Module/C C-1  Course CC 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	sites  Knowledge of the	Pale  pasic construction reproduction reprod	to gain the stee students will bus forms of functional Nuctors: Calculocatalytic activates and kine egradation and the students for students for air process for technical accular structure porous molecular for Functional for Functional	nematics, physics udents' knowledget have competence instruction Materials - student lations of band gavity and quantum setics d depolymerization ability testing all of air and water purification res with different cular structures with Materials: Genera	and che e and shes of te t's prese ap energ efficien n pollutar porous of	emistry a kills in tham work entations by cy distribution	atarzyna.Wilpi	iszewska@zut.6 ry level	materials in terms  Number of hours  10 4 4 1 3 3 3 2 5 5 5 5 5 4 4
Other teal Prerequis W-1  Module/C C-1  Course CC 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	sites  Knowledge of the course unit objective.  The aim of the could of the the could the functional in the country of the could the country of the could the country of	Pale  pasic co es rse is ty. The  vario e art co nicond photo ction r mer de on tecl al deg ssing t otocat ng mat olyme mers f s mole cies of erties logies unction	to gain the state students will bus forms of functional functors: Calculocatalytic activates and kine egradation and for technical activates for air process for technical accular structure porous molecular for Functional for Functional mal Materials	nematics, physics udents' knowledg I have competence instruction Materials - student lations of band gavity and quantum etics d depolymerizatio ability testing  al of air and water purification res with different cular structures wi Materials: Genera	and chee e and shes of te	emistry a kills in tham work entations by cy distribution rent poropts	atarzyna.Wilpi	iszewska@zut.6 ry level	materials in terms  Number of hours  10  4  1  3  3  3  5  5  5  5  4  4  1  1
Other tea  Prerequis W-1  Module/C C-1  Course CC 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	sites  Knowledge of the	Pale  pasic co es rse is ty. The vario e art co nicond photo ction r mer de on tecl ial deg ssing t otocat ng mat olyme mers f s mole cites of erties logies unction sed ma	to gain the state students will bus forms of functional fuctors: Calculocatalytic activates and kine agradation and mail for functional for Functional for Functional for Functional functional mail Materials and discourse and discourse functional functio	nematics, physics udents' knowledget have competence instruction Materials - student lations of band gavity and quantum setics depolymerization ability testing all of air and water purification res with different cular structures with different students. General Materials I Materials evices: Fundamer	and chees and shees of tees of	emistry a  kills in th am work  entations by  cy  hts  distribution rent poro pts	atarzyna.Wilpi	iszewska@zut.6 ry level	materials in terms  Number of hours  10 4 4 1 3 3 3 2 5 5 5 5 5 4 4
Other teal Prerequis W-1  Module/C C-1  Course CC 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 T-W-4	sites  Knowledge of the becourse unit objective The aim of the count of their functionality ontent divided into Current state of the Band theory of sent Calculations of the Calculations of reat Evaluation of polyrethermal degradation Modelling of therm participation in passes Adsorption and phe Photoactive building Plasticizing of biop Water soluble poly Synthesis of porous Adsorption properting Fundamental Properticular Trends in Fundamental Fundamental Properticular Trends in Fundamental Properticular Semiconductor-basses	Pale  pasic construction of the construction o	to gain the stee students will bus forms of functional Natural stee and kine agradation and the stee and stee a	nematics, physics udents' knowledge I have competence instruction Materials - student I lations of band gavity and quantum etics d depolymerizatio ability testing  I of air and water purification res with different cular structures wi Materials: General I Materials evices: Fundamer ductor materials a	a Katar and che e and sk es of te t's prese p energ efficien n  pollutar  porous of the differ il Conce	emistry a  kills in th am work  entations by cy  distributi rent poro pts  d prepara ces	atarzyna.Wilpi	y level g of properties of	materials in terms    Number of hours
Other teal Prerequis W-1  Module/C C-1  Course CC 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 T-W-4 T-W-5	sites  Knowledge of the	Pale  pasic co es rse is ty. The various e art co nicond photo ction r mer de lal deg ssing t otocat ng mat olyme mers f s mole cites of erties logies unction sed ma olication ne pho	to gain the state students will bus forms of a functional functions: Calculated and the state and kine a gradation and the state	nematics, physics udents' knowledg I have competence instruction Materials - student lations of band gavity and quantum etics d depolymerizatio ability testing  al of air and water purification res with different cular structures wi Materials: Genera I Materials evices: Fundamer ductor materials a ctivity: Mechanism	and chees and shees of tees appenency efficien in pollutary porous of the different in the	emistry a  kills in th am work  entations by cy  distributi rent poro pts  d prepara ces	atarzyna.Wilpi	y level g of properties of	materials in terms    Number of hours



Course co		ivided into various forms of instru						Nun	nber o	f hours
T-W-9	biodeg	merization, degradation and destruct radability testing methods	_		•	_				3
T-W-10	(rheolo	es affecting polymer stability (UV ligh gy modifiers, surface active additives ers with improved resistance				nctional	ty			3
T-W-11		pation in the zero-term exam								3
Student v	vorkload	l - forms of activity						Nun	nber o	f hours
A-A-1	_	pation in recitations						- Ivan	1001 01	30
A-A-2		ing for tests								13
A-A-3		udy of the literature								15
A-A-4	Consul									2
A-L-1		pation in laboratory exercises								30
A-L-2		ation to laboratory exercises								10
A-L-3		ation of reports								10
A-L-4		pating in tests								10
A-W-1		pation in lectures								30
A-W-2		ual literature studies								13
A-W-3		ation for the exam								15
A-W-4	The ex									1
A-W-5	Consul									2
Teaching M-1										
M-2		s with presentation		d labaratariaa						
м-2 М-3	subject self stu	discussion during lectures, auditoriu	m excercises an	d laboratories						
	n metho	ds (F - progressive, P - final)								
S-1	Р	written exam								
S-2	F	written completion of exercises and	laboratories							
S-3	F	laboratory reports								
5-4	F	student activity during auditory exce	ercise							
	Desigr	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	e content	Teaching methods	Evaluation methods
Knowledg	ge					1				
MSE_1A_C10 knowledge of terms of the	of the unde	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						_	_			_
their functio	character nality.	rize the properties of materials in terms of	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-6	M-2 M-3	S-1 S-3
Social cor	inpetend	.es	1				T-A-1			
MSE_1A_C10 Students is a work in grou	able to per	form all task on time and cooperate and	MSE_1A_K02	P6S_KK	P6S_WK	C-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-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	S-1 S-3



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	
		from 50 to 55% of percentage points
	3,5	
	4,0	
	4,5	
	5,0	
Other social con	npetenc	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 readin	ng	
1 -	_	adelia I Wright The Science and Engineering of Materials, Congage Learning, 2017, ISBN 12-070

- 1. Donald R. Askeland, Wendelin J. Wright, The Science and Engineering of Materials , Cengage Learning, 2017, ISBN-13: 978-1305076761
- 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



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•	Mate	rials Scienc	e and Engineerir	าg				
dy	stati	onary	Level		first c	cycle	14/T:1/	~ L
qualification	inżyr	nier	<u>,                                      </u>				WTil(	_n
ence	engi	neering and	technology					_
of science	mate	erials engine	ering (100%)					
profile	gene	eral academ	ic					
	Pha	se Transfo	rmations & Mic	crostr	ıcture	of Materials		
	MSE_	_1A_S_C11					\	C
cialisation								
ng faculty	Depa	artment of P	olymer and Bion	nateria	ls Scier	nce		
	5,0		ECTS (forms)		5,0			
rse credit	cred	its	Language		english			
			Elective group					
ruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
urse	Α	4	15	1,	0	0,30	K	credits
ourse	L	4	30	2	0	0,30	K	credits
	W	4	30	2	0	0,40	K	credits
cher	El Fr	ay Mirosław	a (Miroslawa.ElF	ray@zı	ut.edu.p	ol)		
ers	(Kard	olina.Kielbas	sa@zut.edu.pl), ŀ	Kochm	ańska A	gnieszka		zut.edu.pl),
S								
undamentals of m	athen	natics, physic	s and chemistry					
rse unit objective	25							
o gain the knowled naterials	dge, s	kills and com	petences in the ar	ea of ph	nase trar	nsformations and	microstructure (	of engineering
ent divided into	vario	us forms of	instruction					Number of hours
								5
sothermal and non hermograms	-isoth	ermal crystall	lization process of	polyme	rs – ana	lysis and interpre	etation of DSC	3
-			•			-		2
Study of temperatu Raman spectra	ire pha	ase transition	s in TiO2- analysis	and in	erpretat	tion of XRD diffra	ctograms and	5
leasurement and p	oredic	tion of phase	transformation kir	netics				_
errous alloys: stee								5
	_							5
	- ' '	r, Aluminum,	Titanium, Magnes	ium and	lts Allo	ys		5
leat treatment of a	alloys		<del>-</del>		l Its Allo	ys		5 5 5
Heat treatment of a	alloys the n	nelt of semicr	ystalline polymers	3		ys		5 5 5 5
Heat treatment of a Crystallization from Glass transition ten Dislocations and St	alloys the n nperat	nelt of semicr cure of differe	ystalline polymers nt polymers - DSC nisms; Characteris	and DN	1A Dislocati	ons; Slip System	s; Slip in Single	5 5 5
Heat treatment of a Crystallization from Glass transition ten	alloys the n nperat rength forma on; Sol	nelt of semicr ture of different nening Mecha tion of Polycr id-Solution St	ystalline polymers nt polymers - DSC nisms; Characteris ystalline Materials	and DN stics of ; Deforr	/IA Dislocati nation b	ions; Slip System y Twinning; Strei	s; Slip in Single ngthening by	5 5 5 5
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Heat treatment of a Crystallization from Glass transition ten Dislocations and St Crystals; Plastic De Grain Size Reduction Recrystallization; G	alloys the n nperat rength forma on; Sol rain G crostr	nelt of semicr cure of different nening Mecha tion of Polycr id-Solution St irowth ucture in iron erty Changes	ystalline polymers nt polymers - DSC nisms; Characteris ystalline Materials rengthening; Strai -carbon alloys in Iron-Carbon Allo	and DN stics of ; Deforr in Harde	//A Dislocati nation b ening; Re	ions; Slip System y Twinning; Strei ecovery	ngthening by	5 5 5 5 5
Heat treatment of a Crystallization from Glass transition ten Dislocations and St Crystals; Plastic De Grain Size Reduction; Gecrystallization; Govelopment of midicrostructural and	alloys the n nperat rength forma on; Sol rain G crostr Prope	nelt of semicr cure of different nening Mecha tion of Polycr id-Solution St frowth ucture in iron erty Changes ormation diag	ystalline polymers nt polymers - DSC nisms; Characteris ystalline Materials rengthening; Strai -carbon alloys in Iron-Carbon Allorams)	and DM stics of ; Deforr in Harde oys (Pea	//A Dislocati nation b ening; Re	ions; Slip System y Twinning; Strei ecovery	ngthening by	5 5 5 5 5 4
Heat treatment of a Crystallization from Glass transition ten Dislocations and St Crystals; Plastic De Grain Size Reduction; Georgetallization; Govelopment of midicrostructural and Time temperature to Modeling of mass to Modeling of heat transportation; of the stream	alloys the n nperat rength forma n; Sol rain G crostr Prope cransfer ansfer	nelt of semicr cure of different nening Mechation of Polycr id-Solution Starowth ucture in iron erty Changes ormation diag r process in plant	ystalline polymers nt polymers - DSC nisms; Characteris ystalline Materials rengthening; Strai -carbon alloys in Iron-Carbon Alle rams) hase transformati	stics of the properties of the	//A Dislocati nation b ening; Re arlite; Ba	ions; Slip System y Twinning; Strei ecovery ninite; Spheroidit	ngthening by	5 5 5 5 5 4 2 4 3 3
Heat treatment of a Crystallization from Glass transition ten Dislocations and St Crystals; Plastic De Grain Size Reduction; G Development of midicrostructural and Time temperature to Modeling of mass to Modeling of heat transcription	alloys the n nperat rength forma n; Sol rain G crostr Prope cransfe ransfer ansfer	nelt of semicrature of difference of Polycration Statement of Polycration diagonation of Porocess in plants of Polycration Statement of Polycration of Polycratio	ystalline polymers nt polymers - DSC nisms; Characteris ystalline Materials rengthening; Strai -carbon alloys in Iron-Carbon Allo rams) shase transformation and the model of the companies of th	and DM stics of ; Deform in Harde oys (Pea on on	//A Dislocati nation b ening; Re arlite; Ba	ions; Slip System y Twinning; Strei ecovery ninite; Spheroidit	ngthening by	5 5 5 5 5 4 2 4 3 3
Heat treatment of a Crystallization from Glass transition ten Dislocations and St Crystals; Plastic De Grain Size Reduction; Georgetallization; Govelopment of midicrostructural and Time temperature to Modeling of mass to Modeling of heat transportation; of the stream	alloys the n nperat rength forma n; Sol rain G crostr Prope ransfe ransfe ansfer and n	nelt of semicrature of differentian Mechation of Polycrid-Solution Starowth for the control of t	ystalline polymers nt polymers - DSC nisms; Characteris ystalline Materials rengthening; Strai -carbon alloys in Iron-Carbon Allo rams) shase transformation e nucleation (homo polymeric materia	and DM stics of ; Deform in Harde oys (Pea on on	//A Dislocati nation b ening; Re arlite; Ba	ions; Slip System y Twinning; Strei ecovery ninite; Spheroidit	ngthening by	5 5 5 5 5 4 2 4 3 3
	cialisation ag faculty  rse credit  ruction  urse  ourse  cher  ers  sundamentals of materials  ent divided into betermination of disothermal and non- mermograms the glass transition tudy of temperatulaman spectra	profile general genera	Phase Transform  MSE_1A_S_C11  Cialisation  In g faculty  Department of Post of Semester  Urse Credit  Cod Semester  Urse A 4  Ourse L 4  W 4  Cher EI Fray Mirosław  (Karolina. Kielbas (Agnieszka. Koch semester)  Urse Unit objectives  To gain the knowledge, skills and commaterials  Control of diffusion coefficients sothermal and non-isothermal crystall mermograms  The glass transition temperature – analtudy of temperature phase transition aman spectra	Phase Transformations & Michael MSE_1A_S_C11  Sialisation  Ing faculty  Department of Polymer and Bior 5,0  FCTS (forms)  Tree credit  Credits  Language  Elective group  Truction  Cod Semester  Hours  UTSE  A 4 15  OUTSE  L 4 30  W 4 30  Cher  El Fray Mirosława (Miroslawa.ElFers  (Karolina.Kielbasa@zut.edu.pl), I (Agnieszka.Kochmanska@zut.edus)  Sundamentals of mathematics, physics and chemistry  Tree unit objectives  To gain the knowledge, skills and competences in the anaterials  Tent divided into various forms of instruction  Determination of diffusion coefficients and activation ensothermal and non-isothermal crystallization process of the glass transition temperature – analysis and interpretitudy of temperature phase transitions in TiO2- analysis aman spectra	Phase Transformations & Microstru  MSE_1A_S_C11  Tialisation  To faculty  Department of Polymer and Biomaterial  S,0  ECTS (forms)  Tree credit  Credits  Language  Elective group  Truction  Cod Semester  Hours  ECTS  UN  4  30  2,  W  4  30  2,  Cher  EI Fray Mirosława (Miroslawa.EIFray@zu  (Karolina.Kielbasa@zut.edu.pl), Kochma (Agnieszka.Kochmanska@zut.edu.pl), F  S  undamentals of mathematics, physics and chemistry  The company of the semental of the seme	Phase Transformations & Microstructure  MSE_1A_S_C11  Idalisation  Ing faculty  Department of Polymer and Biomaterials Scient  5,0  ECTS (forms)  Fourse credit  Credits  Language  Inglish  Language  Ingl	Phase Transformations & Microstructure of Materials  MSE_1A_S_C11  Sialisation  In graculty  Department of Polymer and Biomaterials Science  5,0  ECTS (forms)  S,0  FECTS (forms)  Fective group  Foruction  Cod Semester  Hours  ECTS  Weight  Ferse  A 4 15 1,0 0,30  Fourse  L 4 30 2,0 0,30  Ferse  First Mirosława (Mirosława.ElFray@zut.edu.pl)  First Fray Mirosława (Mirosława.ElFray@zut.edu.pl)  First Fray Mirosława (Mirosława.ElFray@zut.edu.pl), Kiełbasa Ka (Karolina.Kielbasa@zut.edu.pl), Kochmańska Agnieszka (Agnieszka.Kochmanska@zut.edu.pl), Piegat Agnieszka (Agnieszka.Kochmanska@zut.edu.pl), Piegat Agnieszka (Agnieszka (Agnieszka.Kochmanska@zut.edu.pl), Piegat Agnieszka (Agnieszka (Agnieszka.Kochmanska@zut.edu.pl), Piegat Agnieszka (Agnieszka.Kochmanska@zut.edu.pl), Piegat Agnieszka (Agnieszka.Kochmanska@zut.edu.pl), Piegat Agnieszka (Agnieszka.Kochmanska@zut.edu.pl), Piegat Agnieszka (Agnieszka.Kochmanska.Gent divided into various forms of instruction  First divided into various forms of instruction	Phase Transformations & Microstructure of Materials  MSE_1A_S_C11  Idalisation  In graculty  Department of Polymer and Biomaterials Science  5,0  Insecredit  Credits  Language  Elective group  Fuction  Cod Semester  Hours  ECTS  Weight  Realization  Insecret  A 4 15 1,0 0,30 K  Insecret  L 4 30 2,0 0,30 K  Insecret  EI Fray Miroslawa (Miroslawa.EIFray@zut.edu.pl)  EI Fray Miroslawa (Miroslawa.EIFray@zut.edu.pl), Kiełbasa Karolina (Karolina.Kielbasa@zut.edu.pl), Kochmańska Agnieszka (Agnieszka.Kochmanska@zut.edu.pl), Piegat Agnieszka (Agnieszka.Piegat@secret in the area of phase transformations and microstructure of a pain the knowledge, skills and competences in the area of phase transformations and microstructure of a pain the knowledge, skills and competences in the area of phase transformations and microstructure of a pain the knowledge, skills and competences in the area of phase transformations and microstructure of a pain the knowledge, skills and competences in the area of phase transformations and microstructure of a pain the knowledge, skills and competences in the area of phase transformations and microstructure of a pain the knowledge, skills and competences in the area of phase transformations and microstructure of a pain the knowledge, skills and competences in the area of phase transformations and microstructure of a pain the knowledge, skills and competences of polymers – analysis and interpretation of DSC thermograms  the glass transition temperature – analysis and interpretation of XRD diffractograms and aman spectra

			Cai i CCiiii	ology all	<u> </u>		.9			
		livided into various forms of instru	uction					Nur	nber o	
T-W-10	Therm	al phase transitions in polymers								3
Student w	orkload	d - forms of activity						Nur	nber o	f hours
A-A-1	Partici	pation in recitations								15
A-A-2	prepar	ing of written reports								10
A-A-3	self-stu	udy of the literature								5
A-L-1	parcitp	pation in laboratory exercises								30
A-L-2	individ	ual study of literature								10
A-L-3	consul	tations								5
A-L-4	prepar	ing written reports								15
A-W-1	parcitp	pation in lectures								30
A-W-2	Individ	ual literature studies								8
A-W-3	Consul	tations								3
A-W-4	prepar	ing for tests								20
Teaching	method	ls / tools						· ·		
M-1	lecture	es with presentation								
M-2	subjec	t discussion during lectures and labor	atories							
M-3	self stu	ıdies								
Evaluation	n metho	ods (F - progressive, P - final)								
S-1	Р	written completion of lectures and la	aboratories							
S-2	F	laboratory reports								
S-3	F	student activity during laboratories a	and discussion							
		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	Course	e content	ontent Teaching methods	
Knowledg	e									
	has the k	nowledge of common aspect of phase nicrostructure 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				!	•		•		·	•
	has the k	nowledge of common aspect of phase nicrostructure 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 con	npeten	ces								
	is aware o	of the importance of phase nicrostructure 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					
Knowledg	e									
MSE_1A_C11		2,0								
		3,0 Positive grade of the final test (m	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 (m	nore than 55% corr	ect answers)						
		3,5								
		4,0		· · · · · · · · · · · · · · · · · · ·						
		4,5								
		5,0								



Other social com	npetenc	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 stu	udv	Mate	erials Scienc	e and Engineeri	na				
Mode of st			onary	Level		first o	cycle		
	s qualification	inży		2070.		50	.,,	WTil(	Ch Ch
Fields of s	•	-		technology				* * * * * * * * * * * * * * * * * * * *	
		<u> </u>							_
	s of science			eering (100%)					
Education	al profile	gene	eral academ	IC					
Module									
Course un	it			Biochemical Er	ngine	ering			
Code		MSE	_1A_S_C12					\	
Field of sp	ecialisation								
Administe	ring faculty	Depa	artment of C	Chemical and Pro	cess E	ngineer	ring		_
ECTS		4,0		ECTS (forms)		4,0			
Form of co	ourse credit	cred	its	Language		english	ı		
Electives				Elective group					
Form of in	struction	Cod	Semester	Hours	F(	TS	Weight	Realization	Credit
							_	K	credits
lecturing o		A	4	15		,0	0,25		
project co	urse	Р	4	30		,0	0,50	K	credits
lecture		W	4	15		,0	0,25	K	credits
Leading te	eacher			upak Agata (Aga					
Other tead	chers		kowska-Szcz al.Rakoczy@	upak Agata (Aga Zut.edu.pl)	ata.Ma	rkowska	a@zut.edu.pl),	Rakoczy Rafał	
Prerequisi	tes								
W-1	Basic knowledge of	biolo	gy and chemi	stry, finshed cours	se of m	athemati	CS		
Module/co	urse unit objective	==== es							
C-1	The objective of the (bio)chemical and (processes themselv complex the install	(bio)pı ves, e	rocess engine specially large	ers well-trained in	chemi	cal and b	iochemical proce	ess equipment as	well as the
Course co	ntent divided into	vario	us forms of	instruction					Number of hours
T-A-1	Fermentation kinet								5
T-A-2	Modeling and simu								5
T-A-3	Predicting Reactor	bioma	ss concentra	tion					5
T-P-1	Preparation of own biofactories, probio drink, production of	otics,	biofertilizers,	biopesticides, bloc	od prod				30
T-W-1	What is chemical a			<b>.</b>		and Biop	rocess engineeri	ng	2
T-W-2	Media formulation/s	steriliz	zation in biopi	rocess engineering	]				2
T-W-3	Industrial strain de	velopr	ment. Cell gro	wth kinetics. Effec	t of cu	ture con	ditions.		2
T-W-4	Bioreactor design &	x scale	eup (e.g. airlif	t reactor, stirred a	nd air-	driven et	c.)		3
T-W-5	Fermentation techr	nologi	es						3
T-W-6	Large-scale produc	tion o	f enzymes. M	edical and Industr	ial Utiliz	zation of	Enzymes.		3
	orkload - forms of								Number of hours
A-A-1	Participation in reci								15
A-A-2	preparing of writter		orts						8
A-A-3	self-study of literat	ure							5
A-A-4	Consultations								2
A-P-1	preparation of own	proje	ct on given su	ıbject					30
A-P-2	consultations	orat							10
A-P-3 A-W-1	Self-study of the lit participation in lect		<del>-</del>						20 15
A-W-2	self-study of literat								8
7-VV-Z	Sen-study of literat	ui C							0



orkload	d - form	s of activity	Number of hours							
individ	ual cons	ultations						2		
prepar	ation for	test								5
nethod	ls / tool	S								
lecture	!S									
disscus	sion duri	ng lectures and seminar								
Private	study									
metho	ods (F -	progressive, P - final)								
F		·								
F	semina	r								
F	private	study								
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			Teaching methods	Evaluation methods
9										1
W01 displays nalyze ki riate bio	netics of reactor m	bioreactor processes, design or odels based upon bioproducts	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
U01 able crit s; analyz	ically ana ze and int	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
peten	ces									
K01 icquire a n both in	n appreci dustry an	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
nes	Grade		E	valuation cr	iterion	•				<u> </u>
9										
W01	2,0 3,0 3,5 4,0 4,5 5,0	51% of test points, 30% of project	ct points							
<u>U</u> 01	2,0 3,0 3,5 4,0 4,5 5,0	Have a fundamental understandi calculations.	ng of chemostats a	nd their applica	ations, and be al	ole to pe	rform the	e corresp	oonding	
al com		 ⊇S								
K01	2,0 3,0 3,5 4,0 4,5 5,0		uring course with t	he help of the c	colleaguss and a	teacher				
	individ prepar method lecture disscus Private F F F  Design  wo1 displays halyze ki riate biol and othe  wo1 displays halyze ki riate biol and other  wo1 displays halyze ki riate biol and other	individual consists preparation for methods / tool lectures disscusion duri Private study methods (F - F lecture: F semina F private  Designed lear Private  Designed lear Private  U01 Seminal F private  W01 Seminal F private  W02 Seminal F private  W03 Seminal F private  W03 Seminal F private  W04 Seminal F private  W05 Seminal F private  W06 Seminal F private  W07 Seminal F private  W08 Seminal F private  W09 Seminal F private  W01 Seminal F private  W01 Seminal F private  W02 Seminal F private  W03 Seminal F private  W03 Seminal F private  W04 Seminal F private  W05 Seminal F private  W07 Seminal F private  W08 Seminal F private  W09 Seminal F private  W09 Seminal F private  W09 Seminal F private  W01 Seminal F private  W01 Seminal F private  W02 Seminal F private  W03 Seminal F private  W04 Seminal F private  W05 Seminal F private  W07 Seminal F private  W08 Seminal F private  W09 Seminal F private  W09 Seminal F private  W09 Seminal F private  W01 Seminal F private  W01 Seminal F private  W02 Seminal F private  W03 Seminal F private  W04 Seminal F private  W05 Seminal F private  W07 Seminal F private  W08 Seminal F private  W09 Seminal F private  W09 Seminal F private  W01 Seminal F private  W01	disscusion during lectures and seminar  Private study  methods (F - progressive, P - final)  F lectures with presentation  F seminar  F private study  Designed learning outcomes  Wo1  displays comprehensive knowledge of bioreactor nalyze kinetics of bioreactor processes, design or riate bioreactor models based upon bioproducts and other process criteria  Wo1  able critically analyze biochemical engineering s; analyze and interpret experimental biochemical petences  Ko1  cquire an appreciation for the role of biochemical hobth industry and academia.  Designed learning outcomes  Wo1  able critically analyze biochemical engineering s; analyze and interpret experimental biochemical hobth industry and academia.  Designed learning outcomes  Ko1  2,0  3,0  Have a fundamental understandical calculations.  3,5  4,0  4,5  5,0  al competences  Ko1  2,0  3,0  Student is able to finish all task of 3,5  4,0  4,5  5,0  4,5  4,0  4,5  5,0  A,5  4,0  4,5  5,0  A,5  A,0  A,0	individual consultations preparation for test  methods / tools  lectures  disscusion during lectures and seminar  Private study  methods (F - progressive, P - final)  F lectures with presentation  F seminar  F private study  Designed learning outcomes  W01  displays comprehensive knowledge of bioreactor nalyze kinetics of bioreactor processes, design or riate bioreactor models based upon bioproducts and other process criteria  W01  able critically analyze biochemical engineering sy analyze and interpret experimental biochemical pretences  W10  Cquire an appreciation for the role of biochemical biochemical biochindustry and academia.  MSE_1A_U05  MSE_1A_K02  MSE_1A_K02	individual consultations preparation for test  methods / tools lectures  disscusion during lectures and seminar Private study  methods (F - progressive, P - final) F lectures with presentation F seminar F private study  Designed learning outcomes  designed or the felds of the felds of study learning outcomes a study  MEDISTRICT STATES S	individual consultations preparation for test methods / tools lectures disscusion during lectures and seminar Private study  methods (F - progressive, P - final)  F lectures with presentation F seminar F private study  Designed learning outcomes  Reference to the learning patrones dispered study flees of broad study flees of 27 that enable acquiring accorders and study flees of 27 that enable acquiring accorders and study flees of 27 that enable acquiring accorders and study flees of 37 that enable acquiring accorders and study flees of 37 that enable acquiring accorders and study flees of 37 that enable acquiring accorders and study flees of 37 that enable acquiring accorders and study flees of 37 that enable acquiring accorders and study flees of 37 that enable acquiring analyse comprehensive knowledge of bioreactor ladyze kinetics of bioreactor processes, design or nalyze kinetics of bioreactor processes, de	individual consultations preparation for test methods / tools lectures disscusion during lectures and seminar Private study methods (F - progressive, P - final) F   lectures with presentation F   seminar F   private study  Designed learning outcomes    Seminar   F   private study	individual consultations preparation for test methods / tools lectures disscusion during lectures and seminar Private study methods (F - progressive, P - final) F   lectures with presentation F   seminar F   private study  Designed learning outcomes    Reference to the leading outcomes   Reference to the learning outcomes   Reference to the l	individual consultations preparation for test  methods / tools  lectures  disscusion during lectures and seminar Private study  F   lectures with presentation F   seminar F   private study  Designed learning outcomes    Individual consultations   Individual consul	individual consultations preparation for test  methods / tools   ectures  disscussion during lectures and seminar

- 1. Shigeo Katoh, Jun-ichi Horiuchi, Fumitake Yoshida, Biochemical Engineering: A Textbook for Engineers, Chemists and Biologists, 2nd, Completely Revised and Enlarged Edition, Wiley, 2015, 2
- 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



#### 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



Field of s	tudy	Mate	erials Scienc	e and Engineerii	ng				
Mode of	study	stati	onary	Level		first o	cycle	) A (T-1)	~ 1
Graduate	e's qualification	inżyi	nier					WTil(	_h
Fields of			neering and	technology					
Discipline	es of science	mate	erials engine	eering (100%)					
•	nal profile	-	eral academ					1	
Module								† I 🔳	
Course u	nit	Sma	ert and Nar	nomaterials				1 7	
Code	THE	-	_1A_S_C13	iomaceriais					Ç
	pecialisation	INISE.	_17_5_015					\	
	ering faculty	Don	artment of N	Materials Techno	logy				
ECTS	ering racuity	6,0	artificit of N	ECTS (forms)	юду	6,0			
	course credit	<u> </u>	ningtion			-		_	
		exar	nination	Language		english	1	1	
Electives				Elective group			T.		
	nstruction	Cod	Semester	Hours		TS	Weight	Realization	Credit
lecturing	course	Α	4	15	1	,0	0,25	K	credits
laborator	ry course	L	4	30	4	,0	0,50	K	credits
lecture		W	4	15	1	,0	0,25	K	examination
Leading	teacher	Pasz	kiewicz San	dra (Sandra.Pas:	zkiewi	z@zut.	edu.pl)		
Prerequis W-1 Module/c C-1	The lecture aims in chemistry is requir	ed es n provi	iding to stude	nts general inform	nation a	bout nar	nomaterials, the	ir structure, and p	roperties. Students
	practical skills duri	ng lab	oratories and	auditorium classe					
Course co	Optical properties					tubos)	LIV Vic spectrum		Number of hours
T-A-1 T-A-2	Vibronic properties						·		3
T-A-3	3D types high tem			<u> </u>			<u> </u>	ition	3
T-A-4	Analysis on the oxi	'							2
T-A-5	Chemical structure								2
T-A-6	Different technique	es of li	quid crystals	analysis. Application	on of lic	uid crys	tals – case studi	es	3
T-L-1	Study on high tem	peratu	re materials (	TGA/DSC study)					5
T-L-2	Morphological stud								5
T-L-3	Determination of the microscope.				·	•	J		5
T-L-4	Determination of the differential scanning			hase transitions a	nd thei	renergy	effects of liquid	crystals using	5
T-L-5	Measurements of U	JVVis s	spectra of sing	glewalled carbon r	nanotub	es (1D n	naterial)		5
T-L-6	Study on 1D & 2D		<u> </u>	<u> </u>					5
T-W-1	Layered materials						· · · · ·	5	3
T-W-2	One-dimensional m			<u> </u>			onse		2
T-W-3									
T-W-4 3D types high temperature materials (carbides, nitides, borides etc.)  Liquid crystals – classification according molecular order, thermotropic LC, lyotropic LC and their									3
T-W-5	properties							und then	2
T-W-6	Liquid crystalline p	olyme	rs – classifica	tion, chemical stru	icture a	nd prope	erties.		3
Student	workload - forms of	activ	ity						Number of hours

		Faculty of Chem	iicai recnn	ology an	a Engine	eerin	19			
Student w	orkload	l - forms of activity						Nur	nber of	f hours
A-A-1	Partici	oation in recitations								15
A-A-2	Prepar	ation for recitations								13
A-A-3	Taking	part in exam.								2
A-L-1	Partici	oation in laboratory classes								30
A-L-2		ation for laboratory exercises								60
A-L-3	Taking	part in exam.								2
A-L-4	Prepar	ation of reports								28
A-W-1		pation in lectures.								15
A-W-2		g acquainted with literature (article	s, books, patents)					12		
A-W-3	Partici	pation in consultations								2
A-W-4	Access	ion to the exam								1
Teaching r	method	ls / tools								
M-1	Inform	ative lecture (presentation prepared	d in PowerPoint)							
M-2	Group	discussion								
Evaluation	n metho	ods (F - progressive, P - final)								
S-1	P	Written exam								
S-2	F	Brain storm during lectures, labora	ntories etc Quest	ions and Repli	ies					
<i>S-3</i>	F	Report preparation (at auditorium								
	Design	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 content		Teaching methods	Evaluation methods
Knowledge	е					1	-		-	
MSE 1A C13	_W01 ribes sele	ected issues 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						1	1 5		-	
MSE_1A_C13_ Student chara		smart and 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-6	M-2	S-2 S-3
Social com	npeten	ces								
MSE_1A_C13_ The student u application of	_ understar	nds the importance of fabrication and nanomaterials	MSE_1A_K02	P6S_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-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	S-1 S-3
Outcon	nes	Grade	E	valuation cr	iterion					
Knowledge	 e	1								
MSE_1A_C13_		2,0 3,0 Student describes selected issu 3,5 4,0 4,5	ues at a basic level (	score => 50%)						
Chilla		5,0								
Skills	1101	2.0								
MSE_1A_C13_	_001	2,0 3,0 Student describes selected issu 3,5 4,0 4,5	ues at a basic level (	score => 50%)						
		5,0								



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 of stu	udy	Mate	erials Scienc	e and Engineeri	ng					
Mode of st	tudy	stat	ionary	Level		first o	cycle	\A/T:ICb		
Graduate's	s qualification	inży	nier					WTil(	Jh	
Fields of so	cience	eng	ineering and	technology					_	
Disciplines	s of science	mat	erials engine	ering (100%)						
Education	al profile	gen	eral academ	ic						
Module	·									
Course uni	it	Mat	erials Char	acterization a	nd An	alvtical	Techniques		CIL	
Code	· -		_1A_S_C14			<b>,</b>		\ <b>.</b>		
	ecialisation									
-	ring faculty	Dep	artment of C	atalytic and So	rbent N	1aterials	Engineering			
ECTS		5,0		ECTS (forms)		5,0			_	
	ourse credit	cred	lits	Language		english				
Electives		0.00		Elective group		0.19.101				
Form of in:	struction	Cod	Semester	Hours	EC	CTS	Weight	Realization	Credit	
laboratory		L	5	30		,0	0,50	K	credits	
lecture		W	5	30		,0	0,50	K	credits	
Leading te	achar	<u> </u>		afal.Wrobel@zut			0,50		Credits	
Lendzion-Bieluń Zofia (Zofia.Lendzion-Bielun@zut.edu.pl), Mijowska Palen@zut.edu.pl), Moszyński Dariusz (Dariusz.Moszynski@zut.edu.pl) (Jacek.Przepiorski@zut.edu.pl), Sośnicki Jacek (Jacek.Sosnicki@zut.edu.pl)									piórski Jacek	
Prerequisit	tes									
W-1	no prerequirements	S								
Module/co	urse unit objective	es								
C-1	Learning of principl	es of	most importa	nt analytical tech	niques					
Course cor	ntent divided into	vario	ous forms of	instruction					Number of hours	
T-L-1	Analysis of surface Spectroscopy	comp	osition by X-r	ay Photoelectron					5	
T-L-2	Transmission electranalysis			•					5	
T-L-3	Raman spectroscop presentation and in			thnique in carbon	nanotu	bes inves	stigations: mesur	ements, data	5	
T-L-4		ne sui	face acidity	-			•	_	5	
T-L-5						viding qu	ualitative and qua	antitative	5	
T-L-6						alysis			5	
T-W-1			y Photoelectro	n Spectroscopy a	nd Auge	er			5	
T-W-2			icroscopy and	microanalysis					4	
T-W-3									4	
T-W-4	Scanning tunnelling			•	y, elec	tron field	microscopy, ion	field	3	
strength, identify the surface acidity  T-L-5  High-resolution solution-state NMR as a versatile technique providing qualitative and quantitative information on the chemical structure of a polymeric material  T-L-6  Cold field emission scanning electron microscopy with microanalysis  T-W-1  Surface analysis by X-ray Photoelectron Spectroscopy and Auger Electron Spectrroscopy  T-W-2  Transmission electron microscopy and microanalysis  T-W-3  Scanning electron microscopy and microanalysis  T-W-4  Scanning tunnelling microscopy, atomic force microscopy, electron field microscopy, ion field microscopy  T-W-5  Thermal analysis of materials: microcalorymetry and thermogravimetry									6	
T-W-6	Raman spectroscop	y - fu	ındamentals a	nd materials anal	ysis				3	
T-W-7	Temperature progr	amm	ed techniques	(TPR, TPO, TPD,)	in the c	haracter	istics of mater		5	
Student w	orkload - forms of	activ	vity						Number of hours	
A-L-1	participation in labo	orato	У						30	
A-L-2	Consultations								4	
A-L-3	Preparation of rapo			1					28	
A-L-4	self-study of the lite		re						28	
A-W-1	participation in lect	ures							30	
A-W-2	Consultations								2	



Student wo	orkload	l - form	ns of activity						Nui	mber o	f hours
A-W-3	literatu	ire stud	у								15
A-W-4	probler	n solvir	ng								13
Teaching r	nethod	ls / too	ls								
M-1	Lecture										
M-2	Labora										
			, D ( )								
			progressive, P - final)								
S-1	F	Test									
S-2	Р	Passing	g 			ı	1			1	
	Design	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	e content	Teaching methods	Evaluatio methods
Knowledge	è			1	1	I		•			•
MSE_1A_C14_				MSE_1A_W03	P6S_WG	P6S_WG	C-1	T-W-2	T-W-4	M-1	S-1
Student prope MSE 1A C14		ribes mic	croscopy techniques	1.000.00	P6S_WK			T-W-3		1	S-2
Student descr temperature p	ibes app		and working principles of	MSE_1A_W05	P6S_WG P6S_WK		C-1	T-W-5	T-W-7	M-1	S-1 S-2
Skills	Jiogrann	neu tech	iniques								-
MSE 1A C14	e to work	c alone w	vith scanning electron microscopy	MSE_1A_U07	P6S_UW	P6S_UW	C-1	T-L-6		M-2	5-2
Social com		es									
								T-L-1	T-L-4		
Student is abl	e to anal	yse expe	erimental data	MSE_1A_K02	P6S_KK	P6S_WK	C-1	T-L-2 T-L-3	T-L-5 T-L-6	M-2	S-2
Outcom	nes	Grade		F	 Evaluation cri	iterion	l				
Knowledge		o.uuc	1		- Variadelori eri						
MSE_1A_C14_		2,0									
02_1/ _01		3,0	Student is able in basic lavel to o	describe microscop	y techniques						
		3,5		<u> </u>	,						
		4,0									
		4,5									
MCE 14 C14	14/02	5,0									
MSE_1A_C14_	W02	2,0 3,0	Student is able to explain working	a principles of TCA	and TDD tachni	anoc					
		3,5	Student is able to explain working	ig principles of TGA	and IPD techni	ques					
		4,0									
		4,5									
		5,0									
Skills											
MSE_1A_C14_	U01	2,0									
		3,0	Student is able to introduce the	sample into the mi	croscope and ob	tain sharp pictu	re at lov	<i>ı</i> magnif	ications		
		3,5									
		4,0									
		4,5 5,0									
Other soci	al comi	l	00								
UUIEL SUUI		2,0									
		3,0	Student is able to deliver most for	undamental inform	ation on the bas	sis of raw data o	btained	durina 4	experime	ents	
		,_	1								
		3,5									
		3,5 4,0									
MSE_1A_C14_											

1. Daniel C. Harris, Quantitative Chemical Analysis, W. H. Freeman and Company, New York, 2010

2. AR Clarke; CN EBERHARDT, Microscopy Techniques for Materials Science, CRC, 2002



Field of st	udy	Mate	erials Scienc	e and Engineeri	ng				
Mode of s	tudy	stati	onary	Level		first o	cycle	\A/T:1/	~ I_
Graduate'	's qualification	inży	nier	·				WTil(	Jn
Fields of s	science	engineering and technology						_	
Discipline	s of science	mate	erials engine	eering (100%)					<u> </u>
Education	al profile	gene	eral academ	ic					
Module									
Course un	nit	Poly	mer Synth	esis, Recyclin	g & Sa	fety			
Code		MSE	_1A_S_C15					\ <b>B</b>	CIL
Field of sp	pecialisation								
Administe	ering faculty	Dep	artment of P	olymer and Bio	materia	als Scie	nce		_
ECTS		5,0		ECTS (forms)		5,0			
Form of co	ourse credit	exar	mination	Language		english	ı		
Electives		Elective group							
Form of in	nstruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
laboratory	/ course	L	5	45	4	,0	0,70	K	credits
lecture		W	5	15	1	,0	0,30	K	examination
Leading to	eacher	El Fr	av Mirosław	a (Miroslawa.Elf	rav@z	ut.edu.ı	ol)		
Other tea	chers	(Mire Pasz (Agr	oslawa.ElFra kiewicz San nieszka.Piega	ata (Malgorzata y@zut.edu.pl), l dra (Sandra.Pas at@zut.edu.pl), szewska@zut.e	gnacza zkiewic Wilpisz	ik Wojci z@zut. ewska l	iech (Wojciech. edu.pl), Piegat Katarzyna	lgnaczak@zut. Agnieszka	edu.pl),
Prerequisi	ites								
W-1	Fundamentals of ch	nemis	try and physic	S					
Module/co	ourse unit objective								
C-1	To gain the knowle human aspects	dge, s	skills and com	petences in the fi	eld of po	olymer s	ynthesis, recyclir	g and safety in e	environmental and
Course co	ntent divided into	vario	us forms of	instruction					Number of hours
T-L-1	Radical polymeriza	tion o	f styrene in su	ıspension					5
T-L-2	Condensation polyr								5
T-L-3	Hydrogels from pho								5
T-L-4	Preparation of wast physicochemical pr			ling. Separation o	r polym	er mater	ials based on the	eir	4
T-L-5	Modification of plas		4						
T-L-6	Glycolysis of polym	er ma	aterials (PET, p	oolyurethane etc.)	)				4
T-L-7	Energy recycling of								3
T-L-8	Migration of substa		5						
T-L-9 T-L-10	Polymerization of P Obtaining limonene			<u>.</u>					5
T-L-10	Introduction to poly		•		of polym	nerizatio	n and depolymer	zation	1
T-W-2	reactions.  Chain and step-gro	wth n	olymerization	· monomers meth	nods in	troductio	on to kinetic aspe	cts	4
T-W-3	Copolymerization (						<u> </u>		2
T-W-4	Ionic polymerizatio	n (ani	onic, cationic,	catalyst, living po	olymers	), coordi	nation polymeriz	ation	3
T-W-5	(autoinhibition, Zie Bio-alternatives (bi	-	-						
T-W-6	Introduction to poly							ecveling	2
				ous or plustic re	cy cirrig,	acvice3	asca in piastic re	9	
A-L-1	orkload - forms of participation in labo								Number of hours 45
A-L-1 A-L-2	individual study of								30
A-L-3	consultations								15
_	1								



			Faculty of Chemi	cal lechn	ology an	d Engine	eerir	ıg			
Student wo	rkload	d - form	s of activity						Nun	nber o	f hours
A-L-4	prepar	ation of	written reports								30
A-W-1	partici	pation in	lectures								15
A-W-2	individ	lual stud	y of a literature							10	
A-W-3	consul	tations								2	
A-W-4	prepar	ation for	exam								3
Teaching m	nethod	ds / tool:	S								
M-1	Lectur	e with pr	esentation								
M-2	Labora	itory exe	rcises								
Evaluation	metho	ods (F -	progressive, P - final)								
S-1	F	Continu	ous assessment: laboratory r	reports and activ	ity						
5-2	F	Exam									
S-3	F	Final te	st								
	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	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_C15_V The student ha recycling and s	as the k		of common aspect of synthesis, ic 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				•							
MSE_1A_C15_U01 The student has skills in synthesis, recycling and safety of polymeric materials				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 comp	peten	ces			•			•			•
MSE_1A_C15_k The student ha polymeric mate	as 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
Outcom	es	Grade		E	valuation cri	iterion					
Knowledge											
MSE_1A_C15_V	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_U	J01	2,0 3,0 3,5 4,0 4,5 5,0	Positive grade of the final test (m	nore than 55% corn	ect answers)						
Other socia	al com	-	<u>.                                    </u>								
MSE_1A_C15_k	(01	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)						
Required re	eading	7									

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



#### 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 c	cycle	3 A / T : 1 A	C I
Graduate	's qualification	inży	nier	1				WTil(	Lh
Fields of s	science	engi	neering and	technology					_
Discipline	s of science	mate	erials engine	eering (100%)					
Education		gene							
Module		3 -							
Course ur	nit	Intr	o to Rioma	terials: Implar	nts and	d Devic	·AC		
Code	nc .	_	1A_S_C16a		ics and	a Devic		\ <b>.</b>	C
	pecialisation	IVISE	_1A_3_C10a						
		Don	artment of N	lanomatorials D	hysisas	homist	m.		
	ering faculty	<u> </u>	artifierit of N	Ianomaterials P	riysicoc	1	ТУ		
ECTS		6,0	••	ECTS (forms)		6,0			
	ourse credit	cred	its	Language		english			
Electives		5		Elective group			1		
Form of ir	nstruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
laboratory	y course	L	5	45	4	,0	0,50	K	credits
lecture		W	5	30	2	,0	0,50	K	credits
Leading to	eacher	Che	n Xuecheng	(Xuecheng.Che	n@zut.	edu.pl)			
Other tea		(Xue	cheng.Chen	nna (Anna.Bied @zut.edu.pl), O (psobolewski@	ssowic	z-Rupni	ewska Paula (F	aula.Ossowicz	@zut.edu.pl),
Prerequis	-								
W-1	Knowledge of the b	asic c	ourse in phys	ics and chemistry	at the	elementa	ary level		
Module/co	ourse unit objective								
C-1	To make student to devices	unde	erstand the ba	sic principles in b	iomater	ials desi	gn and characte	rization for impla	nts and medical
Course co	ontent divided into	vario	us forms of	instruction					Number of hours
T-L-1	Preparation patche								5
T-L-2	Determination of fa				drugs t	hrough b	piological membr	anes	5
T-L-3	Controlled release								4
T-L-4	Controlled release	of pro	teins: Materia	l characterization					4
T-L-5	Controlled release	of pro	teins: Assessr	ment of release					2
T-L-6	Metal-organic fram	ework	s derived fror	m biomass and wa	ste pol	mers			7
T-L-7	Characterization of	the p	roduced meta	al-organic framew	orks by	XRD			4
T-L-8	Characterization of							tion technique	4
T-L-9	Testing the resistar								3
T-L-10	Assessment of the						selected biomat	erials.	3
T-L-11	Assessment of bioa		· · · ·		Kokubo	test			4
T-W-1 T-W-2	Introduction to bior Biocompatibility an			<u> </u>					1
T-W-3	Introduction to con								1
T-W-4	Diffusion controlled			у					2
T-W-5	Chemically controll								2
T-W-6	Mesoporous silica r			lled delivery of dr	ugs				6
T-W-7	Transdermal Thera					es and p	atches		4
T-W-8	Molecular mechani			<u> </u>					3
T-W-9	Carbon fibers and r	nanop	articles as vei	rsatile materials fo	or medi	cal applic	cations		2
T-W-10	Materials for use in Pt, etc.), Ceramics (carbon-carbon, wi	(alum	inum oxide, c	alcium phosphate	s includ				2
T-W-11	Manufacturing of ir	nplant	ts ( stainless s	steels , CoCr alloy	s , Ti an	d its allo	ys, etc.).		2
				· · · · · · · · · · · · · · · · · · ·					

			nto various forms of instru						Nun	nber of	f hours	
		ages, d lical mat	isadvantages and examples of terials.	ceramics, metals	s, composites	used for the f	abricati	on of			1	
Student wo	rkload	l - form	s of activity						Nun	nber of	f hours	
A-L-1	particip	ation in	laboratory exercises								45	
A-L-2	prepari	ng for la	aboratory exercises								30	
A-L-3	prepara	ation of	reports						2			
A-L-4	Prepari	ng for te	ests									
A-L-5	Consult	tations							5			
A-W-1	particip	ation in	lectures								30	
A-W-2	Individ	ual litera	ature studies						13			
A-W-3	Prepari	ng for te	ests								15	
A-W-4	Cosulta	itions									2	
Teaching m	ethod	s / tool:	S						<u> </u>			
M-1	lecture	s with p	resentation									
M-2	laborat	ory										
M-3	subject	discuss	ion during laboratories									
M-4	self stu	dies										
Evaluation	metho	ds (F -	progressive, P - final)									
S-1			passing test									
5-2	F laboratory reports											
<b>5-3</b>	F student activity											
[ Knowledge	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 content		Teaching methods	Evaluation methods	
MSE_1A_C16a_ basic knowledgapplication of b	ge in the		synthesis, 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					•							
	asic sco		thesize, characterization and rials 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 comp	petenc	es										
	n synthe		acterization and application of a 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-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	M-1 M-2 M-3	S-1 S-2	
Outcom	es	Grade		E	valuation cr	iterion						
Knowledge												
MSE_1A_C16a_	W01	2,0										
		-,-	from 50 to 55% of percentage po	ints								
		3,5										
		4,0										
		4,5 5,0										
		٥,٥										



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 com	petenc	es
MSE_1A_C16a_K01	2,0	
	3,0	from 50 to 55% of percentage points
	3,5	
	4,0	
	4,5	
	5,0	

#### 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



	· `		- <del>y                                    </del>	Ciliicai i cc				
Field of st	tudy	Mate	rials Sciend	ce and Engineeri	ng			
Mode of s	study	statio	onary	Level	first o	cycle	MITHO	1_
Graduate	's qualification	inżyr	nier		•		WTilC	.n
Fields of s	science	engir	neering and	d technology				_
Discipline	s of science	mate	erials engin					
Education	nal profile	gene	ral academ	nic			†	
Module	,	1						
Course ur	 nit	Intro	o to Bioma	nterials: Drug D	elivery and	Biosensina		
Code		_	1A S C16k		circiy and	2.0309	· (	
	pecialisation	1132					· \ 📄	
	ering faculty	Dona	rtmont of l	Nanomaterials Ph	vsicachamist	n.	-	
	ering racuity	<u> </u>	artifierit of i			ГУ		
ECTS	,,,	6,0		ECTS (forms)	6,0			
	ourse credit	credi	its	Language	english	<u> </u>	_	
Electives		5		Elective group				
Form of ir	nstruction	Cod	Semester	Hours	ECTS	Weight	Realization	Credit
laborator	y course	L	5	45	4,0	0,50	K	credits
lecture		W	5	30	2,0	0,50	K	credits
Leading to	eacher	Chen	Nuecheng	(Xuecheng.Cher	n@zut.edu.pl)			
Other tea	chers	(Xue	cheng.Chei	Anna (Anna.Biedu n@zut.edu.pl), O r (psobolewski@a	ssowicz-Rupni	ewska Paula (	Paula.Ossowicz@	zut.edu.pl),
Prerequis	ites							
W-1	Knowledge of the I	basic co	ourse in phy	sics and chemistry	at the elementa	ary level		
Module/co	ourse unit objectiv	 'es						
C-1	•		rstand the b	asic mechanisms o	f drug delivery a	and biosensing	with the use of vari	ous classes of
Course co	ontent divided into	vario	us forms of	instruction			1	Number of hours
T-L-1	Preparation patche	es cont	aining terpe	ne compounds				5
T-L-2	Isolation of raw ma	aterials	for use in m	edical polymers				5
T-L-3	Microparticles for p							4
T-L-4	Microparticles for p							4
T-L-5	Microparticles for p							2
T-L-6	Preparation of por					<u> </u>		7
T-L-7	Characterization o	•	•	•				4
T-L-8	Characterization o							4
T-L-9	Investigation of su implants.	пасе м	rectability an	iu evaluation of the	: iiiiiuence on th	ie iuricuonai pro	percies 0i	3
T-L-10	Investigation of the			· · · · · · · · · · · · · · · · · · ·		vironments.		3
T-L-11	Assessment of bio				modification			4
T-W-1	Introduction to bio			<u> </u>				1
T-W-2	Biocompatibility ar		•					4
T-W-3	Introduction to cor		drug delive	ry				1
T-W-4	Targeted drug deli							2
T-W-5	Nanoparticles for o							2
T-W-6	Mesoporous silica							3
T-W-7	Transdermal Thera							2
T-W-8	Biomass derived p			· · · · · · · · · · · · · · · · · · ·		sector		5
T-W-9	Carbon-based poly		5					
T-W-10	Materials for ortho							1
T-W-11	Osseointegration is	ssues b	etween the	pone and the surfa	ice of the implai	nted implant		1

Course cor	-		into various forms of instru						Nui	mber o	f hours	
T-W-12	morpho	ology an	m on the surface of implants. Id topography on the induced	response of bio	logical objects	<b>5.</b>					1	
T-W-13	and me	echanica	on of the surface of biomedic al properties dental ceramics.			•					1	
T-W-14			r,Cr:YSGG and Diode Laser Ap Baumannii and Pseudomonas		ental implant s	urfaces conta	minated	d with			1	
Student wo	rkload	l - form	s of activity						Nui	mber o	f hours	
A-L-1	particip	oation in	laboratory exercises							4		
A-L-2	prepara	ation for	laboratory exercises							2		
A-L-3	prepara	ation of	reports							30		
A-L-4	Prepari	ing for t	ests								20	
A-L-5	Consul	tations									5	
A-W-1	particip				30							
A-W-2	Individ				13							
A-W-3	Prepari				15							
A-W-4	Consul			2								
Teaching n	nethod	ls / tool	S									
M-1			resentation									
M-2	labolar											
M-3	subject											
M-4	self stu											
			progressive, P - final)									
S-1	P											
S-2	- Pro- 3											
S-2 S-3	F laboratory reports F student activity											
3-3	-	studeni	- activity	T	T	T					T	
	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	ı				1							
MSE_1A_C16b basic knowled application of	ge in the	e area of rials	synthesis, 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 T-W-9	M-1	S-1	
Skills												
	asic sco selected		thesize, characterization and rials 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-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 com	petend	ces										
MSE_1A_C16b competences selected biom biosensing	in synthe	esis, char in the are	acterization and application of ea of drug delivery and	MSE_1A_K02	P6S_KK	P6S_WK	C-1			M-1 M-2 M-3	S-1 S-2	
Outcom	ies	Grade		E	Evaluation cr	iterion						
Knowledge												
MSE_1A_C16b	_W01	2,0										
		3,0	from 50 to 55% of percentage po	oints								
		3,5										
		4,0										
		4,5										
		5,0										



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 social com	petenc	es
MSE_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
- 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



			-,			- 9, -		9	
Field of st	udy	Mate	erials Scienc	e and Engineeri	ng				
Mode of s	tudy	stati	onary	Level		first o	cycle	3 A / T : 1	C I
Graduate'	s qualification	inżyi	nier			1		WTil	Ch
Fields of s	cience	engi	neering and	technology					_
Disciplines	s of science	mate	erials engine	eering (100%)				_	
Education	al profile	gene	eral academ	ic					
Module	-								
Course un	it	Stru	ctural Def	ormation in Ma	ateria	s			C
Code		MSE	1A_S_C17a					\	
Field of sp	ecialisation								
-	ring faculty	Depa	artment of P	olymer and Bior	materia	als Scier	nce		
ECTS	<u> </u>	5,0		ECTS (forms)		5,0			
	ourse credit	cred	its	Language		english			
Electives		6		Elective group					
	Form of instruction aboratory course		Semester	Hours	E/	TS	Weight	Realization	Credit
		Cod L	5	45		,0	0,50	K	credits
lecture	course	W	5	30		,0 ,0	0,50	K	credits
Leading to				a (Miroslawa.ElF				K	credits
Other tead		Wojo (Agn	ciech (Wojcie iieszka.Koch	y@zut.edu.pl), I ech.lgnaczak@z manska@zut.ec ztof (Krzysztof.k	ut.edu lu.pl), l	pl), Koc Kochma	hmańska Agni ński Paweł (Pa	eszka wel.Kochmans	
Prerequisi	1								
W-1	Fundamentals of m	athen	natics and phy	ysics. Fundamenta	als of m	echanics	<b>5.</b>		
	urse unit objective								
C-1	To gain the knowle	dge, s	kills and com	petences in the fi	eld of st	ructural	deformations of	engineering mat	erials
	ntent divided into								Number of hours
T-L-1	Influence of the str					mers			5
T-L-2 T-L-3	Evaluation of teme Introduction to elas			<u> </u>	ixation				5
T-L-3	Determination of d		·		nder-has	ed laver	·s		5
T-L-5	Preparation and me		<u> </u>						5
T-L-6	Studies on stress le							metals	5
T-L-7	deformability Studies on thermal	recov	ery of metals	microstructure a	nd nror	erties			5
T-L-8	Study on microstru					Cities			5
T-L-9	Study on microstru								5
T-W-1	Stress corrosion an					. Corrosi	on protection me	thods	6
T-W-2	Reinforcing method reinforcement corre			ials. Steel reinford	ced and	prestres	ssed concrete ma	terials. Steel	2
T-W-3	Deformation abilitie	es, me	chanical and	barrier features o	f filled p	oolymer	layers		2
T-W-4	Basics of fracture n								2
T-W-5	Creep and relaxation			elastic recovery a	and per	manent	set		2
T-W-6	Interface fracture r								2
T-W-7	Fatigue crack grow								2
T-W-8	Wear of composites  Deformation mechanisms		•		on micr	ostructui	re and metals pro	operties:	2
T-W-9	recovery mechanis	ms aft	ter stress indu	uced deformation			·		6
T-W-10	Technologies of m	echan	ical deformat	ion for tailoring m	echanio	al prope	rties of metals		4
	orkload - forms of								Number of hours
A-L-1	participation in lab	orator	y exercises						45



		racuity of Chemi	icai reciiii	ology all	u Liigiii		<u></u>				
Student workl	oad - forr	ns of activity						Nun	nber o	f hours	
A-L-2 ind	ividual stu	dy of literature			25						
A-L-3 pre	paration o	f written reports								20	
A-W-1 par	ticipation	in lectures							30		
<i>A-W-2</i> ind	ividual stu	dy of literature								20	
A-W-3 con	sultations									10	
Teaching met	hods / tod	ols									
-	ture										
M-2 Lab	oratory ex	rercises									
Evaluation me	thods (F	- progressive, P - final)									
S-1 F		· -									
S-2 F											
Des		arning 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_C17a_W0 The student has the deformation in diff	ne knowledg	e of common aspect of structural eering 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											
	cills of ident	ification, description and als 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 compet	ences						.1			•	
	stands the i	mportance of structural naterials in practical applications	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-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	
Outcomes	Grade	e	E	valuation cr	iterion					•	
Knowledge											
MSE_1A_C17a_W0	1 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_U0	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 c	_	in the second se									
MSE_1A_C17a_K01		Positive grade of the final test (n	nore than 55% corr	ect answers)							
Required read	<b>!</b>	1									



#### 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



Field of study	,	1						1	
		Mate	rials Science	e and Engineeri	ng				
Mode of study	У	statio	onary	Level		first c	cycle	VA/T:1/	~ L
Graduate's qu	ualification	inżyn	nier					WTil(	∟n
Fields of scien	nce	engir	neering and	technology					_
Disciplines of	science	mate	rials engine	eering (100%)					
Educational pr	rofile	gene	ral academi	ic					
Module									
Course unit		Fatio	ue. Fracti	ure and Wear					
Code			1A S C17b					\ <b>.</b>	
Field of specia	alisation								
Administering				Organic Chemica	al Tech	nology a	and Polymer		
ECTS	, ,	Mate 5,0	riais	ECTS (forms)		5,0			
			L-					_	
Form of course credit Electives Form of instruction laboratory course		credits Language english							
Electives		6		Elective group					
Form of instru	uction	Cod	Semester	Hours	EC	CTS	Weight	Realization	Credit
laboratory cou	urse	L	5	45	3	,0	0,50	K	credits
lecture		W	5	30	2	,0	0,50	K	credits
Leading teach	her	Kowa	alczyk Krzys	ztof (Krzysztof.l	Kowalc	zyk@zut	t.edu.pl)		
Other teachers	rs	(Seba	astian.Frysk	y@zut.edu.pl), a@zut.edu.pl), nieszka (Agnies	Ignacza	ak Wojci		.lgnaczak@zut.	edu.pl),
		(Paw	el.Kochman	iski@zut.edu.pl) na (Karolina.Wil	, Kowa	lczyk Kr	zysztof (Krzysz		
Prerequisites		(Paw	el.Kochman	ıski@zut.edu.pl)	, Kowa	lczyk Kr	zysztof (Krzysz		
·		(Paw Wene	el.Kochman elska Karolii	ıski@zut.edu.pl)	, Kowa gosz@:	lczyk Kr zut.edu.	zysztof (Krzysz pl)		
W-1 Fun		(Paw Wene	el.Kochman elska Karolii	ski@zut.edu.pl) na (Karolina.Wil	, Kowa gosz@:	lczyk Kr zut.edu.	zysztof (Krzysz pl)		
W-1 Fun Module/course	ndamentals of m	(Paw Wene athem	el.Kochman elska Karolii atics and phy	ski@zut.edu.pl) na (Karolina.Wil	, Kowa gosz@z als of m	lczyk Kr zut.edu. echanics	zysztof (Krzysz pl)	ztof.Kowalczyk(	@zut.edu.pl),
W-1 Fun  Module/course C-1 To 0	ndamentals of m	(Paw Wene athem es dge, sk	el.Kochman elska Karolin atics and phy kills and com	ski@zut.edu.pl) na (Karolina.Wil ysics. Fundament petences in the fi	, Kowa gosz@z als of m	lczyk Kr zut.edu. echanics	zysztof (Krzysz pl)	ztof.Kowalczyk(	@zut.edu.pl),
W-1 Fun  Module/course C-1 To C  Course content	ndamentals of me unit objective gain the knowled	(Paw Wene athemes dge, sk	el.Kochman elska Karolin hatics and phy kills and com	ski@zut.edu.pl) na (Karolina.Wil ysics. Fundament petences in the fi	gosz@z	lczyk Kr zut.edu. echanics atigue, fr	zysztof (Krzysz pl)	ztof.Kowalczyk(	eering materials
W-1 Fun  Module/course $C-1$ To $C$ Course content $T-L-1$ Pres	ndamentals of me unit objective gain the knowled into divided into eparation and characters.	(Paw Wene athem es dge, sk variou aracte	el.Kochman elska Karolin atics and phy kills and comp us forms of a	ski@zut.edu.pl) na (Karolina.Wil  ysics. Fundament  petences in the fi  instruction	gosz@z	lczyk Krzut.edu. echanics atigue, fr	zysztof (Krzysz pl)	ztof.Kowalczyk(	eering materials  Number of hours
W-1 Fun  Module/course C-1 To G  Course conten T-L-1 Prep T-L-2 Det T-L-3 Influ	ndamentals of me unit objective gain the knowled into eparation and chartermination of alluence of the structure.	athemess dge, sk variou aracte brasior	el.Kochman elska Karolin atics and phy kills and comp us forms of compirization of comping an I defects on r	ski@zut.edu.pl) na (Karolina.Wil  ysics. Fundament  petences in the fi  instruction  nversion-type ino	als of m eld of fa	lczyk Kr zut.edu. echanics atigue, fr oatings	zysztof (Krzysz pl)  racture and wear	ztof.Kowalczyk(	Dezut.edu.pl), Deering materials  Number of hours  5 5 5 5
W-1         Fun           Module/course         C-1         To g           Course content         T-L-1         Presented           T-L-2         Det         T-L-3         Influt           T-L-4         Fating	e unit objective gain the knowled into eparation and charactermination of all luence of the structure.	(Paw Wene athem es dge, sk variou aracte brasior uctura of biop	el.Kochman elska Karolin matics and phy kills and comp us forms of a rization of co n, cupping an I defects on r polymers	ski@zut.edu.pl) na (Karolina.Wil  ysics. Fundament  petences in the fi  instruction  nversion-type ino id impact resistan mechanical profile	als of m eld of fa	lczyk Kr zut.edu. echanics atigue, fr oatings	zysztof (Krzysz pl)  racture and wear	ztof.Kowalczyk(	eering materials  Number of hours  5  5  5  5
W-1         Fun           Module/course         C-1           C-1         To g           Course content         T-L-1           T-L-2         Det           T-L-3         Influ           T-L-4         Fati           T-L-5         Intr	e unit objective gain the knowled into eparation and charactermination of all fluence of the structique resistance exertacial adhesion	(Paw Wene athem es dge, sk variou aracte brasior uctura of biop	el.Kochman elska Karolin matics and phy kills and comp us forms of comp rization of comp, cupping an I defects on resolymers olymer compo	ski@zut.edu.pl) na (Karolina.Wil  ysics. Fundament  petences in the fi  instruction  nversion-type ino d impact resistan  mechanical profile	als of m eld of fa	lczyk Kr zut.edu. echanics atigue, fr oatings	zysztof (Krzysz pl)  racture and wear	ztof.Kowalczyk(	eering materials  Number of hours  5 5 5 5 5
W-1         Fun           Module/course         C-1           C-1         To g           Course content         T-L-1           T-L-2         Det           T-L-3         Influ           T-L-4         Fati           T-L-5         Intr           T-L-6         Eva	e unit objective gain the knowled into eparation and charactermination of altique resistance exertacial adhesio aluation of corres	(Paw Wene athem es dge, sk variou aracte brasior uctura of biop n in po	el.Kochman elska Karolin atics and phy kills and comp us forms of rization of co n, cupping an I defects on r polymers olymer compo	ski@zut.edu.pl) na (Karolina.Wil  ysics. Fundament  petences in the fi  instruction  nversion-type ino d impact resistan mechanical profile  osites naterials	eld of farganic conce of poly	echanics atigue, fr	zysztof (Krzysz pl) acture and wear yers mposites	aspects of engin	eering materials  Number of hours  5  5  5  5  5  5
W-1         Fun           Module/course         C-1         To g           Course content         T-L-1         Preparent           T-L-2         Det         T-L-3         Influt           T-L-4         Fati         T-L-5         Intr           T-L-6         Eva         T-L-7         Eva	e unit objective gain the knowled and divided into eparation and charactermination of all luence of the structique resistance are facial adhesional uation of tribological and the structure of the structure of the structure and the signal adhesional unit of the structure of the	athem es dge, sk variou aracte brasior uctura of biop n in po	el.Kochman elska Karolin matics and phy exills and comp us forms of comparization of comparization of complete composition of comparison of comparison of comparison of comparison of comparies of matical properties of matical comparison of c	ski@zut.edu.pl) na (Karolina.Wil  ysics. Fundament  petences in the fi  instruction  nversion-type ino id impact resistan mechanical profile  posites materials materials; Analys	eld of farganic conce of poly	echanics atigue, fr	zysztof (Krzysz pl) acture and wear yers mposites	aspects of engin	eering materials  Number of hours  5  5  5  5  5  5  5
W-1         Fun           Module/course         C-1         To g           Course content         T-L-1         Preport           T-L-2         Det         T-L-3         Influt           T-L-3         Influt         T-L-5         Intraction           T-L-5         Intraction         Eva           T-L-7         Eva         T-L-8         Fati	e unit objective gain the knowled and divided into eparation and chartermination of all diuence of the structique resistance arerfacial adhesional unation of tribolatigue of polymer-	(Paw Wene athem es dge, sk variou aracte brasior uctura of biop n in posion progical esuppo	el.Kochman elska Karolin matics and phy kills and comp rization of composition of	ski@zut.edu.pl) na (Karolina.Wil  ysics. Fundament  petences in the fi  instruction  nversion-type ino d impact resistan mechanical profile  osites naterials materials; Analys terials thin films	eld of farganic conce of poly	echanics atigue, fr	zysztof (Krzysz pl) acture and wear yers mposites	aspects of engin	eering materials  Number of hours  5 5 5 5 5 5 5 5 5 5
W-1         Fun           Module/course         C-1         To g           Course content         T-L-1         Preport           T-L-2         Det         T-L-3         Influe           T-L-3         Influe         Intr         T-L-5         Intr           T-L-5         Intr         T-L-6         Eva           T-L-7         Eva         T-L-7         Eva           T-L-8         Fati         T-L-9         Mic           T-W-1         Stee         Stee	e unit objective gain the knowled ant divided into eparation and charactermination of all divided exercistance of the structural effected and alloys core	(Paw Wene wathern was at them was dige, sk wariou aracte brasion progical supposects in prosion prosio	el.Kochman elska Karolin hatics and phy kills and comp us forms of company rization of company defects on risolymers olymer compens operties of m properties of rted nanoma ceramic mate	ski@zut.edu.pl) na (Karolina.Wil  ysics. Fundament  petences in the fi  instruction  nversion-type ino d impact resistan mechanical profile  osites naterials materials; Analys terials thin films	als of m  eld of fa  rganic c  ce of poly  sis of fai	Iczyk Krzut.edu. echanics atigue, fr coatings olymer la mers cor	zysztof (Krzysz pl)  acture and wear yers mposites metallic material	aspects of engings	eering materials  Number of hours  5  5  5  5  5  5  5
W-1         Fun           Module/course         C-1         To g           Course content         T-L-1         Preparent           T-L-2         Det         T-L-3         Influe           T-L-3         Influe         Intr         T-L-5         Intr           T-L-5         Intr         T-L-6         Eva         T-L-7         Eva           T-L-7         Eva         T-L-8         Fati         T-L-9         Mic           T-W-1         Steam         Steam         Steam         Steam         Steam	e unit objective gain the knowled ant divided into eparation and charactermination of all divided eparation of the structure resistance of the structure of the	(Paw Wene wather wariou aracter brasion progical supposets in prosion ction	el.Kochman elska Karolin hatics and phy kills and comp us forms of rization of co n, cupping and defects on risolymers olymer comperoperties of m properties of rited nanoma ceramic mater phenomeno	ski@zut.edu.pl) na (Karolina.Wil  ysics. Fundament  petences in the fi  instruction  nversion-type ino d impact resistan mechanical profile  osites naterials materials; Analys terials thin films erials n. Fatigue corrosi	als of m eld of fa rganic c ce of poly sis of fai	Iczyk Krzut.edu. echanics atigue, fr coatings olymer la mers cor	zysztof (Krzysz pl)  acture and wear yers mposites metallic material	aspects of engings	eering materials  Number of hours  5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5
W-1         Fun           Module/course         C-1         To g           Course content         T-L-1         Preparent           T-L-1         Preparent         T-L-2         Det           T-L-3         Influence         Influence           T-L-4         Fati         Fati           T-L-5         Intr         Eva           T-L-6         Eva         Fati           T-L-7         Eva         Fati           T-L-9         Mic         Steparent           T-W-1         Steparent         Steparent           T-W-2         PVC         Fun	e unit objective gain the knowled and divided into eparation and charactermination of all divided eparation of the structure of the structure resistance aluation of corrosaluation of tribolo tigue of polymer-crostructural effected and alloys conticorrosion protein C and CPVC parandamentals of tri	(Paw Wene athem es dge, sk variou aracte brasior uctura of biop in in position progical ests in rrosion ction ameter ibology	el.Kochman elska Karolin hatics and phy kills and comp us forms of rization of co n, cupping an I defects on risolymers olymer comporties of properties of rted nanoma ceramic mate phenomeno s of thin poly y. Lubrication	ski@zut.edu.pl) na (Karolina.Wil  ysics. Fundament  petences in the fi  instruction  nversion-type ino d impact resistan mechanical profile  psites naterials materials; Analys terials thin films erials n. Fatigue corrosi meric films with periand bearing met	als of m  eld of fa  rganic c  ce of poly  sis of fai  on and a	lczyk Krzut.edu. echanics atigue, fr coatings olymer la mers cor lures in r other cor	rosion types. Fu	aspects of engings	eering materials  Number of hours  5  5  5  5  5  5  6
W-1         Fun           Module/course         C-1         To g           Course conten         T-L-1         Preparent           T-L-1         Preparent         Preparent           T-L-2         Det         Det           T-L-3         Influence         Influence           T-L-4         Fati         Fati           T-L-5         Intr         Eva           T-L-6         Eva         Fati           T-L-7         Eva         Fati           T-L-9         Mic         Stee           T-W-1         Stee         anti           T-W-2         PVC         Fun           T-W-3         Fun         and	e unit objective gain the knowled and divided into eparation and charactermination of all divided eparation of the structure of the structure resistance aluation of corrosaluation of tribolo tigue of polymer-crostructural effected and alloys conticorrosion protein C and CPVC parandamentals of tri	athem es dge, sk variou aracte brasior uctura of biop n in po sion pr ogical -suppo ects in rrosion ction ameter ibology bologic	el.Kochman elska Karolin atics and phy cills and comp us forms of a rization of co n, cupping an I defects on r colymers olymer comporties of m properties of m properties of red nanoma ceramic mate phenomeno s of thin poly y. Lubrication cal applicatio	ski@zut.edu.pl) na (Karolina.Wil  ysics. Fundament  petences in the fi  instruction  nversion-type ino ind impact resistan mechanical profile  posites naterials materials; Analys terials thin films erials n. Fatigue corrosi  meric films with p	als of m  eld of fa  rganic c  ce of poly  sis of fai  on and o	lczyk Krzut.edu. echanics atigue, fr coatings olymer la mers cor lures in r other cor	rosion types. Fu	aspects of engings	eering materials  Number of hours  5 5 5 5 5 5 6 2
W-1         Fun           Module/course         C-1         To g           C-1         To g         Course content           T-L-1         Preport         T-L-2         Det           T-L-2         Det         T-L-3         Influe           T-L-3         Influe         Intr         T-L-5         Intr           T-L-5         Intr         T-L-6         Eva         T-L-7         Eva           T-L-8         Fati         Fati         T-L-9         Mic           T-W-1         Sternation         Sternation         T-W-1         Fundant           T-W-3         Fundant         Fundant         T-W-4         Intr	e unit objective gain the knowled ant divided into eparation and charactermination of all divided eparation and charactermination of all divided eparation of the structural effection of the structural effection of the costructural effection of th	(Paw. Wene athem es dge, sk variou aracte brasion progical suppo ects in crosion ction ameter ibology bologic ture m	el.Kochman elska Karolin hatics and phy kills and com us forms of co n, cupping an I defects on r holymers oblymer comporties of m properties	ski@zut.edu.pl) na (Karolina.Wil  ysics. Fundament  petences in the fi  instruction  nversion-type ino d impact resistan mechanical profile  psites naterials materials; Analys terials thin films erials n. Fatigue corrosi meric films with periand bearing met	als of m eld of fa rganic c ce of poly of poly on and of bologica	lczyk Krzut.edu. echanics atigue, fr coatings olymer la mers cor lures in r other cor s/fillers echanisr al wear re	recture and wear  reacture and wear  yers  metallic material  rrosion types. Fu	aspects of engings	eering materials  Number of hours  5  5  5  5  5  6  2
W-1         Fun           Module/course         C-1         To g           Course content         T-L-1         Preparent           T-L-1         Preparent         T-L-2         Det           T-L-3         Influence         Influence           T-L-4         Fati         Fati           T-L-5         Intr         Fati           T-L-7         Eva         Fati           T-L-8         Fati         Fati           T-L-9         Mic         Mic           T-W-1         Step anti         Step anti           T-W-2         PVC         PVC           T-W-3         Fundand           T-W-4         Intr           T-W-5         Fati	e unit objective gain the knowled ant divided into eparation and charactermination of all divided eparation and charactermination of all divided eparation of the structural effection of the structural effection of the costructural effection of th	(Paw Wene Wene Wene Wene Wene Wene Wene Wen	el.Kochman elska Karolin elska	ski@zut.edu.pl) na (Karolina.Wil  ysics. Fundament  petences in the fi  instruction  nversion-type ino d impact resistan mechanical profile  psites naterials materials; Analys terials thin films erials n. Fatigue corrosi meric films with p n and bearing met ns. Methods of tri  terials: S-N and hy	als of m eld of fa rganic c ce of poly of poly on and of bologica	lczyk Krzut.edu. echanics atigue, fr coatings olymer la mers cor lures in r other cor s/fillers echanisr al wear re	recture and wear  reacture and wear  yers  metallic material  rrosion types. Fu	aspects of engings	eering materials  Number of hours  5 5 5 5 5 6 2 8 2
W-1         Fun           Module/course         C-1         To g           Course content         T-L-1         Preparent           T-L-1         Preparent         T-L-2         Det           T-L-3         Influt         Influt           T-L-4         Fati         Fati           T-L-5         Intr         Eva           T-L-6         Eva         Fati           T-L-7         Eva         Fati           T-L-9         Mic         Ster           T-W-1         Ster         anti           T-W-2         PVC           T-W-3         Fun           and         T-W-4         Intr           T-W-5         Fati           T-W-6         Fati	e unit objective gain the knowled ant divided into eparation and charactermination of all divided eparation and charactermination of all divided eparation of the structural edition of tribological and alloys conticorrosion protection of the edition of the editi	(Paw. Wene athem es dge, sk variou aracte brasior progical suppo ects in rrosion ction ameter ibologic ture m and coth mooth the mooth coth coth coth coth coth coth coth	el.Kochman elska Karolin atics and phy kills and comp us forms of a rization of co n, cupping an I defects on r polymers olymer compo- rized nanoma ceramic mate phenomeno s of thin poly y. Lubrication cal application cal	ski@zut.edu.pl) na (Karolina.Wil  ysics. Fundament  petences in the fi  instruction  nversion-type ino d impact resistan mechanical profile  psites naterials materials; Analys terials thin films erials n. Fatigue corrosi meric films with p n and bearing met ns. Methods of tri  terials: S-N and hy	als of m eld of fa rganic c ce of poly of poly on and of bologica	lczyk Krzut.edu. echanics atigue, fr coatings olymer la mers cor lures in r other cor s/fillers echanisr al wear re	recture and wear  reacture and wear  yers  metallic material  rrosion types. Fu	aspects of engings	eering materials  Number of hours  5 5 5 5 5 6 2 8 2 2
W-1         Fun           Module/course         C-1         To g           Course content         T-L-1         Preparent           T-L-1         Preparent         T-L-2         Det           T-L-3         Influence         Influence           T-L-4         Fati         Fati           T-L-5         Intr         Fati           T-L-7         Eva         Fati           T-L-8         Fati         Fati           T-W-1         Steen and and and and and and and and and an	e unit objective gain the knowled and divided into eparation and charactermination of all divided estermination of all divided estermination of the structural estermination of corrosaluation of tribological divided estermination of tribological divided estermi	(Paw Wene Wene Wene Wene Wene Wene Wene Wen	el.Kochman elska Karolin elska	ski@zut.edu.pl) na (Karolina.Wil  ysics. Fundament  petences in the fi  instruction  nversion-type ino d impact resistan mechanical profile  osites naterials materials; Analys terials thin films erials n. Fatigue corrosi meric films with p n and bearing met ns. Methods of tri  terials: S-N and hy hanisms	als of m eld of fa rganic c ce of poly of poly on and of bologica	lczyk Krzut.edu. echanics atigue, fr coatings olymer la mers cor lures in r other cor s/fillers echanisr al wear re	recture and wear  reacture and wear  yers  metallic material  rrosion types. Fu	aspects of engings	eering materials  Number of hours  5 5 5 5 5 6 2 8 2 2 2
W-1         Fun           Module/course         C-1         To g           Course content         T-L-1         Preparent           T-L-1         Preparent         T-L-2         Det           T-L-3         Influence         Influence           T-L-4         Fati         Fati           T-L-5         Intr         Fati           T-L-7         Eva         Fati           T-L-8         Fati         Fati           T-W-1         Steen and and and and and and and and and an	e unit objective gain the knowled ant divided into eparation and charactermination of all divided into eparation and charactermination of all divided into eparation and character endicated and alloys conticorrosion protection of the eparation of the eparation of the eparatic eparat	(Paw Wene Wene Wene Wene Wene Wene Wene Wen	el.Kochman elska Karolin elska	ski@zut.edu.pl) na (Karolina.Wil  ysics. Fundament  petences in the fi  instruction  nversion-type ino d impact resistan mechanical profile  osites naterials materials; Analys terials thin films erials n. Fatigue corrosi meric films with p n and bearing met ns. Methods of tri  terials: S-N and hy hanisms	als of m eld of fa rganic c ce of poly of poly on and of bologica	lczyk Krzut.edu. echanics atigue, fr coatings olymer la mers cor lures in r other cor s/fillers echanisr al wear re	recture and wear  reacture and wear  yers  metallic material  rrosion types. Fu	aspects of engings	eering materials  Number of hours  5 5 5 5 5 6 2 8 2 2 2 2
W-1         Fun           Module/course         C-1         To g           Course content         T-L-1         Prepare           T-L-1         Prepare         T-L-2         Det           T-L-3         Influe         Influe           T-L-4         Fati         Fati           T-L-5         Intr         Fati           T-L-7         Eva         Fati           T-L-8         Fati         Fati           T-W-1         Stee anti         Stee anti           T-W-2         PVC         PVC           T-W-3         Fundand         Fati           T-W-4         Intr         Intr           T-W-5         Fati         Fati           T-W-7         Inte         Inte           T-W-8         Wei         T-W-9         Fail	e unit objective gain the knowled and divided into eparation and charactermination of all divided estermination of all divided estermination of the structural estermination of corrosaluation of tribological divided estermination of tribological divided estermi	(Paw Wene athem es dge, sk variou aracte brasior progical es suppo ects in crosion ameter ibology bologic ture m and coth moonechar s in me	el.Kochman elska Karolin matics and phy kills and comp us forms of prization of composition of c	ski@zut.edu.pl) na (Karolina.Wil  ysics. Fundament  petences in the fi  instruction  nversion-type ino d impact resistan mechanical profile  osites naterials materials; Analys terials thin films erials n. Fatigue corrosi meric films with p n and bearing met ns. Methods of tri  terials: S-N and hy hanisms	als of m eld of fa rganic c ce of poly of poly on and of bologica	lczyk Krzut.edu. echanics atigue, fr coatings olymer la mers cor lures in r other cor s/fillers echanisr al wear re	recture and wear  reacture and wear  yers  metallic material  rrosion types. Fu	aspects of engings	Dezut.edu.pl),  Description of the property of



			Faculty of Chemi	cai reciiii	ology all	u Liigiii	eerii	19				
Student wo	rkload	d - forms	s of activity						Nur	nber o	f hours	
A-L-2	Instruc	tions rea	ding, literature review							35		
A-L-3	Report	s prepara	ation							5		
A-L-4	Consul	tations								5		
A-W-1	Participation in the lectures										30	
A-W-2	Additio	nal stude	ent work. Literature review.								28	
A-W-3	Consul	tations									2	
Teaching m	nethod	ds / tools	5									
M-1	Lectur	e										
M-2	Labora	tory exe	rcises									
Evaluation	metho	ods (F - I	progressive, P - final)									
S-1	F	Reports										
S-2	P	Exam										
						Reference to						
I	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	learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering competences	Course objectives	Course	content	Teaching methods	Evaluation methods	
Knowledge												
MSE_1A_C17b The student ha fracture and w	s the k		of common aspect of fatigue, g materials	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		1								
	nderstar		portance of fatigue, fracture and practical applications	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-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	es	Grade		E	valuation cr	iterion						
Knowledge												
MSE_1A_C17b		2,0										
			The student knows the fundame	ntals aspects of fat	igue, fracture ar	nd wear of engir	neering r	naterials	;			
		3,5										
		4,0										
		4,5										
C1 '''		5,0										
Skills	1101											
MSE_1A_C17b	_001	2,0 3,0 3,5 4,0	The student can identify,describe	e and prevent fatig	ue, fracture and	l wear of engine	ering ma	aterials				
		4,5										
		5,0										
Other socia			es									
MSE_1A_C17b	_K01	2,0										
			Student understands the importa	ance of fatigue, fra	cture and wear a	aspects of engir	eering n	naterials				
		3,5										
		4,0 4,5										
		5,0										
	eading											



#### 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



		_						1	
Field of st	udy	Mate	erials Scienc	e and Engineeri	ng				
Mode of s	tudy	stati	onary	\A/T:1/	^h				
Graduate'	s qualification	inży	nier					WTil(	υN
Fields of s	cience	engi	neering and	technology					_
Discipline.	s of science	mate	erials engine	eering (100%)					<u> </u>
Education	al profile	gene	eral academ	ic					
Module									
Course un	it	Micı	ro- and Nar	nofabrication o	of Mat	erials			
Code		MSE	_1A_S_C18a					\	Cil
Field of sp	ecialisation								
Administe	ring faculty	Dep	artment of N	lanomaterials Pl	nysicod	hemisti	ry		
ECTS		8,0		ECTS (forms)		8,0			
Form of co	ourse credit	exar	mination	Language		english	l		
Electives		7		Elective group					
Form of in	struction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
lecturing	course	Α	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	К	examination
Leading to	eacher	Zieli	nska Beata (	(Beata.Zielinska	@zut.e	du.pl)			
Other tead		Seba (Dar	astian (Seba iusz.Moszyn	@zut.edu.pl), El stian.Fryska@zu ski@zut.edu.pl) bel@zut.edu.pl)	ıt.edu. <sub> </sub> Wene	ol), Mos Iska Kaı	zyński Dariusz rolina (Karolina	Wilgosz@zut.e	edu.pl), Wróbel
Prerequisi W-1	Knowledge of the b	asic c	ourse in phys	ics and chemistry	at the	alements	ary level		
	ourse unit objective			ies und enemistry	de tire v				
C-1	-	rse is		udent's knowledge	and sk	ills in the	e area of differer	nt techniques use	d for materials and
Course co	ntent divided into			instruction					Number of hours
T-A-1	Kinetic theory of ga								9
T-A-2	Model design and s	_	•	-					9
T-A-3	Chemical vapor de assisted CVD) - effe								9
T-A-4	Participation in pas								3
T-L-1	1a. Studies on met 1b. Studies on com 1c. Studies on poly	posite mer tl	e thin films de hin films depo	eposited by high e esited by high ene	nergeti	c beams		tion.	15
T-L-2	2a. Thin films obtai 2b. Thin films chara 2c. Application of x	acteris	sation – atteni	uation effect of ov					15
T-L-3	Influence of proces	•				•			8
T-L-4	Preparation of RTV of strength). Chemical vapar de								4
T-L-5	on physicochemica	l prop	erties of carb	on nanotubes (syr	nthesis	and prod	uct characteriza	tion)	15
T-L-6	SLA manufacturing				•	_			3
T-W-1	1a. Micro- and nand 1b. Influence of hig	h ene	rgetic beams	on film growth an	d prope	rties			7
T-W-2	Chemical vapor de assisted CVD) as m	ethod	ls of nanostru	ctures synthesis.	nanced	CVD, alc	ohol CVD, gel CV 	/D, laser	7
T-W-3	3a. Principles of the 3b. Magnetron spurasc. Ion etching	ttering	g.						8
	1								
T-W-4 T-W-5	Free-standing polyi Polymer microcaps						LBL)		2

				·	<u> </u>			.9	1.,	•	<i>-</i>		
			nto various forms of inst	truction					Nui	nber o			
T-W-6	Electrospinning of polymeric nanofibres  workload - forms of activity										2		
			<u> </u>						Nui	mber o	f hours		
A-A-1		Participation in recitations											
A-A-2		ing for te									13		
A-A-3		ing for re	citations								15		
A-A-4		tations									2		
A-L-1			laboratory exercises								60		
A-L-2			ooratory exercises								20		
A-L-3		ation of re	<u>'</u>								20		
A-L-4 A-L-5	Cosulta	ing for te	SLS								10		
A-L-5 A-W-1		pations in I	loctures								30		
A-W-2			ture studies								13		
A-W-3		ing for the									15		
A-W-4	The ex		e exam								1		
A-W-5		tations									2		
Teaching													
M-1 M-2			esentation		م الما معاملا								
M-3	subject self stu		on during lectures, auditor	num excercises an	id laboratories								
			progressive, P - final)										
S-1	P	written e											
5-2	F		completion of exercises										
S-3	F		ry reports										
S-4	F	student	activity during auditory ex	cercise		T							
	Desigr	ned learr	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	Cours	e content	Teaching methods	Evaluation methods		
Knowledg	e				•	•							
MSE_1A_C18 knowledge ir synthesis	a_W01 the area	of differer	nt 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 syr	nthesis 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	npeten	ces											
MSE_1A_C18 Competence materials		o- and nano	fabrication of engineering	MSE_1A_K02	P6S_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-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	nes	Grade		E	Evaluation cr	iterion							
Knowledg	e												
MSE_1A_C18		2,0											
		<i>3,0</i> f	rom 50 to 55% of percentage	points									
		3,5											
		3,5 4,0 4,5											



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	petenc	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	g	

- 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



Mode of study	Field of st	udy	Mate	erials Scienc	e and Engineeri	ng				
Pields of science   engineering and technology	Mode of s	tudy	stat	onary	Level		first o	cycle	34/=:1/	C L
Disciplines of science   materials engineering (100%)	Graduate'	s qualification	inży	nier	,		'		W I 110	un
Educational profile	Fields of s	cience	engi	neering and	technology					_
Module Course unit Code MSE_1A_S_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 Form of instruction Cod Semester Hours ECTS Weight Realization Credit Electuring course A 5 30 2.0 0.25 K credits laboratory course L 5 60 4.0 0.50 K credits laboratory course L 5 5 60 4.0 0.50 K credits laboratory course Leading teacher Baranowska Jolanta (Jolanta, Baranowska@zut.edu.pl) Baranowska Jolanta (Jolanta, Baranowska@zut.edu.pl) Baranowska Jolanta (Jolanta, Baranowska@zut.edu.pl), Chen Xuecheng (Xuecheng, Chen@zut.edu.pl), El Fray Miroslawa (Miroslawa, Elfray@zut.edu.pl), Pryska Sebastian (Sebastian, Fryska@zut.edu.pl), D. Ele Pray Miroslawa (Miroslawa, Elfray@zut.edu.pl), Wróbel Rafa'( (Rafal Whoole@zut.edu.pl)), Zeilinska Beata (Beata Zielinska@zut.edu.pl), Wróbel Rafa'( (Rafal Whoole@zut.edu.pl)), J. Zeilinska Beata (Beata Zielinska@zut.edu.pl), Zwir Marek  Prerequisites W-1 Science and Interfacial Phenomena  Module/course unit objectives C-1 to get knowledge about selected advanced manufacturing technologies C-2 formation of skills in the area of technological processes preparation and carrying out.  Course content divided into various forms of instruction T-A-1 Study on influence of synthesis parameters on the physicochemical properties of selected 10 nanostructures produced via vapor deposition techniques: case studies (10n) T-A-2 Kinetic theory of gases – solving problems 10 T-A-2 Kinetic theory of gases – solving problems 11 T-A-2 Kinetic theory of gases – solving problems 12 Advanced deposition of polymer thin film deposition by pulsed laser and pulsed electron beam method 13 Advanced deposition of polymer thin film deposition by pulsed laser and pulsed electron beam method 14 Formation of fect of thin films in EDS/MPS spectroscopies 15 A-1 Magnetron sputtering for preparation of sandwich structure nanolayers 16 Attenuation effect of thin films in EDS/MPS spectroscopies	Discipline	s of science	mat	erials engine	eering (100%)					
Course unit Advanced Manufacturing Processes Code MSE_IA_S_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 TElective group 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 laboratory course L 5 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) Baranowska Jolanta (Jolanta Baranowska@zut.edu.pl) Baranowska Jolanta (Jolanta Baranowska@zut.edu.pl), Chen Xuecheng (Xuecheng, Chen@zut.edu.pl), EFray Miroslawa (Miroslawa ElFray@zut.edu.pl), Fryska Sebastian (Sebastian.Fryska@zut.edu.pl), Monelska Karolina (Karolina Wilgosz@zut.edu.pl), Wiroble Rafal (Rafal.Wrobel@zut.edu.pl), Zielinska Beata (Beata.Zielinska@zut.edu.pl), Zwir Marek  Prerequisites W-1 approval in subjects: Physic of Materials, Intro to MatSci/intro to MatEng, Structure of Solids, Materials processing, Surface Science and Interfacial Phenomena  Module/course unit objectives	Education	al profile	gen	eral academ	ic					
Administering faculty Department of Materials Technology  ECTS 8,0 ECTS (forms) 8,0 ECTS (forms) 8,0  Form of course credit examination Language english  Electives 7 Elective group  Form of instruction Cod Semester Hours ECTS Weight Realization Credit lecturing course A 5 30 2,0 0,25 K credits laboratory course L 5 660 4,0 0,50 K credits laboratory course L 5 660 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)  Baranowska Jolanta (Jolanta Baranowska@zut.edu.pl)  Baranowska Jolanta (Jolanta Baranowska@zut.edu.pl)  Baranowska Jolanta (Jolanta Baranowska@zut.edu.pl), Chen Xuecheng (Xuecheng.Chen@zut.edu.pl), El Fray Miroslawa (Miroslawa.ElFray@zut.edu.pl), Fryska Sebastian (Fysbastian.Fryska@zut.edu.pl), Moszyński Dariusz (Joariusz Moszyński@zut.edu.pl), Wiroslawa (Miroslawa.ElFray@zut.edu.pl), Wiroble Rafal (Rafal (Wroble@zut.edu.pl), Zielinska Beata (Beata, Zielinska@zut.edu.pl)), Zwir Marek Prerequisites  W-1 Science and Interfacial Phenomena  Module/course unit objectives  W-1 Science and Interfacial Phenomena  Module/course unit objectives  W-2 Science and Interfacial Phenomena  Module/course unit objectives  C-2 formation of skills in the area of technological processes preparation and carrying out.  Course content divided into various forms of instruction  Module/course unit objectives	Module									
Administering faculty Department of Materials Technology  ECTS 8,0 ECTS (forms) 8,0 ECTS (forms) 8,0  Form of course credit examination Language english  Electives 7 Elective group  Form of instruction Cod Semester Hours ECTS Weight Realization Credit lecturing course A 5 30 2,0 0,25 K credits laboratory course L 5 660 4,0 0,50 K credits laboratory course L 5 660 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)  Baranowska Jolanta (Jolanta Baranowska@zut.edu.pl)  Baranowska Jolanta (Jolanta Baranowska@zut.edu.pl)  Baranowska Jolanta (Jolanta Baranowska@zut.edu.pl), Chen Xuecheng (Xuecheng.Chen@zut.edu.pl), El Fray Miroslawa (Miroslawa.ElFray@zut.edu.pl), Fryska Sebastian (Fysbastian.Fryska@zut.edu.pl), Moszyński Dariusz (Joariusz Moszyński@zut.edu.pl), Wiroslawa (Miroslawa.ElFray@zut.edu.pl), Wiroble Rafal (Rafal (Wroble@zut.edu.pl), Zielinska Beata (Beata, Zielinska@zut.edu.pl)), Zwir Marek Prerequisites  W-1 Science and Interfacial Phenomena  Module/course unit objectives  W-1 Science and Interfacial Phenomena  Module/course unit objectives  W-2 Science and Interfacial Phenomena  Module/course unit objectives  C-2 formation of skills in the area of technological processes preparation and carrying out.  Course content divided into various forms of instruction  Module/course unit objectives	Course un	nit	Adv	anced Man	ufacturing Pro	cesse	5			
Administering faculty Department of Materials Technology  ECTS 8,0 ECTS (forms) 8,0 ECTS (forms) 8,0  Form of course credit examination Language english  Electives 7 Elective group  Form of instruction Cod Semester Hours ECTS Weight Realization Credit lecturing course A 5 30 2,0 0,25 K credits laboratory course L 5 660 4,0 0,50 K credits laboratory course L 5 660 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)  Baranowska Jolanta (Jolanta Baranowska@zut.edu.pl)  Baranowska Jolanta (Jolanta Baranowska@zut.edu.pl)  Baranowska Jolanta (Jolanta Baranowska@zut.edu.pl), Chen Xuecheng (Xuecheng.Chen@zut.edu.pl), El Fray Miroslawa (Miroslawa.ElFray@zut.edu.pl), Fryska Sebastian (Fysbastian.Fryska@zut.edu.pl), Moszyński Dariusz (Joariusz Moszyński@zut.edu.pl), Wiroslawa (Miroslawa.ElFray@zut.edu.pl), Wiroble Rafal (Rafal (Wroble@zut.edu.pl), Zielinska Beata (Beata, Zielinska@zut.edu.pl)), Zwir Marek Prerequisites  W-1 Science and Interfacial Phenomena  Module/course unit objectives  W-1 Science and Interfacial Phenomena  Module/course unit objectives  W-2 Science and Interfacial Phenomena  Module/course unit objectives  C-2 formation of skills in the area of technological processes preparation and carrying out.  Course content divided into various forms of instruction  Module/course unit objectives	Code		MSE	_1A_S_C18b					\ <b>.</b>	
ECTS   8.0   ECTS (forms)   8.0   ECTS (forms)   8.0	Field of sp	ecialisation								
Form of course credit   Examination   Language   English	Administe	ring faculty	Dep	artment of M	laterials Techno	logy				_
Electives	ECTS		8,0		ECTS (forms)		8,0			
Form of instruction	Form of co	ourse credit	exai	mination	Language		english	l		
lecturing course	Electives		7		Elective group					
Iaboratory course	Form of in	struction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
Lecture	lecturing (	course	Α	5	30	2,	0	0,25	K	credits
Leading teacher   Baranowska Jolanta (Jolanta.Baranowska@zut.edu.pl)	laboratory	/ course	L	5	5 60 4,0 0,50				K	credits
Baranowska Jolanta (Jolanta.Baranowska@zut.edu.pl), Chen Xuecheng (Xuecheng.Chen@zut.edu.pl), El Fray Miroslawa (Miroslawa.ElFray@zut.edu.pl), Fryska Sebastian (Sebastian.Fryska@zut.edu.pl), Miroslawa (Miroslawa.ElFray@zut.edu.pl), Wróbel Rafat (Rafal.Wrobel@zut.edu.pl), Zielinska Karolina (Karolina.Wilgosz@zut.edu.pl), Wróbel Rafat (Rafal.Wrobel@zut.edu.pl), Zielinska Beata (Beata.Zielinska@zut.edu.pl), Zwir Marek Prerequisites  W-1 approval in subjects: Physic of Materials, Intro to MatSci/Intro to MatEng, Structure of Solids, Materials processing, Surface Science and Interfacial Phenomena  Module/course unit objectives  C-1 to get knowledge about selected advanced manufacturing technologies  C-2 formation of skills in the area of technological processes preparation and carrying out.  Course content divided into various forms of instruction  Number of hours  T-A-1 Study on influence of synthesis parameters on the physicochemical properties of selected nanostructures produced via vapor deposition techniques: case studies (10h)  10 T-A-2 Kinetic theory of gases - solving problems  10 T-L-1 Influence of process parameters on coating deposition by magnetron sputtering techniques  5 T-L-2 Advanced deposition of polymer thin films by MAPLE method  5 T-L-2 Advanced deposition of polymer thin films by MAPLE method  7 L-3 Influence of process parameters on thin film deposition by pulsed laser and pulsed electron beam method  7 L-4 Formation of FeXN layers under variable nitriding potential during gaseous nitridation of iron  10 T-L-5 Magnetron sputtering for preparation of sandwich structure nanolayers  5 T-L-6 Attenuation effect of thin films in EDS/XPS spectroscopies  5 T-L-7 Modification of particle size obtained via magnetron sputtering via sintering  5 Experimental comparison of adhesive joints strength prepared wit different polymer adhesives (part 1 - preparation, part 11 - determination of strength)  7 L-10 SLA manufacturing technology. Design, printing and post-processing  5 T-L-10 Magnetron sputtering in coa	lecture		W 5 30 2,0 0,25 K					K	examination	
Baranowska Jolanta (Jolanta.Baranowska@zut.edu.pl), Chen Xuecheng (Xuecheng.Chen@zut.edu.pl), El Fray Miroslawa (Miroslawa.ElFray@zut.edu.pl), Fryska Sebastian (Sebastian.Fryska@zut.edu.pl), Miroslawa (Miroslawa.ElFray@zut.edu.pl), Wróbel Rafat (Rafal.Wrobel@zut.edu.pl), Zielinska Karolina (Karolina.Wilgosz@zut.edu.pl), Wróbel Rafat (Rafal.Wrobel@zut.edu.pl), Zielinska Beata (Beata.Zielinska@zut.edu.pl), Zwir Marek Prerequisites  W-1 approval in subjects: Physic of Materials, Intro to MatSci/Intro to MatEng, Structure of Solids, Materials processing, Surface Science and Interfacial Phenomena  Module/course unit objectives  C-1 to get knowledge about selected advanced manufacturing technologies  C-2 formation of skills in the area of technological processes preparation and carrying out.  Course content divided into various forms of instruction  Number of hours  T-A-1 Study on influence of synthesis parameters on the physicochemical properties of selected nanostructures produced via vapor deposition techniques: case studies (10h)  10 T-A-2 Kinetic theory of gases - solving problems  10 T-L-1 Influence of process parameters on coating deposition by magnetron sputtering techniques  5 T-L-2 Advanced deposition of polymer thin films by MAPLE method  5 T-L-2 Advanced deposition of polymer thin films by MAPLE method  7 L-3 Influence of process parameters on thin film deposition by pulsed laser and pulsed electron beam method  7 L-4 Formation of FeXN layers under variable nitriding potential during gaseous nitridation of iron  10 T-L-5 Magnetron sputtering for preparation of sandwich structure nanolayers  5 T-L-6 Attenuation effect of thin films in EDS/XPS spectroscopies  5 T-L-7 Modification of particle size obtained via magnetron sputtering via sintering  5 Experimental comparison of adhesive joints strength prepared wit different polymer adhesives (part 1 - preparation, part 11 - determination of strength)  7 L-10 SLA manufacturing technology. Design, printing and post-processing  5 T-L-10 Magnetron sputtering in coa	Leading te	teacher Baranowska Jolanta (Jolanta.Baranowska@zut.edu.pl)								
W-1         Science and Interfacial Phenomena           Module/course unit objectives           C-1         to get knowledge about selected advanced manufacturing technologies           C-2         formation of skills in the area of technological processes preparation and carrying out.           Course content divided into various forms of instruction         Number of hours           T-A-1         Study on influence of synthesis parameters on the physicochemical properties of selected nanostructures produced via vapor deposition techniques: case studies (10h)         10           T-A-2         Kinetic theory of gases - solving problems         10           T-A-3         Proper design of adhesive joints. Case analysis and theoretical prediction of joint's bearing capacities         10           T-L-1         Influence of process parameters on coating deposition by magnetron sputtering capacities         5           T-L-2         Advanced deposition of polymer thin films by MAPLE method         5           T-L-3         Influence of process parameters on thin film deposition by pulsed laser and pulsed electron beam method         5           T-L-3         Influence of process parameters on thin film deposition by pulsed laser and pulsed electron beam method         5           T-L-4         Formation of FexN layers under variable nitriding potential during gaseous nitridation of iron         10           T-L-4         Formation of FexN layers under variable nitriding poten			(Dar	iusz.Moszyn	ski@zut.edu.pl)	, Wenel	ska Kai	rolina (Karolina		
C-1     to get knowledge about selected advanced manufacturing technologies       C-2     formation of skills in the area of technological processes preparation and carrying out.       Course content divided into various forms of instruction     Number of hours       T-A-1     Study on influence of synthesis parameters on the physicochemical properties of selected nanostructures produced via vapor deposition techniques: case studies (10h)     10       T-A-2     Kinetic theory of gases - solving problems     10       T-A-3     Proper design of adhesive joints. Case analysis and theoretical prediction of joint's bearing capacities     10       T-L-1     Influence of process parameters on coating deposition by magnetron sputtering techniques     5       T-L-2     Advanced deposition of polymer thin films by MAPLE method     5       T-L-3     Influence of process parameters on thin film deposition by pulsed laser and pulsed electron beam method     5       T-L-4     Formation of FexN layers under variable nitriding potential during gaseous nitridation of iron     10       T-L-5     Magnetron sputtering for preparation of sandwich structure nanolayers     5       T-L-6     Attenuation effect of thin films in EDS/XPS spectroscopies     5       T-L-7     Modification of particle size obtained via magnetron sputtering via sintering     5       T-L-8     Experimental comparison of adhesive joints strength prepared wit different polymer adhesives (part I - preparation, part II - determination of strength)	W-1								ocessing, Surface	
C-2 formation of skills in the area of technological processes preparation and carrying out.  Course content divided into various forms of instruction  T-A-1 Study on influence of synthesis parameters on the physicochemical properties of selected nanostructures produced via vapor deposition techniques: case studies (10h)  T-A-2 Kinetic theory of gases - solving problems  10  T-A-3 Proper design of adhesive joints. Case analysis and theoretical prediction of joint's bearing capacities  10  T-L-1 Influence of process parameters on coating deposition by magnetron sputtering techniques  5  T-L-2 Advanced deposition of polymer thin films by MAPLE method  5  T-L-3 Influence of process parameters on thin film deposition by pulsed laser and pulsed electron beam method  T-L-4 Formation of FexN layers under variable nitriding potential during gaseous nitridation of iron  10  T-L-5 Magnetron sputtering for preparation of sandwich structure nanolayers  5  T-L-6 Attenuation effect of thin films in EDS/XPS spectroscopies  5  T-L-7 Modification of particle size obtained via magnetron sputtering via sintering  5  T-L-8 Experimental comparison of adhesive joints strength prepared wit different polymer adhesives (part I - preparation, part II - determination of strength)  T-L-9 Degradation of waste polymer into metal-organic framworks (MOFs)  10  T-L-10 SLA manufacturing technology. Design, printing and post-processing  5  T-W-1 Principles of the kinetic theory of gasses  7-W-2 Magnetron sputtering in coatings and thin films deposition  7  T-W-2 Magnetron sputtering in coatings and thin films deposition  7  T-W-3 Lithography and surface etching  7  T-W-4 Vapor deposition techniques for growing nanostructures: chemical vapor deposition (CVD) and physical vapor deposition (PVP) and their modification	Module/co	ourse unit objective	es							
Course content divided into various forms of instruction  T-A-1 Study on influence of synthesis parameters on the physicochemical properties of selected nanostructures produced via vapor deposition techniques: case studies (10h)  T-A-2 Kinetic theory of gases - solving problems  10  T-A-3 Proper design of adhesive joints. Case analysis and theoretical prediction of joint's bearing capacities  10  T-L-1 Influence of process parameters on coating deposition by magnetron sputtering techniques  5  T-L-2 Advanced deposition of polymer thin films by MAPLE method  5  T-L-3 Influence of process parameters on thin film deposition by pulsed laser and pulsed electron beam method  5  T-L-4 Formation of FexN layers under variable nitriding potential during gaseous nitridation of iron  10  T-L-5 Magnetron sputtering for preparation of sandwich structure nanolayers  5  T-L-6 Attenuation effect of thin films in EDS/XPS spectroscopies  5  T-L-7 Modification of particle size obtained via magnetron sputtering via sintering  5  T-L-8 Experimental comparison of adhesive joints strength prepared wit different polymer adhesives (part 1 - preparation, part II -determination of strength)  T-L-9 Degradation of waste polymer into metal-organic framworks (MOFs)  10  T-L-10 SLA manufacturing technology. Design, printing and post-processing  5  T-W-1 Principles of the kinetic theory of gasses  4  T-W-2 Magnetron sputtering in coatings and thin films deposition  7  Vapor deposition techniques for growing nanostructures: chemical vapor deposition (CVD) and physical vapor deposition (PVP) and their modification		<u> </u>								
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T-A-2Kinetic theory of gases - solving problems10T-A-3Proper design of adhesive joints. Case analysis and theoretical prediction of joint's bearing capacities10T-L-1Influence of process parameters on coating deposition by magnetron sputtering techniques5T-L-2Advanced deposition of polymer thin films by MAPLE method5T-L-3Influence of process parameters on thin film deposition by pulsed laser and pulsed electron beam method5T-L-4Formation of FexN layers under variable nitriding potential during gaseous nitridation of iron10T-L-5Magnetron sputtering for preparation of sandwich structure nanolayers5T-L-6Attenuation effect of thin films in EDS/XPS spectroscopies5T-L-7Modification of particle size obtained via magnetron sputtering via sintering5T-L-8Experimental comparison of adhesive joints strength prepared wit different polymer adhesives (part I - preparation, part II -determination of strength)5T-L-9Degradation of waste polymer into metal-organic framworks (MOFs)10T-L-10SLA manufacturing technology. Design, printing and post-processing5T-W-1Principles of the kinetic theory of gasses4T-W-2Magnetron sputtering in coatings and thin films deposition2T-W-3Lithography and surface etching2T-W-4Vapor deposition techniques for growing nanostructures: chemical vapor deposition (CVD) and physical vapor deposition (PVP) and their modification7	T-A-1								ed	10
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T-L-2 Advanced deposition of polymer thin films by MAPLE method  T-L-3 Influence of process parameters on thin film deposition by pulsed laser and pulsed electron beam method  T-L-4 Formation of FexN layers under variable nitriding potential during gaseous nitridation of iron  10  T-L-5 Magnetron sputtering for preparation of sandwich structure nanolayers  5  T-L-6 Attenuation effect of thin films in EDS/XPS spectroscopies  5  T-L-7 Modification of particle size obtained via magnetron sputtering via sintering  5  T-L-8 Experimental comparison of adhesive joints strength prepared wit different polymer adhesives (part I – preparation, part II -determination of strength)  T-L-9 Degradation of waste polymer into metal-organic framworks (MOFs)  10  T-L-10 SLA manufacturing technology. Design, printing and post-processing  5  T-W-1 Principles of the kinetic theory of gasses  4  T-W-2 Magnetron sputtering in coatings and thin films deposition  7  Vapor deposition techniques for growing nanostructures: chemical vapor deposition (CVD) and physical vapor deposition (PVP) and their modification		Proper design of ac	lhesiv	e joints. Case	analysis and theo	retical p	redictio	n of joint's beari	ng capacities	10
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method  T-L-4 Formation of FexN layers under variable nitriding potential during gaseous nitridation of iron  T-L-5 Magnetron sputtering for preparation of sandwich structure nanolayers  5 T-L-6 Attenuation effect of thin films in EDS/XPS spectroscopies  T-L-7 Modification of particle size obtained via magnetron sputtering via sintering  5 Experimental comparison of adhesive joints strength prepared wit different polymer adhesives (part I – preparation, part II -determination of strength)  T-L-9 Degradation of waste polymer into metal-organic framworks (MOFs)  T-L-10 SLA manufacturing technology. Design, printing and post-processing  T-W-1 Principles of the kinetic theory of gasses  4 T-W-2 Magnetron sputtering in coatings and thin films deposition  T-W-3 Lithography and surface etching  Vapor deposition techniques for growing nanostructures: chemical vapor deposition (CVD) and physical vapor deposition (PVP) and their modification		1		-	-		d lacar	and nulsed elect	ron heam	<del> </del>
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T-W-2 Magnetron sputtering in coatings and thin films deposition 2  T-W-3 Lithography and surface etching 2  T-W-4 Vapor deposition techniques for growing nanostructures: chemical vapor deposition (CVD) and physical 7		_				st-proces	sairig			
T-W-3 Lithography and surface etching 2  T-W-4 Vapor deposition techniques for growing nanostructures: chemical vapor deposition (CVD) and physical 7  7		· ·				ion				
vapor deposition (PVP) and their modification		,		<del>-</del>	·					2
	T-W-4	Vapor deposition to	echnic	ues for growing	ng nanostructures	: chemi	cal vapo	r deposition (CVI	D) and physical	7
	T-W-5	<u> </u>				echniqu	es; thin	biological layers	formation	3



					<u> </u>		<del></del>			
Course cor		livided into various forms of instr						Nur	nber o	f hours
T-W-6	High e proper	nergetic beams used for thin films de ties; process parameters selections;	eposition and the kinetics of coatin	ir influence on gs growth	coating struc	ture an	d			7
T-W-7	Rapid	protopyping of polymers using photo	curing and therm	oforming pros	sessing (FDM,	SLA)				3
T-W-8	Electro	spinning of polymer nanofibres								2
Student w	orkload	d - forms of activity						Nur	nber o	f hours
A-A-1	Partici	oation 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										
A-W-1										
A-W-2	participation in lectures 30 self-study of the literature 17									
A-W-3	preparing for the exam									10
A-W-4	The ex									1
A-W-5	Consul	tations								2
	aching methods / tools									
M-1		tive lectures, use of presentation (e.	a Powerpoint) fi	lms						
M-2		rium Exercises	g. rowerpoint, ii							
M-3		tory exercises								
		<u> </u>								
		ods (F - progressive, P - final)								
S-1	Р	written exam								
5-2	F	questions								
S-3	F	reports								
	Desigr	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	Cours	e content	Teaching methods	Evaluation methods
Knowledge	9		•	•	•					
MSE_1A_C18b Student descr processes		ues 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_C18b Student has s	o_U01 kills in a	dvanced manufacturing processes	MSE_1A_U08	P6S_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-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 com	peten	ces		1	1		ı			
MSE_1A_C18t Competences materials		nced manufacturing of engineering	MSE_1A_K02	P6S_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



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	tion to Manufacturing Processes, Wiley, 2011
2 Prof Dr Ing Eri	odrich M	filhelm Bach Dr. Andreas Laarmann Dink Ling, Thomas Wenz, Modern Surface Technology, Springer, 2006

- 2. Prof. Dr.-Ing. Friedrich-Wilhelm Bach Dr. Andreas Laarmann Dipl.-Ing. Thomas Wenz, Modern Surface Technology, Springer, 2006
- 3. Ian GibsonDavid W. RosenBrent Stucker, Additive Manufacturing Technologies, Springer, 2010



		1							
Field of st	udy	Mate	erials Scienc	e and Engineeri	ng				
Mode of st	tudy	stati	ionary	Level		first o	cycle	\A/T:1/	~ L
Graduate':	s qualification	inży	nier					WTil(	_n
Fields of s	cience	engi	neering and	technology					
Disciplines	s of science	mat	erials engine	eering (100%)					
Education	al profile	gene	eral academ	ic					
Module	•								
Course un	it .	Fun	ctional Mat	terials and De	vices				
Code	70	<u> </u>	_1A_S_C19	icriais and be	Vices				
	acialisation	IVISE	_IA_5_C19						
	ecialisation	D		la a a a a a ba ai a la D	1			_	
	ring faculty	<u> </u>	artment of N	lanomaterials P	nysico				
ECTS		3,0		ECTS (forms)		3,0			
Form of co	ourse credit	cred	lits	Language		english	l		
Electives				Elective group					
Form of in	of instruction Cod Semester Hours ECTS Weight					Realization	Credit		
laboratory	course L 6 30 1,5 0,50		K	credits					
lecture	W 6 30 1,5 0,50 K				K	credits			
Leading te	teacher Mijowska Ewa (Ewa.Borowiak-Palen@zut.edu.pl)								
Other tead		(Mire	oslawa.ElFra	r (Artur-Bartkow y@zut.edu.pl), iak-Palen@zut.e	Ignacza	ak Wojci	ech (Wojciech.	Ignaczak@zut.	edu.pl), Mijowska @zut.edu.pl)
Prerequisi	1								
W-1	Knowledge of the b	asic c	course in math	nematics, physics	and che	emistry a	t the elementary	level	
Module/co	urse unit objective								
C-1	The students will had for example superc			skills in device fa	bricatio	n compo	sed of functional	materials for de	fined applications
Course co.	ntent divided into	vario	ous forms of	instruction					Number of hours
T-L-1	Preparation of supe	ercapa	acitors and its	measurements (F	Part I).				5
T-L-2	Electrochemical da	ta col	ection and an	alysis (part II)					5
T-L-3	Preparation of poly		<u> </u>						5
T-L-4	Nanoprecipitation of		<u>-</u>			d release	systems		5
T-L-5	Smart pH-indicator								5
T-L-6	Antimicrobial and a				coating	s of poly	mer and cellulos	ic materials	5
T-W-1	Functional material		<u> </u>						3
T-W-2	Electrode compone				.,.				3
T-W-3	Electrode materials				sition				3
T-W-4 T-W-5	Functional material Functional packagi			ctrolytes					2 2
T-W-6	Smart packaging m								2
T-W-7	Modification of bar			lymer materials					2
T-W-8	Bioactive surfaces			nymer materials					2
T-W-9									1
T-W-10	participation in passing test  Porous structures as scaffolding systems  4								
T-W-11	Wet adhesion surfa		Troiding System	113					2
T-W-12	Micro- and nanopar		for drug deliv	verv systems					4
	orkload - forms of			., 5,5005					Number of hours
A-L-1	participation in lab								30
A-L-2	preparing for labor								5
A-L-3	preparation of repo								3
A-L-4	preparing for tests								5
L	preparing for cests								



			ractive or chemin		<u> </u>			.9			
Student wo			s of activity						Nur	nber of	f hours
		tations									2
			lectures								30
	Individ	ual litera	ture studies								5
		ing for te	ests								8
A-W-4	Consul	tations									2
Teaching m	nethod	ls / tools	5								
M-1	lecture	s with pr	esentation								
M-2	practic	al									
M-3	subjec	t discuss	ion during lectures and labor	atories							
M-4	self stu	ıdies									
Evaluation	metho	ods (F -	progressive, P - final)								
S-1	Р		completion of lectures and la	boratories							
5-2	F		ory reports								
S-3	F		activity during lectures and l	laboratories							
	Desigr		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_V knowlegge of c materials for d	device f		composed of functional ns	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-9	M-1	5-1
Skills								•			
MSE_1A_C19_L ability to devic defined applica	e fabric	ation com	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	peten	ces						•			
MSE_1A_C19_k understanding devices in prac	of the i		e of functional materials and	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-W-1 T-W-2 T-W-3	T-W-10 T-W-11		S-1 S-2
Outcom	es	Grade		E	valuation cr	iterion					
Knowledge											
MSE_1A_C19_V		3,5	from 50 to 55% of percentage po	ints							
		4,0 4,5 5,0									
Skills											
MSE_1A_C19_U	J01	2,0 3,0 3,5 4,0 4,5	from 50 to 55% of percentage po	pints							
		5,0									
		٥,٠									



Other social com	npetenc	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



Field of stu	udy	Mate	erials Scienc	e and Engineeri	ng				
Mode of st	tudy	stati	onary	Level		first	cycle	\A/T:1/	~ L
Graduate's	s qualification	inży	nier					WTil(	∟N
Fields of so	cience	engi	neering and	technology					_
Disciplines	of science	mate	erials engine	eering (100%)					
Educationa	al profile	gene	eral academ	ic					
Module									
Course uni	 it	Adh	esives and	Coatings					
Code	· -		1A S C20					\ <b>.</b>	
	ecialisation								C
	ering faculty  Department of Organic Chemical Technology and Polymer Materials								
ECTS									
	ourse credit	cred	itc	Language		english	<u> </u>		
Electives	ourse creare	Crea	103	Elective group		Crigiisi			
	-1	C - 4	C 1			TC.	144 - 1 - 1 - 1	D !' !'	Consults
Form of ins		Cod	Semester	Hours		TS	Weight	Realization	Credit
laboratory	course	L	6	45		,0	0,75	K	credits
lecture								credits	
Leading te	ing teacher Czech Zbigniew (psa_czech@wp.pl)								
Other teac	chers			r (Artur-Bartkow ztof (Krzysztof.I				iew (psa_czech	n@wp.pl),
Prerequisit	tes								
W-1	Fundamentals of ch	nemist	try and mater	ials science, prese	ented in	previou	s courses in this	field of study.	
Module/co	urse unit objective			<u> </u>					
C-1	-		to get knowle	dge and skills in t	he field	of techr	nology of adhesiv	es and coatings (	used in present-day
Course cor	ntent divided into	vario	us forms of	instruction					Number of hours
T-L-1	Preparation and ap	plicat	ion of a solve	nt-borne polyureth	nane pa	int.			5
T-L-2	Preparation and ap	plicat	ion of a water	borne paint					5
T-L-3	Application of a pov	wder d	coating. Testir	ng of the prepared	l varnis	n and pa	int coatings.		5
T-L-4	Preparation and ap	•							5
T-L-5	Preparation and ap								5
T-L-6	Characteristion of o							naterials.	5
T-L-7	Crosslinking of solv								5
T-L-8	Manufacturing of o			<u> </u>		olvent-fr	ee low viscosity a	dhesives.	5
T-L-9 T-W-1	UV-initiated polyme Definitions of a var					bstance	, pigment, micro-	and nanofiller,	5
T-W-2	solvent, diluent. Characterization of				d nanof	llers, pig	gments (decorativ	/e,	4
T-W-3	anticorrosive), solv				itions				2
T-W-4	Preparation and ap	nent o	f adhesives a			times to	o modern techno	ogy. Theories	2
T-W-5	and mechanisms of Types of commonly	used	adhesives ba						2
	type adhesives, dis Adhesives for speci								
T-W-6	many branches of r	noder	n industry						2
T-W-7	Physical and chemi			lysis of adnesives	- metn	oas ana	procedures.		2
	orkload - forms of								Number of hours
A-L-1	Participation in labo								45
A-L-2 A-L-3	Self-study of the lit Consultations	eratul	е						30 15
	Participation in lect	uroc							15
A-W-1									



Teaching methods / tools  ### 1    Cutrue								Nur	nber of	f hours
Teaching methods / tools  M-1 Lecture  M-2 Laboratory exercises  Evaluation methods (F - progressive, P - final)  S-1 P   Written test  Designed learning outcomes   Section to the learning ou										
M-2   Lecture   Laboratory exercises	A-W-3 Coi	nsultations								15
M-2   Laboratory exercises   Evaluation methods (F - progressive, P - final)	Teaching met	hods / tools								
Evaluation   methods   (F - progressive, P - final)	M-1 Led	ture								
Second   Parameter   Second	M-2 Lak	oratory exercises								
Second   Parameter   Second	Evaluation me	ethods (F - progressive, P - final)								
Designed   Learning outcomes   Reference to be surged of any location   Reference to be surged or any location   Ref										
MSE_1A_C20_W1   The student has a knowledge about technology of adhesives and self adhesive materials, coatings, and fillers, solvents and MSE_1A_W00   P65_WG   P65_WG   P65_WG   T.W.2   T.W.5   T.W.4   T.W.5   T.W.4   T.W.5   T.W.6   M-1   S.1   T.W.6   M-1   S.1   T.W.6   M-1	De	signed learning outcomes	learning outcomes designed for the fields o	Learning Outcomes for qualifications at	learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering		Course	e content		Evaluation methods
The Student has a knowledge about technology of adhesives and self adhesive materials, cautifysis, and filters, solvents and self adhesives materials, cautifysis, and filters solvents and self adhesives as well as modern auxiliary agents for coatings, patifies and vernishes.    Skills	Knowledge									
MSE_1A_C20_U01   The student has skills in the field of modern coatings and abtesives, including preparation, purification, application methods, analysis and practical testing of their properties.	The student has a and self adhesive film forming polyn	knowledge about technology of adhesives materials, coatings, and fillers, solvents and ners as well as modern auxiliary agents for		P6S_WG P6S_WK	P6S_WG	C-1	T-W-2 T-W-3	T-W-6	M-1	S-1
MSE_1A_U01   MSE_1A_U01   MSE_1A_U01   P6S_UW	Skills									
MSE_1A_C20_K01 The student understands the role of modern, environmentally friendly technologies in the field of adhesives, self-adhesive MSE_1A_K02 P6S_KK P6S_WK C-1 T-1.2 T-1.9 T-1.9 T-1.2 T-1.9 T-1.2 T-1.9 T-1.9 T-1.2 T-1.9 T	The student has s adhesives, includi	ng preparation, purification, application			P6S_UW	C-1	T-L-2 T-L-3 T-L-4	T-L-7 T-L-8	M-2	S-1
MSE_1A_C20_K01   The Student undergram the field of adhesives, self-adhesive materials and coatings in the field of adhesives, self-adhesive materials and coatings in the field of adhesives, self-adhesive materials and coatings in the field of adhesives, self-adhesive materials and coatings in the field of adhesives, self-adhesive materials and coatings in the field of adhesives, self-adhesive materials and coatings in the field of adhesives, self-adhesive materials and coatings in the field of adhesives, self-adhesive materials and coatings in the field of adhesives, self-adhesive materials and coatings in the field of adhesives, self-adhesive materials and coatings in the field of adhesives, self-adhesive materials and coatings in the field of adhesives, self-adhesive materials and coatings in the field of adhesives, self-adhesive materials and coatings in the field of adhesives, self-adhesive materials and coatings in the field of adhesives, self-adhesive materials and coatings in the field of adhesives, self-adhesive materials and coatings in the field of adhesives, self-adhesive materials and coatings in the field of adhesives, self-adhesive materials and coatings in the field of adhesives, self-adhesive materials and coatings in the field of adhesives, self-adhesives, self-adhesive	Social compet	rences								
NSE_1A_C20_W01	The student under friendly technolog	ies in the field of adhesives, self-adhesive		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-W-1 T-W-2 T-W-3 T-W-4 T-W-5 T-W-6		S-1
MSE_1A_C20_W01       2,0       3,0       Student describes selected issues at a basic level (score => 50%)         3,5       4,0       4,5       5,0       1,0<	Outcomes	Grade	E	Evaluation cr	iterion					
NSE_1A_C20_W01	Knowledge									
MSE_1A_C20_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 competences  MSE_1A_C20_K01  2,0 3,0 Student describes selected issues at a basic level (score => 50%) 3,0 Student describes selected issues at a basic level (score => 50%) 3,5 4,0 4,5 5,0   Required reading	MSE_1A_C20_W01	3,0 Student describes selected issu 3,5 4,0 4,5	es at a basic level (	(score => 50%)						
3,0 Student describes selected issues at a basic level (score => 50%)  3,5   4,0   4,5   5,0    Other social competences  MSE_1A_C20_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	Skills									
	MSE_1A_C20_U01	3,0 Student describes selected issu 3,5 4,0 4,5	es at a basic level (	(score => 50%)						
MSE_1A_C20_K01  2,0  3,0	Other social c									
Required reading		2,0 3,0 Student describes selected issu 3,5 4,0 4,5	es at a basic level (	(score => 50%)						
	D a modern of									
1. J. Koleske, Paint and coating testing manual, ASTM, Philadelphia, 1995	-	<del>_</del>								
	1. J. Koleske, Pa	int and coating testing manual, ASTM, F	Philadelphia, 1995 -	5						

- 2. J.H. Koo, Polymer nanocomposites, The McGraw-Hill Comp., New York, 2006
- 3. Z. Wicks, F. Jones, Organic coatings, John Wiley&Sons, Hoboken, 2007
- 4. A. Pizzi, K.L. Mittal (editors), Handbook of Adhesive Technology, Marcel Dekker Inc., New York Basel, 2003, 2nd Ed.
- 5. I. Benedek, Pressure-Sensitive Adhesives and Application, Marcel Dekker Inc., New York Basel, 2004, 2nd Ed.

### Required reading

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



Mode of study								
Graduate's qualification inżynier Fields of science engineering and technology Disciplines of science materials engineering (100%)  Educational profile general academic  Module Course unit Porous Structures and Foams Code MSE_1A_S_C21  Field of specialisation  Administering faculty Department of Catalytic and Sorbent Materials Engineering ECTS 6,0 ECTS (forms) 6,0 Form of course credit examination Language english Electives Elective group  Form of instruction Cod Semester Hours ECTS Weight Realization Credit laboratory course L 6 30 4,0 0,70 K credits lecture W 6 30 2,0 0,30 K examinati Leading teacher Michalkiewicz Beata (Beata. Michalkiewicz@zut.edu.pl) El Fray Mirosława (Mirosława. ElFray@zut.edu.pl) El Fray Mirosława (Mirosława. ElFray@zut.edu.pl), Sreńscek-Nazzal Joanna (Joanna. Srenscek@zut.edu.pl), Zwir Marek (Marek. Zwir@zut.edu.pl)  Prerequisites  W-1 none  Module/course unit objectives C-1 Gaining knowledge about structure, properties and manufacturing of porous materials and foams  Course content divided into various forms of instruction T-L-1 Surface Area and Porosity Characterization T-L-2 Synthesis of Ordered Mesoporous Silica T-L-3 International standards for determining properties of porous materials. Testing selected properties of various forms of instruction International standards for determining properties of porous materials. Testing selected properties of various forms of instruction International standards for determining properties of porous materials. Testing selected properties of various forms of instruction International standards for determining properties of porous materials. Testing selected properties of various forms of instruction International standards for determining properties of porous materials. Testing selected properties of various forms according to standards								
Fields of science engineering and technology  Disciplines of science materials engineering (100%)  Educational profile general academic  Module  Course unit Porous Structures and Foams  Code MSE_1A_S_C21  Field of specialisation  Administering faculty Department of Catalytic and Sorbent Materials Engineering  ECTS 6.0 ECTS (forms) 6.0  Form of course credit examination Language english  Electives Elective group  Form of instruction Cod Semester Hours ECTS Weight Realization Credit laboratory course L 6 30 4.0 0,70 K credits lecture W 6 30 2.0 0,30 K examinati  Leading teacher Michalkiewicz Beata (Beata.Michalkiewicz@zut.edu.pl)  EI Fray Miroslawa (Miroslawa.ElFray@zut.edu.pl), Michalkiewicz Beata (Beata.Michalkiewicz@zut.edu.pl), Sreńscek-Nazzal (Beata.Michalkiewicz@zut.edu.pl), Zwir Marek (Marek.Zwir@zut.edu.pl)  Prerequisites  W-1 none  Module/course unit objectives  C-1 Gaining knowledge about structure, properties and manufacturing of porous materials and foams  Course content divided into various forms of instruction Number of h  T-1-1 Surface Area and Porosity Characterization  T-1-2 Synthesis of Ordered Mesoporous Silica  International standards for determining properties of porous materials. Testing selected properties of various foams according to standards								
Disciplines of science materials engineering (100%)  Educational profile general academic  Module  Course unit Porous Structures and Foams  Code MSE_IA_S_C21  Field of specialisation  Administering faculty Department of Catalytic and Sorbent Materials Engineering  ECTS 6,0 ECTS (forms) 6,0  Form of course credit examination Language english  Electives  Elective group  Form of instruction Cod Semester Hours ECTS Weight Realization Credit laboratory course L 6 30 4,0 0,70 K credits lecture W 6 30 2,0 0,30 K examinati  Leading teacher Michalkiewicz Beata (Beata.Michalkiewicz@zut.edu.pl)  EI Fray Mirosława (Mirosława.EIFray@zut.edu.pl), Michalkiewicz Beata (Beata.Michalkiewicz@zut.edu.pl), Pelka Rafal (Rafal.Pelka@zut.edu.pl), Sreńscek-Nazzal joanna (Joanna.Srenscek@zut.edu.pl), Zwir Marek (Marek.Zwir@zut.edu.pl)  Prerequisites  W-1 none  Module/course unit objectives  C-1 Gaining knowledge about structure, properties and manufacturing of porous materials and foams  Course content divided into various forms of instruction  T-L-1 Surface Area and Porosity Characterization  T-L-2 Synthesis of Ordered Mesoporous Silica T-L-3 International standards for determining properties of porous materials. Testing selected properties of various foams according to standards								
Educational profile general academic  Module  Course unit Porous Structures and Foams  Code MSE_1A_S_C21  Field of specialisation  Administering faculty Department of Catalytic and Sorbent Materials Engineering  ECTS 6,0 ECTS (forms) 6,0  Form of course credit examination Language english  Electives Elective group  Form of instruction Cod Semester Hours ECTS Weight Realization Credit laboratory course L 6 30 4,0 0,70 K credits lecture W 6 30 2,0 0,30 K examinati  Leading teacher Michalkiewicz Beata (Beata.Michalkiewicz@zut.edu.pl)  EI Fray Miroslawa (Miroslawa.EIFray@zut.edu.pl), Michalkiewicz Beata (Beata.Michalkiewicz@zut.edu.pl), Pleka Rafal (Rafal.Pelka@zut.edu.pl), Sreńscek-Nazzal Joanna (Joanna.Srenscek@zut.edu.pl), Zwir Marek (Marek.Zwir@zut.edu.pl)  Prerequisites  W-1 none  Module/course unit objectives  C-1 Gaining knowledge about structure, properties and manufacturing of porous materials and foams  Course content divided into various forms of instruction  T-L-1 Surface Area and Porosity Characterization  T-L-2 Synthesis of Ordered Mesoporous Silica  T-L-3 International standards for determining properties of porous materials. Testing selected properties of various foams according to standards								
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Course unit Porous Structures and Foams  Code MSE_1A_S_C21  Field of specialisation  Administering faculty Department of Catalytic and Sorbent Materials Engineering  ECTS 6,0 ECTS (forms) 6,0  Form of course credit examination Language english  Electives Elective group  Form of instruction Cod Semester Hours ECTS Weight Realization Credit laboratory course L 6 30 4,0 0,70 K credits lecture W 6 30 2,0 0,30 K examination Leading teacher Michalkiewicz Beata (Beata. Michalkiewicz@zut.edu.pl)  El Fray Mirosława (Mirosława. ElFray@zut.edu.pl), Michalkiewicz Beata (Beata. Michalkiewicz@zut.edu.pl), Pelka Rafal (Rafal. Pelka@zut.edu.pl), Sreńscek-Nazzal Joanna (Joanna. Srenscek@zut.edu.pl), Żwir Marek (Marek. Zwir@zut.edu.pl)  Prerequisites  W-1 none  Module/course unit objectives  C-1 Gaining knowledge about structure, properties and manufacturing of porous materials and foams  C-2 Skills of characterising structure, properties and manufacturing of porous materials and foams  Course content divided into various forms of instruction  T-L-1 Surface Area and Porosity Characterization  T-L-2 Synthesis of Ordered Mesoporous Silica  T-L-3 International standards for determining properties of porous materials. Testing selected properties of various foams according to standards								
Administering faculty  Department of Catalytic and Sorbent Materials Engineering  ECTS  6,0  ECTS (forms)  6,0  Form of course credit  Examination  Language  english  Electives  Elective group  Form of instruction  Cod Semester  Hours  ECTS  Weight  Realization  Credit  laboratory course  L  6  30  4,0  0,70  K  credits  lecture  W  6  30  2,0  0,30  K  examinati  Leading teacher  Michalkiewicz Beata (Beata.Michalkiewicz@zut.edu.pl)  El Fray Mirosława (Mirosława.ElFray@zut.edu.pl), Michalkiewicz Beata (Beata.Michalkiewicz@zut.edu.pl), Pelka Rafal (Rafal.Pelka@zut.edu.pl), Sreńscek-Nazzal Joanna (Joanna.Srenscek@zut.edu.pl), Żwir Marek (Marek.Zwir@zut.edu.pl)  Prerequisites  W-1  none  Module/course unit objectives  C-1  Gaining knowledge about structure, properties and manufacturing of porous materials and foams  C-2  Skills of characterising structure, properties and manufacturing of porous materials and foams  Course content divided into various forms of instruction  T-L-1  Surface Area and Porosity Characterization  T-L-2  Synthesis of Ordered Mesoporous Silica  International standards for determining properties of porous materials. Testing selected properties of various foams according to standards								
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Administering faculty  Department of Catalytic and Sorbent Materials Engineering  ECTS  6,0  ECTS (forms)  6,0  Form of course credit  Examination  Language  english  Electives  Elective group  Form of instruction  Cod Semester  Hours  ECTS  Weight  Realization  Credit  laboratory course  L  6  30  4,0  0,70  K  credits  lecture  W  6  30  2,0  0,30  K  examinati  Leading teacher  Michalkiewicz Beata (Beata.Michalkiewicz@zut.edu.pl)  El Fray Mirosława (Mirosława.ElFray@zut.edu.pl), Michalkiewicz Beata (Beata.Michalkiewicz@zut.edu.pl), Pelka Rafal (Rafal.Pelka@zut.edu.pl), Sreńscek-Nazzal Joanna (Joanna.Srenscek@zut.edu.pl), Żwir Marek (Marek.Zwir@zut.edu.pl)  Prerequisites  W-1  none  Module/course unit objectives  C-1  Gaining knowledge about structure, properties and manufacturing of porous materials and foams  C-2  Skills of characterising structure, properties and manufacturing of porous materials and foams  Course content divided into various forms of instruction  T-L-1  Surface Area and Porosity Characterization  T-L-2  Synthesis of Ordered Mesoporous Silica  International standards for determining properties of porous materials. Testing selected properties of various foams according to standards								
Administering faculty  Department of Catalytic and Sorbent Materials Engineering  ECTS  6,0  ECTS (forms)  6,0  Form of course credit  Examination  Language  english  Electives  Elective group  Form of instruction  Cod Semester  Hours  ECTS  Weight  Realization  Credit  laboratory course  L  6  30  4,0  0,70  K  credits  lecture  W  6  30  2,0  0,30  K  examinati  Leading teacher  Michalkiewicz Beata (Beata.Michalkiewicz@zut.edu.pl)  El Fray Mirosława (Mirosława.ElFray@zut.edu.pl), Michalkiewicz Beata (Beata.Michalkiewicz@zut.edu.pl), Pelka Rafal (Rafal.Pelka@zut.edu.pl), Sreńscek-Nazzal Joanna (Joanna.Srenscek@zut.edu.pl), Żwir Marek (Marek.Zwir@zut.edu.pl)  Prerequisites  W-1  none  Module/course unit objectives  C-1  Gaining knowledge about structure, properties and manufacturing of porous materials and foams  C-2  Skills of characterising structure, properties and manufacturing of porous materials and foams  Course content divided into various forms of instruction  T-L-1  Surface Area and Porosity Characterization  T-L-2  Synthesis of Ordered Mesoporous Silica  International standards for determining properties of porous materials. Testing selected properties of various foams according to standards								
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Form of course credit examination Language english  Electives Elective group  Form of instruction Cod Semester Hours ECTS Weight Realization Credit laboratory course L 6 30 4,0 0,70 K credits lecture W 6 30 2,0 0,30 K examinati Leading teacher Michalkiewicz Beata (Beata.Michalkiewicz@zut.edu.pl)  Other teachers Hours El Fray Mirosława (Mirosława.ElFray@zut.edu.pl), Michalkiewicz Beata (Beata.Michalkiewicz@zut.edu.pl), Pelka Rafal (Rafal.Pelka@zut.edu.pl), Sreńscek-Nazzal Joanna (Joanna.Srenscek@zut.edu.pl), Żwir Marek (Marek.Zwir@zut.edu.pl)  Prerequisites  W-1 none  Module/course unit objectives  C-1 Gaining knowledge about structure, properties and manufacturing of porous materials and foams  C-2 Skills of characterising structure, properties and manufacturing of porous materials and foams  Course content divided into various forms of instruction  T-L-1 Surface Area and Porosity Characterization  T-L-2 Synthesis of Ordered Mesoporous Silica  T-L-3 International standards for determining properties of porous materials. Testing selected properties of various foams according to standards								
Electives   Elective group   Error of instruction   Cod   Semester   Hours   ECTS   Weight   Realization   Credit								
Form of instruction   Cod   Semester   Hours   ECTS   Weight   Realization   Credit								
laboratory course  L 6 30 4,0 0,70 K credits  lecture W 6 30 2,0 0,30 K examinati  Leading teacher  Michalkiewicz Beata (Beata.Michalkiewicz@zut.edu.pl)  El Fray Mirosława (Miroslawa.ElFray@zut.edu.pl), Michalkiewicz Beata (Beata.Michalkiewicz@zut.edu.pl), Pelka Rafal (Rafal.Pelka@zut.edu.pl), Sreńscek-Nazzal Joanna (Joanna.Srenscek@zut.edu.pl), Żwir Marek (Marek.Zwir@zut.edu.pl)  Prerequisites  W-1 none  Module/course unit objectives  C-1 Gaining knowledge about structure, properties and manufacturing of porous materials and foams  C-2 Skills of characterising structure, properties and manufacturing of porous materials and foams  Course content divided into various forms of instruction  T-L-1 Surface Area and Porosity Characterization  T-L-2 Synthesis of Ordered Mesoporous Silica  T-L-3 International standards for determining properties of porous materials. Testing selected properties of various foams according to standards								
lecture W 6 30 2,0 0,30 K examination   Leading teacher								
Leading teacher  Michalkiewicz Beata (Beata.Michalkiewicz@zut.edu.pl)  El Fray Mirosława (Miroslawa.ElFray@zut.edu.pl), Michalkiewicz Beata (Beata.Michalkiewicz@zut.edu.pl), Pelka Rafal (Rafal.Pelka@zut.edu.pl), Sreńscek-Nazzal Joanna (Joanna.Srenscek@zut.edu.pl), Żwir Marek (Marek.Zwir@zut.edu.pl)  Prerequisites  W-1   none  Module/course unit objectives  C-1   Gaining knowledge about structure, properties and manufacturing of porous materials and foams  C-2   Skills of characterising structure, properties and manufacturing of porous materials and foams  Course content divided into various forms of instruction   Number of h  T-L-1   Surface Area and Porosity Characterization    T-L-2   Synthesis of Ordered Mesoporous Silica    International standards for determining properties of porous materials. Testing selected properties of various foams according to standards								
El Fray Mirosława (Miroslawa.ElFray@zut.edu.pl), Michalkiewicz Beata (Beata.Michalkiewicz@zut.edu.pl), Pelka Rafal (Rafal.Pelka@zut.edu.pl), Sreńscek-Nazzal Joanna (Joanna.Srenscek@zut.edu.pl), Żwir Marek (Marek.Zwir@zut.edu.pl)  Prerequisites  W-1								
El Fray Mirosława (Miroslawa.ElFray@zut.edu.pl), Michalkiewicz Beata (Beata.Michalkiewicz@zut.edu.pl), Pelka Rafal (Rafal.Pelka@zut.edu.pl), Sreńscek-Nazzal Joanna (Joanna.Srenscek@zut.edu.pl), Żwir Marek (Marek.Zwir@zut.edu.pl)  Prerequisites  W-1								
Joanna (Joanna.Srenscek@zut.edu.pl), Żwir Marek (Marek.Zwir@zut.edu.pl)    Prerequisites								
Prerequisites  W-1   none    Module/course unit objectives  C-1   Gaining knowledge about structure, properties and manufacturing of porous materials and foams  C-2   Skills of characterising structure, properties and manufacturing of porous materials and foams  Course content divided into various forms of instruction   Number of Interval    T-L-1   Surface Area and Porosity Characterization    T-L-2   Synthesis of Ordered Mesoporous Silica    T-L-3   International standards for determining properties of porous materials. Testing selected properties of various foams according to standards								
W-1noneModule/course unit objectivesC-1Gaining knowledge about structure, properties and manufacturing of porous materials and foamsC-2Skills of characterising structure, properties and manufacturing of porous materials and foamsCourse content divided into various forms of instructionNumber of hT-L-1Surface Area and Porosity CharacterizationT-L-2Synthesis of Ordered Mesoporous SilicaT-L-3International standards for determining properties of porous materials. Testing selected properties of various foams according to standards								
Module/course unit objectivesC-1Gaining knowledge about structure, properties and manufacturing of porous materials and foamsC-2Skills of characterising structure, properties and manufacturing of porous materials and foamsCourse content divided into various forms of instructionNumber of hT-L-1Surface Area and Porosity CharacterizationT-L-2Synthesis of Ordered Mesoporous SilicaT-L-3International standards for determining properties of porous materials. Testing selected properties of various foams according to standards								
C-1 Gaining knowledge about structure, properties and manufacturing of porous materials and foams  C-2 Skills of characterising structure, properties and manufacturing of porous materials and foams  Course content divided into various forms of instruction  T-L-1 Surface Area and Porosity Characterization  T-L-2 Synthesis of Ordered Mesoporous Silica  T-L-3 International standards for determining properties of porous materials. Testing selected properties of various foams according to standards								
C-2 Skills of characterising structure, properties and manufacturing of porous materials and foams  Course content divided into various forms of instruction Number of home								
Course content divided into various forms of instruction  T-L-1 Surface Area and Porosity Characterization  T-L-2 Synthesis of Ordered Mesoporous Silica  T-L-3 International standards for determining properties of porous materials. Testing selected properties of various foams according to standards								
T-L-1 Surface Area and Porosity Characterization  T-L-2 Synthesis of Ordered Mesoporous Silica  T-L-3 International standards for determining properties of porous materials. Testing selected properties of various foams according to standards								
T-L-2 Synthesis of Ordered Mesoporous Silica  T-L-3 International standards for determining properties of porous materials. Testing selected properties of various foams according to standards								
T-L-3 International standards for determining properties of porous materials. Testing selected properties of various foams according to standards								
various foams according to standards								
T. / Modelling and design of page particle (using a constant behaviors)								
T-L-4   Modelling and design of porous materials (using computer techniques)								
T-L-5 Measurements of catalytic activity of porous materials								
T-L-6 Density and pore structure of PUR foam as function of amount and kind of a blowing agent. Synthesis and characterization of PUR foams.								
T-W-1 Nature's Porous Materials								
T-W-2 Theory of Adsorption and Catalysis: Surface Area and Porosity								
T-W-3 Zeolites and Zeotypes								
T-W-4 Ordered Mesoporous Silica								
T-W-5 Carbons								
T-W-6 Polyurethane microcellular materials and foams								
T-W-7 Introduction to numerical modelling								
T-W-8 Modelling of the structure of porous materials								
T-W-9 Modelling of catalytic properties of porous materials								
T-W-10 Metals, metal oxides, ceramics, glasses and composites								
T-W-11 Characterization methods of porous polymeric materials								
T-W-12 Processing methods and blowing agents for preparation of polymeric foams								
Student workload - forms of activity  Number of h								
-								
Attending Classes 30								
A-L-1 Attending Classes  A-L-2 Preparing for tests  A-L-3 Preparing reports								



			racuity of chem	icai reciiii	ology all	Liigiii		19			
			s of activity						Nun	nber o	f hours
			ultations								6
		ing Clas									30
			ne exam								26
			ultations								2
	The ex										2
Teaching m			S								
	Lecture										
M-2	Labora	tory									
Evaluation	metho	ods (F -	progressive, P - final)								
S-1	Р	Exam									
5-2	F	written	test								
	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_\ Student descri porous materia	bes 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											
MSE_1A_C21_U Student charac properties of p	cterizes		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		elected no	prous materials	MSE_1A_U08	P6S_UK	P6S_UW	C-2	T-L-2	T-L-4	M-2	S-2
Social com			Tous materials								
MSE_1A_C21_k Student under foams in pract	stands t		tance of porous structures and	MSE_1A_K02	P6S_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-11 T-W-12	M-1 M-2	S-1 S-2
Outcom	ies	Grade		E	valuation cr	iterion					
Knowledge											
MSE_1A_C21_\		2,0									
		3,0	Student describes selected issue	es concerning the st	tructure of porou	us materials, pr	operties	and syn	thesis at	a basic l	evel
		3,5	(exam score => 50%)								
ı		4,0									
		4,5									
CL:II-		5,0									
Skills	101	2.0									
MSE_1A_C21_U	JUI	2,0 3,0	Student characterizes properties	s of norque material	ls at a basic love	al (eyam score -	=> 50%\				
		3,5	stadent characterizes properties	o or porous illaterial	s at a basic leve	r (evaill scole :	-/ 3070)				
		4,0									
		4,5				·					
MCE 14 CO1 :	102	5,0									
MSE_1A_C21_U	JU2	2,0 3,0	Student synthetises selected po	rous materials at a	hasic level (ever	m score -> 500	%)				
		3,5	otadent synthetises selected po	ious materiais at a	DUSIC IEVEI (EXAI	III 3COTE => 30	,,,				
		4,0									
		4,5									
		5,0									



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



M-2

Discussion

# Zachodniopomorski Uniwersytet Technologiczny w Szczecinie

Field of study     Materials Science and Engineering       Mode of study     stationary       Level     first cycle	
Mode of study stationary Level first cycle	
	ELICI
Graduate's qualification inżynier	ΓilCh
Fields of science engineering and technology	
Disciplines of science materials engineering (100%)	
Educational profile general academic	
Module	
Course unit Case Studies in Biomaterials	C
Code MSE_1A_S_C22a	
Field of specialisation	
Administering faculty Department of Polymer and Biomaterials Science	
ECTS 4,0 ECTS (forms) 4,0	
Form of course credit credits Language english	
Electives 8 Elective group	
Form of instruction Cod Semester Hours ECTS Weight Realiz	ration Credit
project course P 6 15 1,0 0,25 kg	C credits
seminars S 6 45 3,0 0,75 k	C credits
Leading teacher El Fray Mirosława (Miroslawa.ElFray@zut.edu.pl)	
Biedunkiewicz Anna (Anna.Biedunkiewicz@zut.edu.pl), Chen Xuecher	
Other teachers (Xuecheng.Chen@zut.edu.pl), El Fray Mirosława (Miroslawa.ElFray@z	
Piotr (psobolewski@zut.edu.pl)	
Prerequisites  Basic knowledge in polymer, metal and ceramic materials synthesis, characterization and structure.	e-properties relationship
W-1 with the application as biomaterials	
Module/course unit objectives	
C-1 To gain the knowledge, skills and competences in the field of various aspects of biomaterials synt medical applications	nesis, characterization and
C-2 To carry out a basic literature search based on databases and scientific literature.	
Course content divided into various forms of instruction	Number of hours
T-P-1 Design of biomaterials for hard and soft tissue repair	5
T-P-2 Design of metal and ceramic biomaterials	5
T-P-3 Nanomaterials for medical applications	5
T-S-1 Operating conditions and mechanisms of dergadation/failure of biomedical materials	3
T-S-2 The most common problems with ensuring the quality of implants and endoprostheses	3
T-S-3 Methods of preventing biomaterials from destructive phenomena	3
T-S-4 The issue of biocompatibility	3
T-S-5 Development directions of nano- and micro-crystalline ceramic, metallic and composite biomateri Intelligent structures	3
T-S-6 Production process of TiO2 - cause and effect relationships	6
T-S-7 Analysis and discussion of current biomaterials literature	15
T-S-8 Analysis and discussion of current nanomaterials literature	9
Student workload - forms of activity	Number of hours
A-P-1 participation in projects	15
A-P-2 individual study of literature	10
A-P-3 consultations	5
A-S-1 participation in seminars	45
A-S-2 individual study of literature	30
(A. L. Consultations	15
A-S-3 consultations	
Teaching methods / tools  M-1 Seminars	



M-3	Case s	tudv									
	Project										
			progracely a D. E								
			progressive, P - final)			de dans e als cadas as als		/	!		
S-1	F		ment based on evaluation of t		tation and act	livity during a	ISCUSSIO	ns (sei	ninar).		
S-2	P	Written	project and presentation (pro	oject)	1			1			
С	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	Evaluatio methods
Knowledge											
MSE_1A_C22a_ The student had field of biomate	s know	ledge in t	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											
MSE_1A_C22a_I Studdent can p Engineering pro	erform	a case st	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 comp	eten	ces									
MSE_1A_C22a_l Student unders development in	tands t		for continuous training and estudies	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
Outcome	es	Grade		E	valuation cr	iterion					
Knowledge											
MSE_1A_C22a_'	W01	2,0 3,0 3,5 4,0 4,5 5,0	from 50 to 55% of percentage po	ints							
Skills		3,0									
MSE_1A_C22a_	U01	2,0 3,0 3,5 4,0 4,5 5,0	from 50 to 55% of percentage po	ints							
Other social	l com		<u> </u>								
MSE_1A_C22a_I		2,0 3,0 3,5 4,0 4,5	from 50 to 55% of percentage po	ints							
		5,0									
Required re											

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

4. Aldo R. Boccaccini, Peter X. Ma, Tissue Engineering Using Ceramics and Polymers, Elsevier, 2014

3. A. Serra Ed., Advances in Bioengineering, InTechOpen, 2015



			- <b>,</b>			- 9,5 -					
Field of st	udy	Mate	erials Scienc	e and Engineeri	ing						
Mode of s	tudy	stat	ionary	Level		first o	cycle	3.4.7T:1.	C I		
Graduate'	s qualification	inży	nier	•				WTil	Ch		
Fields of s	science	engi	neering and	technology							
Discipline	s of science	mat	erials engine	ering (100%)				_			
Education	al profile	gen	eral academ	ic				1			
Module											
Course ur	nit	Cas	e Studies i	n Medical Dev	ices				C		
Code		MSE	_1A_S_C22b					· \			
Field of sp	pecialisation		<del></del>								
Administe	ering faculty	Dep	artment of M	laterials Techno	ology				_		
ECTS		4,0		ECTS (forms)		4,0					
	ourse credit	cred	lits	Language		english	 1	-			
Electives		8		Elective group				-			
Form of in	 nstruction	Cod	Semester	Hours	EC	 TS	Weight	Realization	Credit		
project co	K	credits									
seminars	K	credits									
Leading to											
Other tea	Biedunkiewicz Anna (Anna.Biedunkiewicz@zut.edu.pl), Chen Xuecheng Other teachers (Xuecheng.Chen@zut.edu.pl), El Fray Mirosława (Miroslawa.ElFray@zut.edu Piotr (psobolewski@zut.edu.pl)										
Prerequisi											
W-1	Basic knowledge in with the application				als synth	esis, ch	aracterization ar	nd structure-prop	erties relationship		
Module/co	ourse unit objective										
C-1	To gain the knowle	dge, s		petences in the fi	eld of va	rious as	pects of biomate	erials synthesis, o	characterization in		
C-2	medical devices ap  To carry out a basic	•		asod on database	oc and c	ciontific	litoraturo				
	entent divided into				es and s	Cientine			Number of hours		
T-P-1	Design criteria and				cal devic	os (hoa	rt assist devices	<u> </u>	Number of flours		
T-P-2	Design criteria and					.es (nea	it assist devices,	·	5		
T-P-3	Nanocomposites in			used in incurcur.	acvices				5		
T-S-1	Issues with biocom			s and endoprosth	eses. Im	pact of	implants on life	processes.	3		
T-S-2	Introduction to the ceramic, metallic a human tissue.	struc	ture of the hu	man body. Proble	ms with	ensurin	g the durability o	of the quality of	3		
T-S-3	Improving oseointe Titanium nanotube	gratio	on (ceramic bi	oactive layers). M	licroporc	us cera	mic capsules for	drug carriers.	3		
T-S-4	Reconstruction of b								3		
T-S-5	Problems of joining	meta	Illic and ceran	nic biomaterials.					3		
T-S-6	Production process	of Ti	D2 - cause and	d effect relationsh	ips				6		
T-S-7	Analysis and discus	sion	of current med	dical device litera	ture				15		
T-S-8	Analysis and discus	sion	of current nan	ocomposites liter	ature				9		
Student w	orkload - forms of	activ	vity						Number of hours		
A-P-1	participation in pro	jects							15		
A-P-2	individual study of	literat	ture						10		
A-P-3	consultations								5		
A-S-1	participation in sen	ninars	<b>i</b>						45		
A-S-2	study of literature								20		
A-S-3	consultations								15		
A-S-4	written reports								10		
Teaching	methods / tools										

Teaching m	ethor	ds / tool									
	Semin		5								
	Discus										
		tudies									
	Project										
	-		progressive, P - final)								
S-1	F		nent based on evaluation of t	he given presen	tation and act	tivity durina di	iscussio	ins (sei	minar)		
S-2	Р		project and presentation (pro		- Italion and act	arring ar		,,,,,			
			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					•	•				•	
field of medical	s know	ledge in t	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				T	1	1		T D 1		1	
MSE_1A_C22b_ Studdent can p problems.	U01 erform	a case st	udy 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 comp	peten	ces									
MSE_1A_C22b_ Student unders development ir	tands t	the need t	or 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
Outcome	es	Grade		E	valuation 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	oints							
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 social	I com		es								
MSE_1A_C22b_	K01	2,0 3,0 3,5 4,0 4,5 5,0	from 50 to 55% of percentage po	pints							
Required re	ading										
-			, D.R. Peterson, Biomaterials	Principles and Pr	ractices, CRC I	Press, 2013					
	-		Majernik,, Biomedical engine	•			nTech.	2012			
2 ^ C 5			Diagrama and Antonio			22.2	,				

3. A. Serra Ed., Advances in Bioengineering, InTech Open, 2015



T-L-1 Preparation of BMC-type polymer composites  T-L-2 Determination of mechanical properties and fracture behavior of fiber reinforced composites  T-L-3 Preparation and determination of electroconductivity of nano-soot based functional polymer nanocomposites  T-L-4 Preparation of polymer nanocomposites (melt blending, in situ)  Processing techniques used to prepare samples for measurements (injection moulding, pressing, casting); Physicochemical properties of polymer nanocomposites containing different types of nanofillers  T-L-6 Physical (mechanical, impact test etc.) properties of polymer nanocomposites containing different types of nanofillers  T-W-1 Composite materials: general principles and basic concepts  T-W-2 Materials for composites: fibres and matrices										
Fields of science	Field of stu	ıdy	Mate	erials Scienc	e and Engineeri	ng				
Fields of science engineering and technology  Disciplines of science  Educational profile  general academic  Module  Course unit  Composite and Advanced Materials  Code  MSE_IA_S_C23  Field of specialisation  Administering faculty  Department of Polymer and Biomaterials Science  ECTS  6,0	Mode of st	udy	stati	onary	Level		first o	cycle	34/	C I
Disciplines of science materials engineering (100%)  Educational profile general academic  Module  Course unit  Composite and Advanced Materials  Code MSE_IA_S_C23  Field of specialisation  Administering faculty  Department of Polymer and Biomaterials Science  ECTS 6.0 ECTS (forms) 6.0  Form of course credit examination Language english  Electives  Elective group  Form of instruction  Cod Semester Hours ECTS Weight Realization Credit laboratory course L 6 30 4.0 0.50 K credits lecture W 6 30 2.0 0,50 K examination  Leading teacher  El Fray Miroslawa (Miroslawa.ElFray@zut.edu.pl), Ignaczak Wojciech (Wojciech.Ignaczak@zut.edu.pl), Audaczyk Krzysztof (Krzysztof Kowalczyk@zut.edu.pl), Kwiatkowska Magdalena (Magdalena Kwiatkowska@zut.edu.pl), Paszkiewicz Sandra (Sandra.Paszkiewicz@zut.edu.pl), Zwir Marek (Marek.Zwir@zut.edu.pl)  Prerequisites  W-1 Fundamentals of chemistry of polymers, their synthesis and processing.  W-2 Fundamentals of mechanics of materials.  Module/course unit objectives  C-1 To gain the knowledge, skills and competences in the field of composite and advanced materials  Course content divided into various forms of instruction  T-L-1 Preparation of BMC-type polymer composites  T-L-2 Determination of mechanical properties and fracture behavior of fiber reinforced composites  T-L-3 Preparation of polymer nanocomposites  T-L-4 Preparation of polymer nanocomposites (melt blending, in situ)  Processing techniques used to prepare samples for measurements (injection moulding, pressing, casting);  Physicochemical properties of polymer nanocomposites containing different types of nanofillers  T-L-4 Preparation of polymer nanocomposites for polymer nanocomposites containing different types of nanofillers  T-L-5 (Ambrillers)  T-L-6 (Ambrillers)  T-L-7 (Ambrillers)  T-L-8 (Ambrillers)  T-L-8 (Ambrillers)  T-L-9 (Ambrillers)	Graduate's	qualification	inżyı	nier	•				W 1110	un 🗀
Educational profile general academic  Module  Course unit  Composite and Advanced Materials  Code MSE_IA_5_C23  Field of specialisation  Administering faculty  Department of Polymer and Biomaterials Science  ECTS 6,0 ECTS (forms) 6,0  Form of course credit examination Language english  Electives  Electives  Elective group  Form of instruction  Cod Semester Hours ECTS Weight Realization Credit  laboratory course L 6 30 4,0 0,50 K credits  lecture W 6 30 2,0 0,50 K examination  Leading teacher  El Fray Miroslawa (Miroslawa.ElFray@zut.edu.pl), Ignaczak Wojciech  (Wojciech.Ignaczak@zut.edu.pl), Kowalczyk Krzysztof (Krzysztof, Kowalczyk, Guzt.edu.pl), Kwiatkowska Magdalena (Magdalena, Kwiatkowska@zut.edu.pl), Paszkiewicz Sandra  (Sandra-Paszkiewicz@zut.edu.pl), Zwir Marek (Marek. Zwir@zut.edu.pl)  Prerequisites  W-1 Fundamentals of chemistry of polymers, their synthesis and processing.  W-2 Fundamentals of mechanics of materials.  Module/course unit objectives  C-1 To gain the knowledge, skills and competences in the field of composite and advanced materials  Course content divided into various forms of instruction  Number of ho  T-L-1 Preparation of BMC-type polymer composites  T-L-2 Determination of mechanical properties and fracture behavior of fiber reinforced composites  T-L-3 Preparation and determination of electroconductivity of nano-soot based functional polymer nanocomposites  T-L-4 Preparation of polymer nanocomposites (melt blending, in situ)  Processing techniques used to prepare samples for measurements (injection moulding, pressing, casting);  Physical (mechanical, impact test etc.) properties of polymer nanocomposites containing different types of nanofillers  T-W-2 Materials for composites: fibres and matrices	Fields of so	cience	engi	neering and	technology					_
Module  Course unit  Composite and Advanced Materials  Code  MSE_1A_S_C23  Field of specialisation  Administering faculty  Department of Polymer and Biomaterials Science  ECTS  6.0	Disciplines	of science	mate	erials engine	eering (100%)				_	
Administering faculty Department of Polymer and Biomaterials Science  ECTS 6,0 ECTS (forms) 6,0  Form of course credit examination Language english  Electives  Electives  Elective group  Form of instruction  Cod Semester Hours ECTS Weight Realization Credit laboratory course  L 6 30 4,0 0,50 K credits lecture  W 6 30 2,0 0,50 K examination  Leading teacher  El Fray Miroslawa (Miroslawa.ElFray@zut.edu.pl)  El Fray Miroslawa (Miroslawa.ElFray@zut.edu.pl), Ignaczak Wojciech (Wojciech.Ignaczak@zut.edu.pl), Kowalczyk Krzysztof (Krzysztof.Kowalczyk@zut.edu.pl), Kwiatkowska Magdalena (Miroslawa.ElFray@zut.edu.pl), Paszkiewicz Sandra (Sandra.Paszkiewicz@zut.edu.pl), Xwir Marek (Marek.Zwir@zut.edu.pl) Paszkiewicz Sandra (Sandra.Paszkiewicz@zut.edu.pl), Xwir Marek (Marek.Zwir@zut.edu.pl)  Prerequisites  W-1 Fundamentals of chemistry of polymers, their synthesis and processing.  W-2 Fundamentals of mechanics of materials.  Module/course unit objectives  C-1 To gain the knowledge, skills and competences in the field of composite and advanced materials  Course content divided into various forms of instruction  Number of ho  T-L-1 Preparation of BMC-type polymer composites  T-L-2 Determination of mechanical properties and fracture behavior of fiber reinforced composites  T-L-3 Preparation and determination of electroconductivity of nano-soot based functional polymer nanocomposites  T-L-4 Preparation of polymer nanocomposites (melt blending, in situ)  Processing techniques used to prepare samples for measurements (injection moulding, pressing, casting);  Physicochemical properties of polymer nanocomposites containing different types of nanofillers  T-L-6 Opmosite materials: general principles and basic concepts  Materials for composites: fibres and matrices	Educationa	al profile	gene	eral academ	ic					
Administering faculty   Department of Polymer and Biomaterials Science   ECTS   6,0   ECTS (forms)   6,0     Form of course credit   examination   Language   english	Module									
Administering faculty Department of Polymer and Biomaterials Science  ECTS 6,0 ECTS (forms) 6,0  Form of course credit examination Language english  Electives  Electives  Elective group  Form of instruction  Cod Semester Hours ECTS Weight Realization Credit laboratory course  L 6 30 4,0 0,50 K credits lecture  W 6 30 2,0 0,50 K examination  Leading teacher  El Fray Miroslawa (Miroslawa.ElFray@zut.edu.pl)  El Fray Miroslawa (Miroslawa.ElFray@zut.edu.pl), Ignaczak Wojciech (Wojciech.Ignaczak@zut.edu.pl), Kowalczyk Krzysztof (Krzysztof.Kowalczyk@zut.edu.pl), Kwiatkowska Magdalena (Miroslawa.ElFray@zut.edu.pl), Paszkiewicz Sandra (Sandra.Paszkiewicz@zut.edu.pl), Xwir Marek (Marek.Zwir@zut.edu.pl) Paszkiewicz Sandra (Sandra.Paszkiewicz@zut.edu.pl), Xwir Marek (Marek.Zwir@zut.edu.pl)  Prerequisites  W-1 Fundamentals of chemistry of polymers, their synthesis and processing.  W-2 Fundamentals of mechanics of materials.  Module/course unit objectives  C-1 To gain the knowledge, skills and competences in the field of composite and advanced materials  Course content divided into various forms of instruction  Number of ho  T-L-1 Preparation of BMC-type polymer composites  T-L-2 Determination of mechanical properties and fracture behavior of fiber reinforced composites  T-L-3 Preparation and determination of electroconductivity of nano-soot based functional polymer nanocomposites  T-L-4 Preparation of polymer nanocomposites (melt blending, in situ)  Processing techniques used to prepare samples for measurements (injection moulding, pressing, casting);  Physicochemical properties of polymer nanocomposites containing different types of nanofillers  T-L-6 Opmosite materials: general principles and basic concepts  Materials for composites: fibres and matrices	Course uni	t	Com	posite and	l Advanced Ma	aterial	 S			
Administering faculty   Department of Polymer and Biomaterials Science   ECTS   6,0   ECTS (forms)   6,0     Form of course credit   examination   Language   english	Code		-						\ <b>.</b>	
Administering faculty   Department of Polymer and Biomaterials Science   ECTS   6,0   ECTS (forms)   6,0     Form of course credit   examination   Language   english	Field of spe	ecialisation	-							
ECTS   6,0   ECTS (forms)   6,0   ECTS (forms)   6,0   ECTS (forms)   Electives   Electives   Elective group   Elective group   Electives   Elective group   Electives   Elective group   Elective group   Electives   Elective group   Electives   Elective group   Electives   Elective group   Electives   Elective group   Elective group   Elective group   Elective group   Electives   Elective group   Electiv	•		Depa	artment of P	olvmer and Bio	materia	als Scier	nce		
Form of course credit Electives   Cod   Semester   Hours   ECTS   Weight   Realization   Credits		<u> </u>	<u> </u>		_					
Flectives   Selective group   Form of instruction   Cod   Semester   Hours   ECTS   Weight   Realization   Credit		urse credit	· ·	nination			-	1		
Form of instruction   Cod   Semester   Hours   ECTS   Weight   Realization   Credits		arse creare	CXG					•		
laboratory course		struction	Cad	Comactar		F.	TC	Maiabt	Poplization	Cradit
Lecture										
Leading teacher  El Fray Mirosława (Mirosława.ElFray@zut.edu.pl),  Chher teachers  El Fray Mirosława (Mirosława.ElFray@zut.edu.pl), Ignaczak Wojciech (Wojciech.Ignaczak@zut.edu.pl), Kowalczyk Krzysztof (Krzysztof.Kowalczyk@zut.edu.pl), Kwiatkowska Magdalena (Magdalena.Kwiatkowska@zut.edu.pl), Paszkiewicz Sandra (Sandra.Paszkiewicz@zut.edu.pl), Żwir Marek (Marek.Zwir@zut.edu.pl)  Prerequisites  W-1 Fundamentals of chemistry of polymers, their synthesis and processing.  W-2 Fundamentals of mechanics of materials.  Module/course unit objectives  C-1 To gain the knowledge, skills and competences in the field of composite and advanced materials  Course content divided into various forms of instruction  T-L-1 Preparation of BMC-type polymer composites  T-L-2 Determination of mechanical properties and fracture behavior of fiber reinforced composites  T-L-3 Preparation and determination of electroconductivity of nano-soot based functional polymer nanocomposites  T-L-4 Preparation of polymer nanocomposites (melt blending, in situ)  Processing techniques used to prepare samples for measurements (injection moulding, pressing, casting); Physical (mechanical, impact test etc.) properties of polymer nanocomposites containing different types of nanofillers  T-L-6 Physical (mechanical, impact test etc.) properties of polymer nanocomposites containing different types of nanofillers  T-W-1 Composite materials: general principles and basic concepts  T-W-2 Materials for composites: fibres and matrices		course						-		
El Fray Mirosława (Miroslawa.ElFray@zut.edu.pl), Ignaczak Wojciech (Wojciech.Ignaczak@zut.edu.pl), Kowalczyk Krzysztof.Kowalczyk@zut.edu.pl), Kwiatkowska Magdalena (Magdalena.Kwiatkowska@zut.edu.pl), Paszkiewicz Sandra (Sandra.Paszkiewicz@zut.edu.pl), Żwir Marek (Marek.Zwir@zut.edu.pl)   Prerequisites   Fundamentals of chemistry of polymers, their synthesis and processing.   W-2   Fundamentals of mechanics of materials.   Module/course unit objectives									K	examination
Other teachers  (Wojciech.Ignaczak@zut.edu.pl), Kowalczyk Krzysztof (Krzysztof.Kowalczyk@zut.edu.pl), Kwiatkowska Magdalena (Magdalena.Kwiatkowska@zut.edu.pl), Paszkiewicz Sandra (Sandra.Paszkiewicz@zut.edu.pl), Żwir Marek (Marek.Zwir@zut.edu.pl)  Prerequisites  W-1 Fundamentals of chemistry of polymers, their synthesis and processing.  W-2 Fundamentals of mechanics of materials.  Module/course unit objectives  C-1 To gain the knowledge, skills and competences in the field of composite and advanced materials  Course content divided into various forms of instruction Number of ho  T-L-1 Preparation of BMC-type polymer composites  T-L-2 Determination of mechanical properties and fracture behavior of fiber reinforced composites  T-L-3 Preparation and determination of electroconductivity of nano-soot based functional polymer nanocomposites  T-L-4 Preparation of polymer nanocomposites (melt blending, in situ)  Processing techniques used to prepare samples for measurements (injection moulding, pressing, casting); Physicochemical properties of polymer nanocomposites containing different types of nanofillers  T-L-6 Physical (mechanical, impact test etc.) properties of polymer nanocomposites containing different types of nanofillers  T-W-1 Composite materials: general principles and basic concepts  T-W-2 Materials for composites: fibres and matrices	Leading te	acher								
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W-2       Fundamentals of mechanics of materials.         Module/course unit objectives         C-1       To gain the knowledge, skills and competences in the field of composite and advanced materials         Course content divided into various forms of instruction       Number of ho         T-L-1       Preparation of BMC-type polymer composites         T-L-2       Determination of mechanical properties and fracture behavior of fiber reinforced composites         T-L-3       Preparation and determination of electroconductivity of nano-soot based functional polymer nanocomposites         T-L-4       Preparation of polymer nanocomposites (melt blending, in situ)         Processing techniques used to prepare samples for measurements (injection moulding, pressing, casting); Physicochemical properties of polymer nanocomposites containing different types of nanofillers         T-L-6       Physical (mechanical, impact test etc.) properties of polymer nanocomposites containing different types of nanofillers         T-W-1       Composite materials: general principles and basic concepts         T-W-2       Materials for composites: fibres and matrices	Prerequisit	es	•							
Module/course unit objectives  C-1 To gain the knowledge, skills and competences in the field of composite and advanced materials  Course content divided into various forms of instruction  T-L-1 Preparation of BMC-type polymer composites  T-L-2 Determination of mechanical properties and fracture behavior of fiber reinforced composites  T-L-3 Preparation and determination of electroconductivity of nano-soot based functional polymer nanocomposites  T-L-4 Preparation of polymer nanocomposites (melt blending, in situ)  Processing techniques used to prepare samples for measurements (injection moulding, pressing, casting); Physicochemical properties of polymer nanocomposites containing different types of nanofillers  T-L-6 Physical (mechanical, impact test etc.) properties of polymer nanocomposites containing different types of nanofillers  T-W-1 Composite materials: general principles and basic concepts  T-W-2 Materials for composites: fibres and matrices			nemist	ry of polymei	rs, their synthesis	and pro	cessing.			
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T-L-3  Preparation and determination of electroconductivity of nano-soot based functional polymer nanocomposites  T-L-4  Preparation of polymer nanocomposites (melt blending, in situ)  Processing techniques used to prepare samples for measurements (injection moulding, pressing, casting); Physicochemical properties of polymer nanocomposites containing different types of nanofillers  T-L-6  Physical (mechanical, impact test etc.) properties of polymer nanocomposites containing different types of nanofillers  T-W-1  Composite materials: general principles and basic concepts  T-W-2  Materials for composites: fibres and matrices	T-L-1	Preparation of BMC	-type	polymer com	posites					5
nanocomposites  T-L-4 Preparation of polymer nanocomposites (melt blending, in situ)  T-L-5 Processing techniques used to prepare samples for measurements (injection moulding, pressing, casting); Physicochemical properties of polymer nanocomposites containing different types of nanofillers  T-L-6 Physical (mechanical, impact test etc.) properties of polymer nanocomposites containing different types of nanofillers  T-W-1 Composite materials: general principles and basic concepts  T-W-2 Materials for composites: fibres and matrices	T-L-2	Determination of m	nechar	nical propertie	es and fracture be	havior o	of fiber re	einforced compo	sites	5
T-L-4 Preparation of polymer nanocomposites (melt blending, in situ)  Processing techniques used to prepare samples for measurements (injection moulding, pressing, casting); Physicochemical properties of polymer nanocomposites containing different types of nanofillers  T-L-6 Physical (mechanical, impact test etc.) properties of polymer nanocomposites containing different types of nanofillers  T-W-1 Composite materials: general principles and basic concepts  T-W-2 Materials for composites: fibres and matrices	T-L-3		termir	nation of elect	troconductivity of	nano-so	ot base	d functional poly	mer	5
Processing techniques used to prepare samples for measurements (injection moulding, pressing, casting); Physicochemical properties of polymer nanocomposites containing different types of nanofillers  Physical (mechanical, impact test etc.) properties of polymer nanocomposites containing different types of nanofillers  T-W-1 Composite materials: general principles and basic concepts  T-W-2 Materials for composites: fibres and matrices	T-L-4		mer n	anocomposite	es (melt blending,	in situ)				5
T-L-6 Physical (mechanical, impact test etc.) properties of polymer nanocomposites containing different types of nanofillers  T-W-1 Composite materials: general principles and basic concepts  T-W-2 Materials for composites: fibres and matrices	T-L-5	Processing technique casting);	ues us	sed to prepare	e samples for mea	sureme	•		-	5
T-W-1 Composite materials: general principles and basic concepts  T-W-2 Materials for composites: fibres and matrices	T-L-6	Physical (mechanic								5
·	T-W-1		ls: ger	neral principle	es and basic conce	epts				2
	T-W-2	Materials for compo	osites:	fibres and m	atrices					4
T-W-3 Design examples: natural and man-made composites	T-W-3	Design examples: r	natura	l and man-ma	ade composites					3
T-W-4 Interfaces in composites		•								2
T-W-5 Fracture physics of composites										2
T-W-6 Composites based on biology		•			/l-:-: :		J. C. 111			2
T-W-7 Introduction to polymer nanocomposites (historical background, definition, general information)  Properties of polymer nanocomposites containing carbon nanofillers (mechanical, electrical, thermal				•		-		-		2
etc.)		etc.)		·	<del>-</del>		- (		, - <del>-</del>	5
T-W-9 Polymer nanocomposites containing natural fibers						-				2
T-W-10 Preparation methods and applications of polymer nanocomposites		<u> </u>						lan ang /		4
T-W-11 Destructive and non-destructive methods for (nano)composites properties assessment	ı -VV-1 1	Destructive and no	n-dest	ructive meth	oas for (nano)com	iposites	properti	ies assessment		2
										Number of hours

			Faculty of Chemi	cal Techn	ology an	d Engine	eerir	ıg			
Student wo	rkload	l - form	s of activity						Nun	nber o	f hours
A-L-2	individ	ual stud	y of literature								40
A-L-3	prepara	ation of	written reports								30
A-L-4	consult	tations									20
A-W-1	particip	oation ir	n lectures								30
A-W-2	individ	ual stud	y of the literature								20
A-W-3	Consul	tations									10
A-W-4	The ex	am									1
Teaching m	nethod	ls / tool	's						<u> </u>		
	Lecture		-								
	Labora	tory exe	ercises								
		-	progressive, P - final)								
S-1	P	Exam	progressive, r - mai								
5-2	- F	written	test								
32		Wilce				Defense to					
I	Desigr	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	e content	Teaching methods	Evaluation methods
Knowledge											
MSE_1A_C23_V The student ha and advanced	as the kr		of common aspect of composite erials	MSE_1A_W02 MSE_1A_W06	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 T-W-9 T-W-10 T-W-11	M-1 M-2	S-1 S-2
Skills				1		l					
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 comp	petend	ces									
MSE_1A_C23_k The student ur advanced engi	nderstan	nds the in material	nportance of composite and s in practical applications	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-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	es	Grade		E	valuation cr	iterion					
Knowledge											
MSE_1A_C23_V		2,0									
		3,0	from 50 to 55% of percentage po	pints							
		3,5 4,0									
		4,5									
		5,0									
Skills											
MSE_1A_C23_U	J01	2,0									
		3,0	from 50 to 55% of percentage po	oints							
		3,5									
		4,0 4,5									
		5,0									
Other socia	al comi		<u>.                                    </u>								
MSE_1A_C23_k	-	2,0									
		3,0	from 50 to 55% of percentage po	oints							
		3,5									
		4,0									
		4,5 5,0									
		ارد ا									



### 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



group discussion

## Zachodniopomorski Uniwersytet Technologiczny w Szczecinie

			- <b>,</b>			9,					
Field of st	rudy	Mate	erials Scienc	e and Engineeri	ng						
Mode of s	tudy	stat	ionary	Level		first c	cycle	\A/T:1/	~ I_		
Graduate'	's qualification	inży	nier	•		•		W 1110	un 🗀		
Fields of s	science	engi	ineering and	l technology					_		
Discipline	s of science	mat	erials engine	eering (100%)							
Education	nal profile	gen	eral academ	ic							
Module											
Course ur	nit	Med	hanics of I	Materials					C		
Code			_1A_S_C24					·			
	pecialisation	INSE									
		Dan		Antoriala Tachna	loo.						
	ering faculty	<u> </u>	artment of r	Materials Techno							
ECTS		2,0		ECTS (forms)		2,0					
	ourse credit	cred	lits	Language		english					
Electives			<u> </u>	Elective group							
Form of in	nstruction	Cod	Semester	Hours	ECT	S	Weight	Realization	Credit		
laboratory	boratory course L 3 15 1,0 0,50 K										
lecture											
Leading to	eading teacher Baranowska Jolanta (Jolanta.Baranowska@zut.edu.pl)										
	Baranowska Jolanta (Jolanta.Baranowska@zut.edu.pl), Fryska Sebastian (Sebastian.Fryska@zut.edu.pl), Ignaczak Wojciech (Wojciech.Ignaczak@zut.edu.pl), Kochmański Paweł (Pawel.Kochma										
Prerequisi	ites										
W-1	Approval in Mather	natics	s, Physics of m	naterials, Intro to N	MatSci/Int	ro to M	atEng				
Module/co	ourse unit objectiv	es									
C-1	to get the basic kneeds	owled	ge about med	hanics of materia	ls, main r	nechan	ical parameters	of materials and	methods of their		
C-2	formation of the sk	ills in	mechanical p	roperties testing							
Course co	ntent divided into	vario	ous forms of	instruction					Number of hours		
T-L-1	Tensile test of met	allic n	naterials; Cha	rpy impact strengt	th test				5		
T-L-2	Compressive test of	f met	als and ceram	nic					5		
T-L-3	Tensile and flexura	l prop	erties of engi	neering polymeric	materia	s.			5		
T-W-1	Introduction to med mechanics of mate					ains an	d displacements	; Models used in	3		
T-W-2	Hooke's low in a ur determination of pr	niaxial	l tensile or co	mpressive stress:	stress-sti	ains cu	rves for differen	t materials,	4		
T-W-3	Multiaxial stress ar					generali	ized Hooke's law	, moments of	4		
T-W-4	Mechanics of mate	rials c	during shear, l	pending and torsic	n; impac	t tough	ness		2		
T-W-5	Stress concentration				·				2		
Student w	ıorkload - forms of	activ	vity						Number of hours		
A-L-1	participation in lab	orator	ry exercises						15		
A-L-2 preparation for laboratory exercises									6		
A-L-3 Preparation of reports									7		
A-L-4 Consultations									2		
A-W-1 participation in lectures									15		
A-W-2 individual studies of the subject									8		
A-W-3 preparing for tests									5		
A-W-4	Consultations								2		
Teaching	methods / tools										
M-1	interactive lectures	s, pres	sentation (e.g	. power point)							
	1										

Teaching m	nethod	ls / tool									-
M-3	reports	s prepara	ation								
Evaluation	metho	ods (F -	progressive, P - final)								
S-1	Р	written	exam								
S-2	F	questio	ns								
S-3	F	raports	prepration								
]	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	Cours	e content	Teaching methods	Evaluation methods
Knowledge											
MSE_1A_C24_V Student describ materials	N01 bes sele	ected issu	es 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_U has skills in pra	J01 actical ι	usage of n	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 comp	peten	ces									
MSE_1A_C24_k Students is abl work in group.	le to pe	rform all t	ask 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	ies	Grade		E	valuation cr	iterion					
Knowledge			I								
MSE_1A_C24_V		2,0									
			Student describes selected issue	s at a basic level (	score => 50%)						
		3,5									
		4,0									
		4,5 5,0									
Skills		3,0									
MSE_1A_C24_U	I01	2.0									
M3L_1A_024_0	J01	2,0 3,0	Student describes selected issue	es at a hasic level (	score => 50%)						
		3,5	State in acceptance science and acceptance in acceptance i	s at a basic level (	36016 7 30707						
		4,0									
		4,5									
		5,0									
Other socia	al com	petence	es								
MSE_1A_C24_K	<01	2,0									
			Student describes selected issue	s at a basic level (	score => 50%)						
		3,5									
		4,0									
		4,5 5,0									
Poquired	di										
Required re			sharing of Mark 111 CDC D	2014							
1. Clarence V	w. de S	oliva, Me	chanics of Materials, CRC Pre	ess, 2014							

2. James H. Allen III, Mechanics of Materials For Dummies, Wiley, 2011



Field of study  Materials Science and Engineering  Mode of study  Stationary  Level  Graduate's qualification  inżynier												
Mode of s	,	101										
Graduate'	's qualification	inżyr	nier	<u>'</u>		<b>'</b>		M	/ I 1	ICr	)	
Fields of s	science	engir	neering and	technology							-	
Discipline	s of science	mate	rials engine	eering (100%)							<u>.                                    </u>	
Education	nal profile	gene	ral academ	ic				1	- 1			
Module								1 ▮	- 1			
Course ur	nit	Man	agement a	nd Project Pla	nnin	g		1	- 1			
Code		MSE_	1A_S_C24a	a				1	- 1	. ·		
Field of s	pecialisation								LΙ		_	
Administe	ering faculty	RCIiT	Т					1			4	
ECTS		1,0		ECTS (forms)		1,0		1				
Form of c	ourse credit	credi	ts	Language		english		1				
Electives		9		Elective group				1				
Administering faculty  ECTS  1,0  ECTS (forms)  1,0  Form of course credit  credits  Language  english  Electives  9  Elective group  Form of instruction    Cod   Semester   Hours   ECTS   Weight   Realization											Cred	dit
Administering faculty  ECTS  1,0  ECTS (forms)  1,0  Form of course credit  Credits  Language  english  Electives  9  Elective group  Form of instruction  Cod Semester Hours  ECTS Weight Realization  lecture  W 7  15  1,0  1,00  K  Leading teacher  Żebrowski Paweł (Pawel.Zebrowski@zut.edu.pl)  Other teachers  Żebrowski Paweł (Pawel.Zebrowski@zut.edu.pl)  Prerequisites  W-1  Basics of Mathematics  W-2  Engineering  Module/course unit objectives  C-1  Consolidation of knowledge related to the management in engineering.  C-2  Developing student's ability to recognize the basic concepts of management in engineering.  C-3  Improving student's awareness of the need for continuous education and professional development.  C-4  Project management of engineering projects in practice. Get to know and forming teams. Teams management Milestones. Risks and how to aviod them. Project planning and executing											cred	its
ECTS 1,0 ECTS (forms) 1,0  Form of course credit credits Language english  Electives 9 Elective group  Form of instruction Cod Semester Hours ECTS Weight Realization lecture W 7 15 1,0 1,00 K  Leading teacher Żebrowski Paweł (Pawel.Zebrowski@zut.edu.pl)  Other teachers Żebrowski Paweł (Pawel.Zebrowski@zut.edu.pl)  Prerequisites  W-1 Basics of Mathematics  W-2 Engineering  Module/course unit objectives  C-1 Consolidation of knowledge related to the management in engineering.  C-2 Developing student's ability to recognize the basic concepts of management in engineering.  C-3 Improving student's awareness of the need for continuous education and professional development.  Project management of engineering projects in practice. Get to know and forming teams. Teams management in the project management in engineering.												
lecture W 7 15 1,0 1,00 K  Leading teacher Żebrowski Paweł (Pawel.Zebrowski@zut.edu.pl)  Other teachers Żebrowski Paweł (Pawel.Zebrowski@zut.edu.pl)  Prerequisites  W-1 Basics of Mathematics  W-2 Engineering  Module/course unit objectives  C-1 Consolidation of knowledge related to the management in engineering.												
Prerequisites W-1 Basics of Mathematics												
·												
Module/c												
			ge related to	the management	in en	gineering.						
				<del>-</del>			ent in enginee	ring.				
C-3	Improving student	's awar	eness of the	need for continuo	us ed	ucation and	professional d	evelopi	ment.			
C-4							forming team	s. Tean	ns man	agemen	t. Workf	low.
Course co	ontent divided into	vario	ıs forms of	instruction						Nui	nber of	f hours
T-W-1	Team Managemen	t: form	ing teams an	d team building								5
T-W-2	Workflow. Mileston											5
T-W-3	Project planning ar	nd exec	cuting. Projec	t management of	engin	eering proje	cts in practice	<b>?.</b>				5
Student и	vorkload - forms of	activi	ty							Nui	nber of	f hours
A-W-1	Classroom particip											15
A-W-2	Self-study of the le	cture c	ontent and li	terature								10
A-W-3	Consultations											5
	methods / tools											
M-1	Lecture											
	n methods (F - pro		ve, P - final,	)								
S-1	F Written tes	t					<del></del>	1	T			1
	Designed learnin	g outc	omes	Reference to learning outco designed for the f study	mes l	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	Evaluation methods
	ie			l			1	1	1		1	1
Knowledg								C-1				
MSE_1A_C24 Student has	la_W01 theory-based knowledg t in engineering.	e within	the scope of	MSE_1A_W	/11	P6S_WK		C-1 C-2 C-3 C-4	T-W-1 T-W-2	T-W-3	M-1	S-1



MSE_1A_C24a_U01 Student can use the selected problems in	acquired k the field o	nowledge to solve and evaluate of 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			•			'			
MSE_1A_C24a_K01 Student is aware of t professional develop engineering.	he need fo ment in th	or 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 3,5 4,0 4,5 5,0	Student demonstrates basic know	vledge of manager	ment in enginee	ring.					
Skills	,								-	
MSE_1A_C24a_U01	2,0 3,0 3,5 4,0 4,5 5,0	Student is able to use the acquire management in engineering.	ed knowledge at a	basic level to sc	olve and evaluat	e select	ed probl	ems in th	e field of	
Other social con	npetence	es								
MSE_1A_C24a_K01	2,0 3,0 3,5 4,0 4,5 5,0	The student understands the nee engineering.	d for continuous e	ducation and tra	aining at a basic	: level in	the field	d of mana	gement i	n
Required readin		1								
		E Meredith, Strategic Corpora	ate Management	t for Engineeri	ing, Oxford Un	niversit	y Press,	UK, 200	00	
		oiect Management for Engine								

- 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 stu	udy		Mate	rials Scienc	e and Engine	ering							
Mode of studystationaryLevelfirst cycleGraduate's qualificationinżynierFields of scienceengineering and technology											~ I-		
Graduate':	s qualif	ication	inżyr	nier					M	/ [1]	Cr	1	
Fields of s	cience		engii	neering and	l technology							-	
Disciplines	s of scie	ence	mate	erials engine	eering (100%	,)				_	_	<u>-</u>	
Education	al profi	'e	gene	ral academ	ic								
Module													
Course un	it		Inno	vation Tea	ams								
Code			MSE_	_1A_S_C24b	)						( )		
Field of sp	ecialisa	ation										4	
Administe	ring fac	ulty	RCIiT	Т	_							4	
ECTS			1,0		ECTS (form:	5)	1,0						
Form of co	ourse ci	redit	credi	its	Language		english						
Electives			9		Elective gro	up							
Form of instruction   Cod   Semester   Hours   ECTS   Weight   Realization   Realizati												Crec	lit
lecture W 7 15 1,0 1,00 K  Leading teacher Żebrowski Paweł (Pawel.Zebrowski@zut.edu.pl)  Other teachers Żebrowski Paweł (Pawel.Zebrowski@zut.edu.pl)  Prerequisites  W-1 Student knows the basics of high school mathematics										K		cred	ts
Other teachers Żebrowski Paweł (Pawel.Zebrowski@zut.edu.pl)  Prerequisites											•		
· · · · · · · · · · · · · · · · · · ·													
Module/course unit objectives													
C-1				ge related to	the innovation	า manageı	ment.						
C-2	Develo	ping studen	t's abil	lity to recogn	ize the basic o	oncepts o	f innovation	management	i.				
C-3	· ·				need for cont			•					
C-4	cquirin	g knowledge	e on fu	ndamentals o	of innovation t	eam forma	ation, work	and delivering	outcor	nes			
Course co				us forms of							Nur	nber of	hours
T-W-1		t, business p ement tools		s, and organi	zational innov	ation. Inno	vation man	agement. Inno	ovation				5
T-W-2	Creatir roles.	ıg multi-fund	tional	development	t teams. Leade	ership for i	innovation;	Innovation tea	ım desi	gn and			5
T-W-3		ing team int ing innovati			hinking to driv	e innovati	ion; Creating	g innovation s	trategy	;			5
Student w	orkload	l - forms of	activ	ity							Nur	nber of	hours
A-W-1	Particip	ation in lect	tures										15
A-W-2		ıdy of the lit	eratur	e									10
A-W-3	Consul	tations											5
Teaching I													
M-1	Lecture	=======================================											
				ive, P - final,	)								
S-1	F	Written test	<u> </u>		<u> </u>			1		1			
	Desigr	ned learnin	g outo	comes	learning designed 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 co	ontent	Teaching methods	Evaluation methods
Knowledge													
	theory-ba		e withir	n the scope of	MSE_1	A_W11	P6S_WK		C-1 C-2 C-3	T-W-1 T-W-2	-W-3	M-1	S-1
innovation ma	anageme								C-4				



		nowledge to solve and evaluate of 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-1
Social competer	nces								•	
MSE_1A_C24b_K01 Student is aware of t professional develop management.		or continuous education and e field of innovation	MSE_1A_K03	P6S_KO	P6S_WK	C-1 C-2 C-3 C-4	T-W-1 T-W-2	T-W-3	M-1	S-1
Outcomes	Grade		Е	valuation cr	iterion					
Knowledge	-1	ı								
MSE_1A_C24b_W01	2,0									
	3,0	Student demonstrates basic know	wledge of innovatio	on management	•					
	3,5									
	4,0									
	4,5									
61.111	5,0									
Skills										
MSE_1A_C24b_U01	2,0								c: 1 1 c	
	3,0	Student is able to use the acquire innovation management.	ed knowledge at a	basic level to so	live and evaluat	e select	ed probl	ems in th	e field of	
	3,5									
	4,0									
	4,5									
	5,0									
Other social con	npetenc	es								
MSE_1A_C24b_K01	2,0									
	3,0	The student understands the nee management.	ed for continuous e	ducation and tra	aining at a basid	level in	the field	l of innov	ation	
	3,5									
	4,0									
ĺ	4,5									

### Required reading

- 1. Scott Anthony, Build an Innovation Engine in 90 Days, Harvard Business Review, 2011
- 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 st	udy	Mate	rials Scienc	e and Er	ngineering								
Mode of s	tudy	statio	nary	Le	evel	firs	t cyc	cle	3.4		~ I		
Graduate'	s qualification	inżyn	ier	I					T W	/Til(	Lh.		
Fields of s	cience	engir	neering and	technol	logy								
Discipline	s of science		rials engine						Г				
Education		general academic											
Module	ai prome	gene	Tar academi										
	.:.	Dia i		_ 4! _ 1 _	- C Ct								
Course un	IIT .		nspired Ma	ateriais	s & Structi	ures			٠.				
Code		MSE_	1A_S_C25						- ■			7	
	ecialisation									\_			
Administe	ring faculty	Depa	rtment of P	olymer	and Biomat	erials Sc	ienc	e					
ECTS		1,0		ECTS (f	forms)	1,0							
Form of co	ourse credit	credi	ts	Langua	age	engli	sh						
Electives				Elective	e group								
Form of in	struction	Cod	Semester	Ног	urs	ECTS		Weight	Rea	alization		Crea	 lit
laboratory		L	5	1	5	0,5		0,50		K		credi	
lecture		w	5	1		0,5		0,50		K		credi	
		1 1										Crear	
Leading te	eacner		ay Mirosława				-						
Other tead	chers							El Fray Miro (psobolewsl		edu.pl)			
Prerequisi	tes	1.		,				· ·					
W-1	basic knowledge of	f biolog	y and chemis	stry									
Module/co	ourse unit objectiv		<u>-</u>										
C-1	To familiarize the s		with the has	ic concer	nts of biomin	netics and	nati	ıre-insnired st	ructure	<u> </u>			
C-2	Preparing and deliv								actar c				
	ntent divided into										Numl	har at	f hours
T-L-1	Self-cleaning and s					d characte	rizat	ion			Num	Jei Oi	9
T-L-2	Immobilisation of a												3
T-L-3	Bioimmobilisation			•					metho	ds			3
T-W-1	Bioinspiration from												2
T-W-2	Molecular design o												3
T-W-3	Bio-inspired intellig	gent an	d morphing s	structures	S								3
T-W-4	Functional surfaces	s in bio	logy										2
T-W-5	Immobilisation of a	ctive c	ompounds										2
T-W-6	Bioimmobilisation (	of enzy	mes and livir	ng cells									3
Student w	orkload - forms of	activi	ty								Numl	ber of	f hours
A-L-1	participation in lab												15
A-W-1	participation in lect	tures											15
Teaching	methods / tools												
M-1	lecture with preser	ntation											
M-2	laboratory exercise												
Evaluation	n methods (F - pro	arecci	ve P - final)	)									
S-1	F continuous			<u> </u>									
S-2	P questions,	probler	ii soiviiig										



MSE_1A_C25_W01 the student defines t and bio-inspired struc		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-1 T-W-2	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-W-4 T-L-3 T-W-1 T-W-5 T-W-2	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	P6S_KK	P6S_WK	C-1 C-2	T-L-1 T-L-2 T-L-3 T-W-1 T-W-1 T-W-2	M-1 M-2	S-1 S-2
Outcomes	Grade		E	valuation cr	iterion				
Knowledge									
MSE_1A_C25_W01  Skills  MSE_1A_C25_U01	3,5 4,0 4,5 5,0	Positive grade of the final test (m		ect answers)					
	5,0								
Other social con	2,0 3,0 3,5 4,0 4,5 5,0	Positive grade of the final test an	d exam (more than	n 55% correct a	nswers)				
Required readin									
-		cs Biologically Inspired Techno	ologies, CRC Tay	/lor&Francis, N	lew York, 200	6			
		nd Bioengineering Handbook							
		tic biomaterials: Structure an				d. 201	3		



Field of st	udy	Mate	erials Scienc	e and Engineeri					
Mode of s	tudy	stati	onary	Level		first o	cycle	3 A / T : 1 A	C I
Graduate'	's qualification	inży	nier	1				WTil(	Lh
Fields of s	science	engi	neering and	technology					_
Discipline	s of science	mat	erials engine	eering (100%)					
Education		1	eral academ						
Module	,								
Course un	nit	Mat	erials for H	lealthcare					
Code			1A S C26						
	pecialisation	1.02							Cil
	ering faculty	Den	artment of N	lanomaterials Pl	nysicoc	hemist	rv		
ECTS	ing ractity	4,0	artificite of it	ECTS (forms)	Tysicoc	4,0	У		
	ourse credit	cred	lite			english		-	
	ourse crean	cred	IILS	Language		engiisi	<u> </u>	1	
Electives				Elective group					
Form of in		Cod	Semester	Hours		TS	Weight	Realization	Credit
lecturing		Α	7	15	0		0,25	K	credits
laboratory	/ course	L	7	30	1	,5	0,25	K	credits
lecture		W	7	30	2	,0	0,50	K	credits
Leading to	eacher	Mijo	wska Ewa (E	wa.Borowiak-Pa	len@zı	ıt.edu.p	ol)		
Other tea		Koch Pale	nmańska Agı n@zut.edu.p		zka.Kod szka (A	hmans gnieszl	ka@zut.edu.pl ka.Piegat@zut.	), Mijowska Ewa edu.pl), Sobole	igiel@zut.edu.pl), a (Ewa.Borowiak- wski Piotr
Prerequisi W-1	_					:-1:-			
	Knowledge of the b		ourse in priys	Sics, chemistry an	u mater	iais scie	Tice at the eleme	entary level	
Module/co	ourse unit objective		a davalan stua	dont's knowledge	in tha a	coa of m	atorials used in	modical diagnosia	s, water purification
C-1	from heavy metals life quality.	and c	Irugs and in o	verall the student	s will be	skilled	to designe mate	rials and its perfo	rmance to increase
Course co	ntent divided into	vario	us forms of	instruction					Number of hours
T-A-1	Characterization of						_		2
T-A-2	Polymeric material properties and deg			ase studies: surfac	e modi	fication,	tailoring of mecl	nanical	3
T-A-3	Analysis of influence			orphology on anti	microbi	al perfor	mance: explana	tion and	5
T-A-4	Analysis of failure of	of sele	cted metal m	edical devices					5
T-L-1	Determination of si	ze an	d Zeta potent	ial of polymeric m	icelles.				5
T-L-2	Surface modification	n of b	oiopolymers. C	Contact angle dete	rminati	on			5
T-L-3	Photocatalytic rem	oval o	f drug molecu	ıles form wastewa	ter				5
T-L-4	Magnetic separatio		-						5
T-L-5	Antibacterial coatir Composites for der				ng				5
T-L-6	Corrosive and tribo	corro	sive wear of m	netallic biomateria	ıls				5
T-W-1	Antimicrobial mate								3
T-W-2 Materials in medical diagnostics: overview, needs, perspectives								3	
T-W-3	Biosensors and bio		· .		ase stu	dy			3
T-W-4	The human eye: ar		· · · · · ·	· · · · · · · · · · · · · · · · · · ·					3
T-W-5	Intraocular lenses:			ment to the most	ımplant	ed medi	cal device		4
T-W-6	Drug delivery in the		<u> </u>	aakinaa	4				2
T-W-7 T-W-8	Metals, metal-base		<u> </u>		eaitnca	re;			5
T-W-9	Selected aspects of Participation in pas			tact with body					3
1-44-3	i di dicipation in pas	Jing L	CJL						3

G: 1 :					<u> </u>			9	1		- ,
		l - forms of							Nur	nber of	
		pation in recit	rations oratory exercises								15 30
		ation of lab re									5
			pratory exercises								3
		ing for tests	ratory exercises								5
		tations							2		
	partici	pation in lecti	ures								30
A-W-2	self-stu	ıdy of the lite	erature								13
A-W-3	prepar	ing for tests									15
A-W-4	Consul	tations									2
Teaching m	nethod	ls / tools									
	lecture										
M-2	case st	udy									
M-3	laborat	ory work									
M-4	prepar	ation and pre	esentation of multimedia	a presentations by	y the student	during the the	ematic e	exercis	es		
M-5	self stu	ıdies									
Evaluation	metho	ods (F - prog	gressive, P - final)								
S-1	Р	Written pass	sing test								
S-2	F	Continuous a	assessment during rese	earch conductiong							
S-3	Р	assessment	of lab reports								
S-4	F participation in the discussion during lectures										
	Desigr	ned learning	g 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				1	•	•					
MSE_1A_C26_V knowledge in t healthcare app	he area		nat 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-5 T-W-6 T-W-7 T-W-9	M-1	S-1 S-4
Skills				1	1	ı					
MSE_1A_C26_U abilities to des increase the lif	sign ma	terials and eva y.	luate 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 com	peten	ces									
MSE_1A_C26_k The student ur development a	nderstar		ance of materials chcare	MSE_1A_K02	P6S_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-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	M-1 M-2 M-3 M-4	S-1 S-2 S-3 S-4
Outcom	es	Grade			valuation cr	iterion					
Knowledge		<u> </u>									
MSE_1A_C26_V		2,0									
<del>_</del>		3,0 from	50 to 55% of percentage p	ooints							
		3,5									
		4,0									
		5,0									
		ا 0,0									



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 com	petence	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 Śelimović, Nanopatterning and Nanoscale Devices for Biological Applications (Devices, Circuits, and Systems), CRC Press, 2014, ISBN-13: 978-1466586314



Field of st	udy	Mate	erials Science	and E	Engineering							
Mode of st	tudy	stati	ionary	L	evel	first cy	cle					
	s qualification	inży						∃ W	/Ti	ICh	1	
Fields of s	<u> </u>	<u> </u>	neering and t	techno	ology			†			_	
	s of science	+	erials engine					Т			٦.	
Education		+	eral academic		100707			1				
	ат ргоппе	gene	erar academic					<b>.</b> ■	- 1			
Module	**							- 1	- 1			
Course un	nt	+	repreneursh	nip for	r Engineers			- 1	- 1			
Code		MSE	_1A_S_C27a					- \				
	ecialisation							_ \	<b>\</b> '			
Administe	ring faculty	RCIi	П								-	
ECTS		1,0	1	ECTS (	(forms)	1,0						
Form of co	ourse credit	cred	lits	Langu	ıage	english						
Electives		10		Electiv	e group							
Form of in	struction	Cod	Semester	Н	ours	ECTS	Weight	Rea	alizatio	on	Cred	dit
lecture		w	7		15	1,0	1,00		K		cred	its
Leading te	acher	+	ay Mirosława			•			* =			
Other tead		LI FI	ay MIII US1aWa	0 111141 )	siawa.⊑iFlay	پدسد. <del>د</del> ست.۱۱)	'					
Prerequisi												
W-1	Student knows the		s of high schoo	ol math	ematics.							
	ourse unit objectiv											
C-1	Consolidation of kr											
C-2	Developing studer											
C-3	Improving student					ducation and	professional d	ievelopi	ment.			
Course co.	ntent divided into					16.11				Nui	mber o	f hours
T-W-1	Enerpreneurship B Technological com			ation. K	ey successes a	and failures of	young compa	anies.				5
T-W-2	Procedures of form	-		oreneur	rship Economy							5
T-W-3	Business models. S Intellectual Proper			vision	. Finding partr	ers and buildi	ing competitiv	e adva	ntages			5
Student w	orkload - forms of									Nin	nber o	f hour
A-W-1	Classroom particip		rity							INUI	nber o	15
A-W-2	Preparing for the le											8
A-W-3	Self-study of the li											5
A-W-4	Consultations											2
Teaching	methods / tools											
M-1	Lecture											
		aras	ivo D finall									
S-1	n methods (F - pro		ive, P - final)									
J-1	vviitteirtes						Poference to				T	
	Designed learnin	g out	comes	de	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	Cours	se content	Teaching methods	Evaluatio methods
Knowledge	е					I.	I.	1	I		1	1
MSE_1A_C27a Student has t entrepreneur		je withi	n the scope of		MSE_1A_W11	P6S_WK		C-1 C-2 C-3	T-W-1 T-W-2	T-W-3	M-1	S-1
Skills	2 1101					I		C 1				
MSE_1A_C27a_U01 Student can use the acquired knowledge to recognize the basic concepts of entrepreneurship for engineers.  MSE_1A_U06 P6S_UW P6S_UW P6S_UW C-1 C-2 C-3 T-W-1 T-W-2 T-W-2								T-W-3	M-1	S-1		
Social con	npetences											



		r dedicty or original		J. J			· <u> </u>						
		or 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		Evaluation criterion										
Knowledge	•												
MSE_1A_C27a_W01	2,0												
	3,0	Student demonstrates basic kno	es basic knowledge of entrepreneurship for engineers.										
	3,5												
	4,0												
	4,5												
	5,0												
Skills													
MSE_1A_C27a_U01	2,0												
	3,0	Student is able to use the acquir engineers.	ed knowledge at a	basic level to re	ecognize the bas	sic conce	epts of er	ntreprene	urship fo	or			
	3,5												
	4,0												
	4,5												
	5,0												
Other social com	petence	es											
MSE_1A_C27a_K01	2,0												
	3,0	The student understands the need engineers.	ed for continuous e	ducation and tra	aining at a basic	level in	the field	of entre	preneurs	hip for			
	3,5												
	4,0												
	4,5												
	5,0												

#### Required reading

- 1. Uchino Kenji, Entrepreneurship for engineers, CRC Press, 2009
- 2. Alexander Osterwalder, Yves Pigneur, Business Model Generation, 2011



Field of s	tudy	Materials Scien	ce and Engineeri	ng							
Mode of s	study	stationary	Level		first cy	cle	3.4	/T: L	C L		
Graduate	e's qualification	inżynier					V١	/Til	un	1	
Fields of	science	engineering and	d technology								
Discipline	es of science	materials engin	eering (100%)					_	_	<u>.                                    </u>	
Education	nal profile	general academ	nic								
Module											
Course u	nit	Strategies for	Startups				_ [				
Code		MSE_1A_S_C27I	b								
Field of s	pecialisation						_			_	
Administ	ering faculty	RCIiTT								4	
ECTS		1,0	ECTS (forms)		1,0						
Form of c	course credit	credits	Language	6	english						
Electives		10	Elective group								
Form of i	nstruction	Cod Semester	Hours	ECT	TS	Weight	Re	alization		Crea	lit
lecture		W 7	15	1,0	0	1,00		K		credi	ts
Leading t	teacher	El Fray Mirosłav	va (Miroslawa.ElF	ray@zu	ıt.edu.pl)	)					
Other tea	achers	Żebrowski Pawe	eł (Pawel.Zebrow	ski@zut	t.edu.pl)						
Prerequis	sites										
			aal mathamatics								
W-1	Student knows the	e basics of nigh sch	ooi mathematics.								
			ooi mathematics.								
	ourse unit objectiv										
Module/c	course unit objectiv	res	the startups.	epts of s	tartups.						
Module/c	Consolidation of k	res nowledge related to nt's ability to recogn r's awareness of the	o the startups. nize the basic conc	us educa	ation and	•					
Module/co	Consolidation of k	res nowledge related to nt's ability to recogn	o the startups. nize the basic conc	us educa	ation and	•			of busi	ness ve	enture
Module/ci C-1 C-2 C-3	Consolidation of king Developing student Margarian Acquiring knowled	res  nowledge related to  nt's ability to recogn  's awareness of the  ge on startup deve	o the startups. nize the basic conc e need for continuo lopment proces an	us educa	ation and	•				ness ve	
Module/ci C-1 C-2 C-3	Consolidation of keep Developing student Marketing strategies	nowledge related to nt's ability to recogn s's awareness of the ge on startup deve o various forms of es for startups. And	o the startups.  nize the basic conce need for continuo lopment proces an instruction alysis of the marke	d tools. S	ation and Strategies market tr	s to use in con	isecutiv	e stages (			
Module/co C-1 C-2 C-3 C-4	Consolidation of keep Developing student Improving student Acquiring knowled development.  Ontent divided into Marketing strategip projections. Industrial	nowledge related to nt's ability to recogn s's awareness of the ge on startup deve o various forms of es for startups. Ana cry analysis - the ro tents. Pricing strate	o the startups.  nize the basic concerned for continuous lopment proces and instruction alysis of the market les of major industrial.	t needs,	ation and Strategies market tr	ends and mar	secutiv	e stages o			hours
Module/co C-1 C-2 C-3 C-4 Course co	Consolidation of keep Developing student Marketing strategy projections. Industry Marketing program Market research to the Control of the Con	nowledge related to nt's ability to recogn s's awareness of the ge on startup deve o various forms of es for startups. Ana cry analysis - the ro tents. Pricing strate	o the startups.  nize the basic concerned for continuous lopment proces and instruction alysis of the marked les of major industry. Promotion strativalue proposition	t needs, ry competegy. Dis	market tretitors.	ends and mar and delivery s	rket gro	e stages of with			hours 5
Module/cd C-1 C-2 C-3 C-4 Course cd T-W-1 T-W-2	Consolidation of keep Developing student Marketing strategy projections. Industry Marketing program Market research to the Control of the Con	nowledge related to nt's ability to recognists awareness of the ge on startup developments of the startups. And ary analysis - the rolents. Pricing strate ins. echniques; Forming techniques; Forming techniques.	o the startups.  nize the basic concerned for continuous lopment proces and instruction alysis of the marked les of major industry. Promotion strativalue proposition	t needs, ry competegy. Dis	market tretitors.	ends and mar and delivery s	rket gro	e stages of with	Nun		hours 5 5 5
Module/cd C-1 C-2 C-3 C-4 Course cd T-W-1 T-W-2 T-W-3 Student v	Consolidation of key Developing student Improving student Acquiring knowled development.  Ontent divided into Marketing strategic projections. Indust Positioning statem Marketing program Market research to Viable Product; Boworkload - forms of Participation in lections and student program of the product o	nowledge related to nt's ability to recogniss awareness of the ge on startup development of the startups. And the startups of the rolents. Pricing stratens. Pricing stratens. Pricing techniques; Forming otstraping techniques of activity stures	o the startups.  nize the basic concerned for continuous lopment proces and instruction alysis of the marked les of major industry. Promotion strativalue proposition	t needs, ry competegy. Dis	market tretitors.	ends and mar and delivery s	rket gro	e stages of with	Nun	nber of	hours 5 5 5
Module/ci C-1 C-2 C-3 C-4 Course co T-W-1 T-W-2 T-W-3 Student v A-W-1 A-W-2	Consolidation of king Developing student Improving student Acquiring knowled development.  Ontent divided into Marketing strateging projections. Indust Positioning statem Marketing program Market research to Viable Product; Boworkload - forms of Participation in less Self-study of the light	nowledge related to nt's ability to recogniss awareness of the ge on startup development of the startups. And the startups of the rolents. Pricing stratens. Pricing stratens. Pricing techniques; Forming otstraping techniques of activity stures	o the startups.  nize the basic concerned for continuous lopment proces and instruction alysis of the marked les of major industry. Promotion strativalue proposition	t needs, ry competegy. Dis	market tretitors.	ends and mar and delivery s	rket gro	e stages of with	Nun	nber of	5 5 5 hours 15 13
Module/ci C-1 C-2 C-3 C-4 Course co T-W-1 T-W-2 T-W-3 Student v A-W-1 A-W-2 A-W-3	Consolidation of key Developing student Improving student Acquiring knowled development.  Marketing strategic projections. Indust Positioning statem Marketing program Market research to Viable Product; Boworkload - forms of Participation in lect Self-study of the light Consultations	nowledge related to nt's ability to recogniss awareness of the ge on startup development of the startups. And the startups of the rolents. Pricing stratens. Pricing stratens. Pricing techniques; Forming otstraping techniques of activity stures	o the startups.  nize the basic concerned for continuous lopment proces and instruction alysis of the marked les of major industry. Promotion strativalue proposition	t needs, ry competegy. Dis	market tretitors.	ends and mar and delivery s	rket gro	e stages of with	Nun	nber of	5 5 5 hours 5 15
Module/co C-1 C-2 C-3 C-4 Course co T-W-1 T-W-2 T-W-3 Student v A-W-1 A-W-2 A-W-3	Consolidation of key Developing student Improving student Acquiring knowled development.  Ontent divided into Marketing strategic projections. Indust Positioning statem Marketing program Market research to Viable Product; Bo Workload - forms of Participation in lect Self-study of the life Consultations	nowledge related to nt's ability to recogniss awareness of the ge on startup development of the startups. And the startups of the rolents. Pricing stratens. Pricing stratens. Pricing techniques; Forming otstraping techniques of activity stures	o the startups.  nize the basic concerned for continuous lopment proces and instruction alysis of the marked les of major industry. Promotion strativalue proposition	t needs, ry competegy. Dis	market tretitors.	ends and mar and delivery s	rket gro	e stages of with	Nun	nber of	5 5 5 hours 15 13
Module/ci C-1 C-2 C-3 C-4 Course co T-W-1 T-W-2 T-W-3 Student v A-W-1 A-W-2 A-W-3 Teaching M-1	Consolidation of ker Developing student Improving student Acquiring knowled development.  Marketing strateging projections. Indust Positioning statem Marketing program Market research to Viable Product; Boworkload - forms of Participation in lect Self-study of the life Consultations  methods / tools  Lecture	nowledge related to nt's ability to recogniss awareness of the ge on startup developments of the startups. And the startups of the rolents. Pricing strate in startups. Pricing strate in startups. Pricing strate in startups. Forming otstraping techniques of activity of activity of the starture	o the startups.  nize the basic concerned for continuous lopment proces and surprise soft the market les of major industry. Promotion stratus value proposition ues; Defining IPR st	t needs, ry competegy. Dis	market tretitors.	ends and mar and delivery s	rket gro	e stages of with	Nun	nber of	5 5 5 hours 15 13
Module/cd C-1 C-2 C-3 C-4 Course cd T-W-1 T-W-2 T-W-3 Student v A-W-1 A-W-2 A-W-3 Teaching M-1 Evaluatio	Consolidation of key Developing student Improving student Acquiring knowled development.  Ontent divided into Marketing strategic projections. Indust Positioning statem Marketing program Market research to Viable Product; Bo Workload - forms of Participation in lect Self-study of the life Consultations  I methods / tools  Lecture	nowledge related to nowledge related to nowledge related to nowledge related to nowledge on startup developed on startup developed on startup developed on startups. And the startup developed on startups analysis - the rowledge of startups. Pricing stratems. Pricing stratems. Pricing stratems. Pricing techniquestraping techniquestrapin	o the startups.  nize the basic concerned for continuous lopment proces and surprise soft the market les of major industry. Promotion stratus value proposition ues; Defining IPR st	t needs, ry competegy. Dis	market tretitors.	ends and mar and delivery s	rket gro	e stages of with	Nun	nber of	5 5 5 hours 15 13
Module/ci C-1 C-2 C-3 C-4 Course co T-W-1 T-W-2 T-W-3 Student v A-W-1 A-W-2 A-W-3 Teaching M-1	Consolidation of ker Developing student Improving student Acquiring knowled development.  Marketing strateging projections. Indust Positioning statem Marketing program Market research to Viable Product; Boworkload - forms of Participation in lect Self-study of the life Consultations  methods / tools  Lecture	nowledge related to nowledge related to nowledge related to nowledge related to nowledge on startup developed on startup developed on startup developed on startups. And the startup developed on startups analysis - the rowledge of startups. Pricing stratems. Pricing stratems. Pricing stratems. Pricing techniquestraping techniquestrapin	o the startups.  nize the basic concerned for continuous lopment proces and surprise soft the market les of major industry. Promotion stratus value proposition ues; Defining IPR st	t needs, ry competegy. Dis	market tretitors.	ends and mar and delivery s	rket gro	e stages of with	Nun	nber of	5 5 5 hours 15 13
Module/cd C-1 C-2 C-3 C-4 Course cd T-W-1 T-W-2 T-W-3 Student v A-W-1 A-W-2 A-W-3 Teaching M-1 Evaluatio	Consolidation of key Developing student Improving student Acquiring knowled development.  Ontent divided into Marketing strategic projections. Indust Positioning statem Marketing program Market research to Viable Product; Bo Workload - forms of Participation in lect Self-study of the life Consultations  I methods / tools  Lecture	nowledge related to nt's ability to recogniss awareness of the ge on startup developments of a various forms of es for startups. Analysis - the rolents. Pricing stratens. Echniques; Forming otstraping techniques of activity stures terature	o the startups.  nize the basic concerned for continuous lopment proces and surprise soft the market les of major industry. Promotion stratus value proposition ues; Defining IPR st	t needs, ry competegy. Dis	market tretitors.	ends and mar and delivery s	ket gro strategy g Minim nageme	wth '. um ent	Nun	nber of	5 5 5 hours 15 13
Module/cd C-1 C-2 C-3 C-4 Course cd T-W-1 T-W-2 T-W-3 Student v A-W-1 A-W-2 A-W-3 Teaching M-1 Evaluatio	Consolidation of k Developing student Improving student Acquiring knowled development.  Ontent divided into Marketing strategi projections. Indust Positioning statem Marketing program Market research to Viable Product; Bo Workload - forms o Participation in lector Self-study of the liter Consultations I methods / tools Lecture Designed learning	nowledge related to nt's ability to recogniss awareness of the ge on startup developments of a various forms of es for startups. Analysis - the rolents. Pricing stratens. Echniques; Forming otstraping techniques of activity stures terature	the startups.  Inize the basic concerned for continuous lopment proces and laysis of the market les of major industriction strain value proposition ues; Defining IPR starning outcome learning o	t needs, ry competegy. Dis	market tretitors.  itribution ness mod Strategies	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering	ket gro strategy g Minim nageme	wth '. um ent	Nun	nber of	5 5 5 15 13 2
Module/ci C-1 C-2 C-3 C-4 Course co T-W-1 T-W-2 T-W-3 Student v A-W-1 A-W-2 A-W-3 Teaching M-1 Evaluatio S-1	Consolidation of king Developing student Improving student Acquiring knowled development.  Ontent divided into Marketing strateging projections. Indust Positioning statem Marketing program Market research to Viable Product; Bo Morkload - forms of Participation in led Self-study of the life Consultations  Immethods / tools  Lecture  Designed learning Designed Learning Ge	nowledge related to nt's ability to recognit's awareness of the ge on startup developments forms of the set of the startups. And the set of the	the startups.  nize the basic conce need for continuo lopment proces and lysis of the market les of major industry. Promotion strativalue proposition uses; Defining IPR starting outcodesigned for the first study.	t needs, ry competegy. Dis	market tretitors.  itribution ness mod Strategies	Reference to learning outcomes for qualifications at level 6 or 7 that enable acquiring engineering	ket gro strategy g Minim nageme	wth  Course co	Nun	nber of	5 5 5 15 13 2



MSE_1A_C27b_U01 Student can use the a concepts of startups.		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 the professional developm		continuous education and field of startups.	MSE_1A_K03	P6S_KO	P6S_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										

ranomicage		
MSE_1A_C27b_W01	2,0	
	3,0	Student demonstrates basic knowledge 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 acquired knowledge at a basic level to recognize the basic concepts of startups.
	3,5	
	4,0	
	4,5	
	5,0	
Other social com	petenc	es
MSE_1A_C27b_K01	2,0	
	3,0	The student understands the need for continuous education and training at a basic level in the field of startups.
	3,5	
	4,0	
	4,5	
	5,0	

### Required reading

- 1. Uchino Kenji, Entrepreneurship for engineers, CRC Press, 2009
- 2. Steve Blank, The Startup Owner's Manual: The Step-By-Step Guide for Building a Great Company, 2011
- 3. Eric Ries, The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, 2011
- 4. Ash Maurya, Running Lean: Iterate from Plan A to a Plan That Works, 2011



			- <b>,</b>			- 37 -			
Field of st	rudy	Mate	erials Scienc	e and Engineeri	ing				
Mode of s	tudy	stati	onary	Level		first o	cycle	\A/T:1/	C L
Graduate'	's qualification	inżyı	nier					WTil	un
Fields of s	science	engi	neering and	technology					
Discipline	s of science	mate	erials engine	eering (100%)	1 1 —				
Education	al profile	general academic							
Module									
Course ur	nit	Bior	naterials S	cience Project	Resea	arch			
Code		MSE	_1A_S_D01a	1				\ <b>\</b>	
ield of sp	pecialisation								
Administe	ering faculty	Depa	artment of P	olymer and Bio	materia	ıls Scier	nce		_
CTS		9,0		ECTS (forms)		9,0			
Form of co	ourse credit	cred	its	Language		english	 	_	
Electives		11		Elective group				_	
======================================	nstruction	Cod	Semester	Hours	EC	TS	Weight	Realization	Credit
laboratory	/ course	L	7	180	9	,0	1,00	K	credits
Leading to	eacher	El Fr	av Mirosław	a (Miroslawa.Ell	Frav@z	ut.edu.ı	ol)	1	
Other tea	chers	Mich Pale	ıalkiewicz Be n@zut.edu.p	y@zut.edu.pl), eata (Beata.Micl bl), Piegat Agnie ut.edu.pl), Wrób	halkiew eszka (A	icz@zut .gnieszk	t.edu.pl), Mijov ka.Piegat@zut.	vska Ewa (Ewa. edu.pl), Sobole	Borowiak- wski Piotr
Prerequisi	_								
N-1	Passing classes fr	om sen	nester I-VI						
Module/co	ourse unit objecti	/es							
C-1	Consolidation of o	letailed	knowledge re	elated to the key i	issues o	f materia	als science and e	engineering.	
C-2	Developing stude		<u> </u>						
C-3	Developing stude								g.
C-4	Developing of stu								ioning of technical
C-5	solutions in the fi	eld of m	naterials engir	neering.					
C-6	Improving studen				ous educ	ation an	a professional d	evelopment.	1
Course co	Presentation the				nd scion	tific ron	arts reports on	studios expert	Number of hours
Γ-L-1	opinions. Breakdo	wn of c	ontent. Lingu	istic correctness.	Quoting	literatu	re. Plagiarisms.	•	5
-L-2	Presentation of the culture of discuss		for the prese	ntation of the pro	gress in	the diplo	oma thesis. Prin	ciples and	5
r-L-3	Conducting resea		asurements,	calculations relate	ed to the	e subject	of dissertation.		85
Γ-L-4	Presentation by so	tudents	of the progre	ess in the research	n being t	he subje	ect of dissertation	n. Discussion of	40
Γ-L-5	Discussion of mat dissertation defer	erials e	ngineering is:	sues covered by t	he prog			ed for the	45
Student w	vorkload - forms d	of activ	rity						Number of hours
A-L-1	participation in classes								180
\-L-2	preparing a presentation								40
<b>\-L-3</b>	preparation for di	scussio	n on issues co	overed by prograr	n conter	nt			40
A-L-4	Consultations								10
Teaching	methods / tools								
M-1	Seminar								
M-2	Didactic discussion	n							
	n methods (F - pr								
S <b>-</b> 1	F Credit bas	ed on t	he presented	presentations					



Evaluation	meth	ods (F - progressive, P - final)							
S-2	F	Credit based on the student's cor	ntinuous activity ass	sessment in cl	ass discussion	ıs			
S-3	Р	Final credit based on the average					cination in the	discuss	ions
		Timal create based on the average	or the positive ma	TRS from the p	1	la parti			10113.
1	Desig	ned learning outcomes	Reference to the learning outcomes designed for the fields o 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
Knowledge				•	•				•
	well-est	ablished detailed knowledge related to erails engineering.	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									
	e abilit	/ to acquire and critically evaluate data d formulate 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 engii	to dev	elop the 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 result	to pre	pare and present the development of e field of materials 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	re of th	e need for continuous education and nent.	MSE_1A_K01	P6S_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		 Evaluation cr	iterion				
Knowledge									
MSE_1A_D01a_		2,0 3,0 Student is able to explain key 3,5 4,0 4,5 5,0	y operations and proce	esses in the field	of materials en	gineerin	g.		
Skills									
MSE_1A_D01a_	U01	2,0							
		3,0 Student is able to acquire an 3,5 4,0 4,5 5,0	d critically evaluate in	formation from l	iterature and pr	epare a	report at a basic	level.	
MSE_1A_D01a_	_U02	2,0 3,0 Student is able to prepare a : 3,5 4,0 4,5	simple development of	f the results of re	esearch in the fi	eld of ma	aterials enginee	ring.	
MSE_1A_D01a	IIU3	5,0							
52_1, _5010_	_233	3,0 Student can prepare and pre 3,5 4,0	sent an oral presentat	ion on issues in	materials engin	eering.			
		4,0 4,5 5,0							



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	נ	

- 1. Wise D.L., Biomaterials and Bioengineering Handbook, Marcel Dekker, New York, 2000
- 2. Ratner B.D., Biomaterials Science, Elsevier, New York, 2004



Field of st	tudy		Mate	erials Scienc	e and	Engineering	)							
Mode of s	study		stati	onary		Level		first cyc	cle	3.4	/ <del></del>	~ 1		
Graduate	's qualific	cation	inży	nier	4			<u> </u>		W	/Til(	Jh	)	
Fields of s	science		engi	neering and	techi	nology							-	
Discipline	es of scie	nce	mate	erials engine	ering	(100%)							<u> </u>	
Education	nal profile	,	gene	eral academ	ic									
Module										1				
Course ur	nit		Mat	erials Engi	neeri	ng Project	Res	earch						
Code			MSE	_1A_S_D01b	)									
Field of sp	pecialisat	tion											4	
Administe	ering facu	ılty	Dep	artment of N	lanon	naterials Phy	sico	chemistry					4	
ECTS			9,0		ECTS	(forms)		9,0						
Form of c	ourse cre	edit	cred	its	Lang	guage		english						
Electives			11		Elective group									
Form of ir	nstructio	า	Cod	Semester	I	Hours	E	CTS	Weight	Rea	lization		Crea	lit
project co	ourse		Р	7		180	g	0,0	1,00		K		credi	ts
Leading to	ing teacher Mijowska Ewa (Ewa.Borowiak-Palen@zut.edu.pl)													
Other tea	achers		Mich Pale	nalkiewicz Be n@zut.edu.p	eata ( ol), Pie	t.edu.pl), Igr Beata.Michal egat Agniesz u.pl), Wróbel	lkiev :ka ( <i>i</i>	vicz@zut.e Agnieszka.	du.pl), Mijov .Piegat@zut.	vska Ev edu.pl)	wa (Ewa. ), Sobole	Boro wski	wiak- Piotr	
Prerequis	sites													
W-1	Passing	classes fror	n sen	nester I-VI										
Module/co		t objective												
C-1	Forming the form	the ability of an oral	to rev	view and seled Intation	ct avai	lable publicati	ions ı	related to th	ne subject of o	disserta	tion and tl	neir e	elaborat	ion in
C-2	Prepara	tion for the	devel	opment of res	search	results and th	neir r	eliable inte	rpretation					
Course co	ontent div	vided into	vario	us forms of	instru	ıction						Nun	nber of	hours
T-P-1			-	-	-	ertation in the				-	_			15
T-P-2		to know the plementatio		rimental metl	nods a	pplied in the o	disse	rtation and	checking the	correctr	ness of			40
T-P-3				stand and che	ecking	its operation								30
T-P-4	Conduct	ing prelimir	nary t	ests										95
Student w	vorkload	- forms of	activ	rity								Nun	nber of	hours
A-P-1		ation in labo		y classes										180
A-P-2	, ,	g of literatu												15
A-P-3			h and	analysis of th	e obta	ained results								65
A-P-4	consulta											<u> </u>		10
Teaching														
M-1 M-2				student in the		atory ctness of the t	osts	carried out	and the intern	rotatio	n of rocult			
						thess of the t	esis	carried out	and the interp	retatio	n or result	<u> </u>		
				ive, P - final,		£ +b			d discussion of	£				
S-1	<del> </del>					n of the assum he implement						ngine	ering di	ploma
5-2	r t	hesis								- 1				
S-3	F	Assessment	ot in	dependence a	ind act	tivity in condu	cting	research					T	ı
	Designe	ed learning	g out	comes		Reference to the learning outcomes designed for the fields study		Reference to arning Outcomes 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



Knowledge										
MSE_1A_D01b_W01 knowledge in the field it to control the engin results	l of mater eering pro	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-2	T-P-3 T-P-4	M-1 M-2	S-1 S-2 S-3
Skills										
the subject of engined in the process of self- build a research star operations and unit pro-	ering thes education nd, use an rocesses r	he basis of collected literature on is and deepening his knowledge halytical 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		or 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	l of materials er	gineerir	ng.			
	3,5									
	4,0									
	4,5									
	5,0									
Skills	-1									
MSE_1A_D01b_U01	2,0									
	3,0	Student is able to acquire and crit	tically evaluate inf	ormation from I	iterature and pi	repare a	report a	it a basic	level.	
	3,5									
	4,0 4,5									
	5,0									
Other social com		<u> </u>								
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	ering.			
	3,5	oracon is asic to anaerstand key	operations and p			cg				
	4,0									
	4,5									
	5,0									
Required reading	7									
	nim Mülle	er, Anthony K. Cheetham, The 06862	Chemistry of Na	anomaterials:	Synthesis, Pro	opertie	s and A	pplicatio	ns, Wile	у,
2. Jin Zhang, Zhong	g-lin War	ng, Jun Liu, Self-Assembled Na	nostructures, Sp	oringer, 2002,	ISBN-13: 978	3-03064	472992			
3. Zhifeng Ren, Yuo ISBN 97814987657		an, Qinyong Zhang, Advanced	Thermoelectrics	s, Materials, C	ontacts, Devi	ces, and	d Syste	ms, CRC	Press, 2	2017,
·			·	· · · · · · · · · · · · · · · · · · ·	·	· ·				



		_						1	
Field of stu	udy	Mat	erials Scienc	e and Engineeri	ing				
Mode of st	tudy	stat	ionary	Level		first o	cycle	VA/T:1/	C I-
Graduate's	s qualification	inży	nier					WTil(	un .
Fields of s	cience	eng	ineering and	technology					
Disciplines	s of science	mat	erials engine	ering (100%)					<u> </u>
Education	al profile	gen	eral academ	ic					
Module									
Course un	it	Dis	sertation R	esearch in Ma	tSci				Cil
Code		MSE	_1A_S_D02a					\ <b> </b>	
Field of sp	ecialisation								
Administe	ring faculty	Dep	artment of P	olymer and Bio	materia	als Scie	nce		_
ECTS		15,0	)	ECTS (forms)		15,0			
Form of co	ourse credit	crec	dits	Language		english	l		
Electives		12		Elective group					
Form of in	struction	Cod	Semester	Hours	EC	CTS	Weight	Realization	Credit
		PD	7	0	1:	5,0	1,00	K	credits
Leading te	eacher	<u> </u>		a (Miroslawa.Elf				<u> </u>	
Other tead		Mijo (Agr	wska Ewa (E nieszka.Piega	y@zut.edu.pl), wa.Borowiak-Pa at@zut.edu.pl), ut.edu.pl), Zieli	alen@z Sobole	ut.edu.p wski Pic	ol), Piegat Agni otr (psobolewsk	eszka :i@zut.edu.pl),	
Prerequisi									
W-1	knowledge and skil	ls acc	quired through	out the course of	educat	ion			
	urse unit objective								
C-1	Acquire the basic s				obtaine	d results	in the field of m	aterials science	
C-2	Acquire the skills in			<u> </u>					
	ntent divided into								Number of hours
T-PD-1	Presentation of rec Gathering and anal		_						0
T-PD-2	the subject of the v	vork.						-	0
T-PD-3	Formulating the ba solved in dissertation		oint of the diss	ertation by the st	udent a	nd indica	ating the issues t	hat should be	0
T-PD-4	Depending on the s			rk, the student pe	erforms	a measu	rement / design	or	0
T-PD-5	computational part The student's analy			the work receive	d. Stud	ent's fina	al conclusions.		0
T-PD-6	The student's perfo	rman	ice of the grap					ables and other	0
T-PD-7	annexes to the diss								0
T-PD-8	Preparation of oral								0
	orkload - forms of								Number of hours
A-PD-1	Collecting and anal		-	t is the subject of	dissert	ation			60
A-PD-2	Performing measur								260
A-PD-3	Carrying out the ar	nalysis	s of the receiv	ed work results.					75
A-PD-4	Writting the dissert	ation							45
A-PD-5	Preparing for the d	efens	e						20
Teaching I	methods / tools								
M-1	Consultations with	the th	nesis superviso	or					
Evaluation	methods (F - pro	gress	sive, P - final)	)					
S-1	P Consultation	ns wit	th the thesis s	upervisor			<u> </u>		



Desig	ıned leaı	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
Knowledge									
		ssues related to manufacturing of and structure-property	MSE_1A_W02	P6S_WG	P6S_WG	C-1 C-2	T-PD-1 T-PD-5 T-PD-2 T-PD-6 T-PD-3 T-PD-7 T-PD-4 T-PD-8	M-1	S-1
Skills									
MSE_1A_D02a_U01 Student can acquire 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-1 T-PD-5 T-PD-2 T-PD-6 T-PD-3 T-PD-7 T-PD-4 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-1 T-PD-5 T-PD-2 T-PD-6 T-PD-3 T-PD-7 T-PD-4 T-PD-8	M-1	S-1
Outcomes	Grade		E	valuation cr	iterion				
Knowledge	-								
MSE_1A_D02a_W01	2,0								
	3,0	Student is able to explain key correlationship at a basic level.	mponents for vario	ous materials ma	anufacturing and	d describ	e structure-prope	erties	
	3,5	, , , , , , , , , , , , , , , , , , ,							
	4,0								
	4,5								
	5,0								
Skills									
MSE_1A_D02a_U01	2,0								
	3,0	Student can acquire information	from the literature	at a basic level	•				
	3,5 4,0								
	4,5								
	5,0								
Other social con		es							
MSE_1A_D02a_K01	2,0								
	3,0	is able to critically assess the kno	owledge and conte	nt received					
	3,5	-							
	4,0						-		
	4,5								
	5,0								
Required readin	 g								
1. Literature deali	ng with s	ubject of research - papers, m	onographs, boo	ks, patents, 20	011				

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



Field of st	tudy													
Mode of s	study stationary Level first cycle										WTilCh			
Graduate	's qualit	ication	inży	nier						W	/   1 (	٦n		
Fields of s	science		engi	neering and	techi	nology								
Discipline	s of scie	ence	mate	erials engine	ering	(100%)				1	_		<u>-</u>	
Education	nal profi	le	gene	eral academ	ic									
Module										1				
Course ur	nit		Diss	ertation R	eseaı	rch in MatEı	ng							
Code			MSE	_1A_S_D02b	1									
Field of s	pecialisa	ation											4	
Administe	ering fac	culty	Dep	artment of N	lanon	naterials Phys	sico	chemistry	•					
ECTS			15,0	١	ECTS	(forms)		15,0						
Form of c	ourse c	redit	cred	its	Lang	guage		english						
Electives			12		Elect	tive group								
Form of in	nstructio	on	Cod	Semester	I	Hours	EC	TS	Weight	Rea	alization		Crea	lit
			PD	7		0	15	5,0	1,00		K		credi	ts
Leading t	ading teacher Mijowska Ewa (Ewa.Borowiak-Palen@zut.edu.pl)											1		
Other tea			(Miro	oslawa.ElFra wska Ewa (E	y@zu wa.Bo	cheng.Chen@ t.edu.pl), Mic prowiak-Pale ut.edu.pl), Wr	halk า@z	kiewicz Be ut.edu.pl)	eata (Beata.I ), Piegat Agn	∕lichalk ieszka	_		•	a
Prerequis														
W-1	knowle	dge and skil	ls acq	uired through	out th	e course of ed	ucati	ion ————						
		nit objective												
C-1						oretation of ob	taine	d results in	n the field of n	naterial	engineerir	ıg.		
C-2				collection and		pretation tation based o	n the	e subiect li	terature resea	arch and	l obtained	exper	imenta	al
C-3	results													
Course co	ontent a	ivided into	vario	us forms of	instru	ıction						Num	ber of	hours
T-PD-1		cting laborat												0
T-PD-2		ing and anal oject of the w		by the studer	it the	literature cont	aının	g the curre	ent state of kn	owledge	e about			0
T-PD-3	Analys	is and interp	retati	on of obtained	l resul	ts								0
T-PD-4	Prepar	ation of oral	prese	ntation for the	e defe	nse								0
Student v	vorkload	d - forms of	activ	rity								Num	ber of	hours
A-PD-1				y experiments										260
A-PD-2				on of obtained	d resul	ts								50
A-PD-3	_	the disserta												100
A-PD-4		ing for the de	erense	<del></del>										40
Teaching				Date of the state of	e	falon III		1	_ t 100	<b>.</b>				
M-1 M-2						of degree's the eture analysis,		· -			rk out			
						iture ariarysis,	COIIC	iuction of s	studies and re	Suits wo	ik out			
				ive, P - final)		-1:			£ -l l - +l					
S-1 S-2	F	1 2		vity and indiv		dies and progr	ess i	n editing d	or degree's the	SIS				
5-2 5-3	P	Valuation of			luualit	.y								
<u> </u>	1 .	ned learning				Reference to the learning outcomes designed for the fields study	of for	Reference to arning Outcomes qualifications at PQF 6, 7 or 8		Course objectives	Course cont		Teaching methods	Evaluation methods
Knowledg	je								· ·	1	<u> </u>			<u> </u>
9														



		components for manufacturing and structure-property	MSE_1A_W03	P6S_WG P6S_WK	P6S_WG	C-1 C-2 C-3		M-1 M-2	S-1 S-2 S-3		
Skills				•							
studies is able to prep of engineering thesis specialists	are docui	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	M-2	S-1		
to control unit operati	on 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-3	M-1 M-2	S-1 S-2 S-3		
Social competen	ces										
on the final results of	group wo	ole realization of self-work tasks rk, can determine the order of hare knowledge and discuss	MSE_1A_K01 MSE_1A_K02	P6S_KK	P6S_WK	C-1 C-2 C-3	T-PD-1 T-PD-3 T-PD-2 T-PD-4		S-1 S-2		
Outcomes Grade Evaluation criterion											
Knowledge											
MSE_1A_D02b_W01	2,0										
	3,0	Student is able to explain key cor relationship at a basic level.	nponents for vario	ous materials ma	anufacturing and	d descril	oe structure-prop	erties			
	3,5	relationship at a basic level.									
	4,0										
	4,5										
	5,0										
Skills											
MSE_1A_D02b_U01	2,0										
	3,0	Student can acquire information t	from the literature	at a basic level	•						
	3,5										
	4,0 4,5										
	5,0										
MSE_1A_D02b_U02	2,0										
	3,0	Guided by the tutor, he builds a r			analytical meth	ods to c	ontrol operation	and unit			
	3,5	processes related to the subject of	or the engineering	dipiorna triesis							
	4,0										
	4,5										
	5,0										
Other social com	petence	es									
MSE_1A_D02b_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											
1. Literature dealin	ng with s	ubject of research - papers, m	onographs, boo	ks, patents, 20	020	-					



		-acui	ty of Cn	emical Te	cnno	logy an	a Engin	eerin	<u>g</u>			
Field of st	tudy	Mate	erials Scienc	e and Enginee	ring							
Mode of s	tudy	stati	ionary	Level		first cyc	cle	1.4	/T: 1/	~ L		
Graduate	's qualification	inży	nier					VV	Til(	υN		
Fields of s	science	engi	neering and	technology								
Discipline	s of science	mat	erials engine	eering (100%)					_		<u>.                                    </u>	
Education	nal profile	gene	eral academ	ic								
Module											7	
Course ur	nit	Pra	cticum (Int	erniship)								
Code		MSE	_1A_S_P01									
Field of sp	pecialisation										4	
Administe	ering faculty	Dep	artment of P	olymer and Bi	omater	ials Science	e	1				
ECTS		6,0		ECTS (forms)		6,0						
Form of c	ourse credit	cred	lits	Language		english						
Electives				Elective group	 ט							
Form of ir	nstruction	Cod	Semester	Hours	_	CTS	Weight	Rea	lization		Crea	lit
2 0. 11		PR	6	180		6,0	1,00	1.00	K		credi	
Leading to	eacher			ek.Zwir@zut.e		-,-						
Other tea		ZWII	INIAI EK (IVIAI	EK.ZWII @ZUL.E	au.pi)							
Prerequis												
W-1 W-2	Materials science Materials engine		rties and testi	ng								
W-3	Materials proces		Lidentification	in industry								
	ourse unit object											
C-1	1. raw materials 2. the course of materials take pl 2. methods of m. 3. automation an 4. practical cours optimization 5. use of raw ma 6. become famili	material ace anagem d proce se of des terials, e	s production a ent and organ ss control me signing produc energy and th	and processing, nization of produ thods used in pr cts, equipment a e reduction and	food, er ction actice and tech manage	nergy and oth inologies, an ement of was	her processes  Id the procedu  Ste in industri	ures for t	heir impl	emen	tation a	and
Course co	ontent divided in	o vario	ous forms of	instruction						Nun	nber of	hours
T-PR-1	Acquaintance wi required specific that carry out pr materials with the analysis and chas of research and certification and work in the materinstitutions, institutions,	h techn materia ocedure e requir racteriza developi approva rials en	ological proce al characterist s for the supe ed specific ch ation of raw m ment work, or al of the qualit gineering and	esses in the indu ics, or in institut rvision, identific aracteristics. Ac naterials and ma the organization by of raw materials related industric	ions tha ation ar quisition terials in a and in als and e es, desi	nt maintain d nd analysis, on of practical n technologion plementation engineering of gn offices, so	lesign studios certification a I methods of cal processes on of procedu materials. Procientific and r	and labord nd approselection or in the res for coreparation esearch	oratories oval of , e course ontrol,			6
Student w	vorkload - forms	of activ	rity			<del></del>				Nun	nber of	hours
A-PR-1	Participation in p	racticun	n (internship)									178
A-PR-2	Contact with sup	ervisor										2
Teaching	methods / tools											
M-1	Professional Prac	tice										
Evaluation	n methods (F - p	ogress	ive, P - final,	)			·					
S-1	F Evaluatio	n of the	class report									
5-2	P Assessme	ent in th	e form of oral	credit by the pe	erson re	sponsible for	the course					
	Designed learn	ng out	comes	Reference l learning out designed for th study	comes L e fields of f	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



Knowledge	-								
of materials industry at the course of material and other processes in materials take place; management and org used in practice and t understands the course technologies, and the optimization; he/she kenergy and limiting the industrial processes; h	and other Is product n which st he/she kn anization; the ways of procedur knows the ne creation ne/she kno	d materials used in the processes industries; he/she understands ion and processing, food, energy tructural transformations of lows 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, in and management of waste in lows the valid safety regulations materials and apparatus used.	MSE_1A_W02 MSE_1A_W04 MSE_1A_W07 MSE_1A_W09 MSE_1A_W11	P6S_WG P6S_WK	P6S_WG	C-1	T-PR-1	M-1	S-1 S-2
Skills					1			L	
technological process	es in the f nods 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 competen					-			l e	
MSE_1A_P01_K01 The student is able to influence of own actio	work in 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 cr	iterion				
Knowledge	1	1							
MSE_1A_P01_W01	2,0								
	3,0	Student sufficiently demonstrated knowledge necessary to perform materials and the ways of their chanagement and energy and safe	the tasks assigned naracterization, the	during the pra	ctice in terms o	f knowle	dge of materia	ls and raw	n has
	3,5	3,	, 3						
	4,0								
	4,5								
	5,0								
Skills									
MSE_1A_P01_U01	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	petence	es							
MSE_1A_P01_K01	2,0 3,0 3,5 4,0 4,5	The student is able to work in a te	eam, being aware o	of the influence	of his own acti	ons on th	ne work of the	whole team	
	5,0								
Required reading	7								

1. 2011, Brak



Field of stu	ıdy									
Mode of st	study stationary Level first cycle								~1	
Graduate's	s qualification	inży	nier					WTil(	_n	
Fields of so	cience	engi	neering and	technology					_	
Disciplines	s of science	mate	erials engine	eering (100%)						
Education		gene	eral academ	ic						
Module	, ,	J -								
Course uni		Intr	o to Chemi	strv						
Code		-	1A S U01	3C1 <b>y</b>						
	ecialisation	INISE	_IA_3_001						C	
-		D				l Cla aa :	-t	_		
	ring faculty	<u> </u>	artment of ir	norganic and An	lalytica		stry			
ECTS		0,0 cred		ECTS (forms) Language		0,0 english				
	ourse credit									
Electives										
Form of in:	struction	Realization	Credit							
lecturing c	course	K	credits							
lecture		W	1	15	0	,0	0,50	K	credits	
Leading te	eacher	Rozv	wadowski Zb	igniew (Zbignie	w.Rozv	vadowsl	ki@zut.edu.pl)			
Other teac		Bosa Koło	acka Monika dziej Beata		a@zut j@zut.e	.edu.pl) :du.pl),	, Filipek Elżbiet Rozwadowski Z		pek@zut.edu.pl),	
Prerequisit										
W-1	The basic knowledg	ge of f	undamental c	themistry (inorgar	nic and	organic)				
Module/co	urse unit objective	es								
C-1	Knowledge and und	dersta	ndig the basic	concepts and lav	ws of ch	emistry				
Course cor	ntent divided into	vario	us forms of	instruction					Number of hours	
T-A-1	Nomenclature and	formu	ılas of inorgan	nic compounds					4	
T-A-2	Chemical reactions	and o	chemical equa	itions					4	
T-A-3	Oxidation - reduction								4	
T-A-4	Calculations based			ons. Yield of reac	tions				4	
T-A-5	Concentrations of s								4	
T-A-6	The stoichiometry								4	
T-A-7	The electronic structure			<u> </u>	ble				2	
T-A-8	The equilibrium law Acid – base equilibr				ncont F	quilibria	involving wook n	nolocular acide	2	
T-A-9	and bases	iuiii ii	ii aqueous soi	utions. The pri co	ncept. L	quilibria	involving weak i	noieculai acius	2	
T-W-1	Introduction to che			ire of inorganic co	mpound	ls. Atom	s, molecules and	moles	2	
T-W-2	Fundamental chem	ical la	aws						2	
T-W-3	Chemical reactions								2	
T-W-4	The periodic table a			s of the elements					2	
T-W-5	Chemical bonding:		<u> </u>						2	
T-W-6	Reaction rate, equi			constants, cataly	ts.				1	
T-W-7	Electrolytes, pH co								1	
T-W-8	An introduction to o								3	
	orkload - forms of								Number of hours	
A-A-1	Participation in reci		ns						30	
A-A-2	Preaparation for cla								30	
A-A-3	Individual problem solving 27									
A-A-4 A-W-1	Consultations  Participation in loca	uroc							3	
W-NN-T	Participation in lectures 15									



8. G. Marc Laudon, Organic Chemistry, Oxford, New York, 2002, (4th edition)

		Faculty of Chei	mical Techn	ology an	d Engin	eerin	g		
Student	workload	d - forms of activity						Number	of hours
A-W-2	Prepar	ation for final test							15
A-W-3	Individ	ual literature studies							28
A-W-4	Consu	tations							2
Teaching	g method	ls / tools							
M-1	Lectur	e							
M-2	Discus	sion							
Evaluatio	on meth	ods (F - progressive, P - final)							
S-1	Р	Final test							
S-2	Р	Continuous assessment: test (exe	ercises)						
	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 con	tent Teachi metho	
Knowled	ge								
Skills									
Social co	mpeten	ces							
Outco	omes	Grade	E	valuation cri	iterion				
Knowled	ge								
Skills									
Other so	cial com	petences							
Required	d reading								
1. C. E. Ho	ousecroft	and A. G. Sharpe, Inorganic Chem	istry, Pearson Educa	ation Limited,	Edinburgh, UI	<, 2001,	ISBN 058	2-31080-6	
1990, ISB	N 0582-3							imited, Ne	w York,
		ral Chemistry. Principles and Struc							
		l, Inorganic Chemistry. A Unified A	· ·					8	
		A. Tarr, Inorganic Chemistry, Pea							
	-	olman, Chemistry in Context, Thom		ns Ltd, Edinbu	rgh, UK, 1989	, ISBN 0	-17-43840	01-7	
7. John E.	McMurry.	Organic Chemistry, New York, 20	12, (8th Edition)						



	Г	acui	ty or Ch	eiiii	cai ieci	11101	ugy a	ina Engin	eering		
Field of s	study	Mate	erials Scienc	e and	Engineerin	ıg					
Mode of	study	stationary Level first cycle					\	CI			
Graduate	e's qualification	inży	nier	'			•		WTil	Ch	
Fields of	science	engi	neering and	techn	nology						
Disciplines of science		mate	materials engineering (100%)								
Educational profile		general academic							1		
Module		90							† I 📕		
	ınit	Intr	o to Piolog							C	
Course unit			Intro to Biology								
Code		MSE_1A_S_U02							· \		
	specialisation										
Administ	tering faculty	+ -	Department of Chemical and Process Engineering								
ECTS		0,0		ECTS (forms)			0,0				
Form of o	course credit	credits		Language			english				
Electives	5	Elective grou			ive group	)					
Form of i	instruction	Cod	Cod Semester Hours		EC	ECTS Wei		Realization	Credit		
lecturing	j course	Α	1		30	0	,0	0,50	К	credits	
lecture		W	1		15	0	,0	0,50	К	credits	
Leading	teacher	Mark	kowska-Szcz	runak A	Agata (Aga	ta Ma	rkowsk	a@zut edu pl)			
			Markowska-Szczupak Agata (Agata.Markowska@zut.edu.pl)  Markowska-Szczupak Agata (Agata.Markowska@zut.edu.pl), Sobolewski Piotr								
Other tea	acners 		bolewski@z								
Prerequis	sites										
W-1	knowledge at the b	oasic o	of natural scie	nce, bio	ology or rela	ted su	bjects				
Module/c	course unit objectiv	es									
C-1	To introduce stude genetics and evolu			f struct	ture, functio	n and	nteracti	ons of living org	anisms including	cell theory,	
<u> </u>					- L'					No. and the same of the same	
		ontent divided into various forms of instruction								Number of hours	
T-A-1 T-A-2		Design and panning biological experiments. Statistical Methods in Biology								10	
T-A-2 T-A-3		Calculation of concentrations and dilutions cell bology								5	
T-A-4		The kinetics of growth								5	
T-A-5	·	Examination of plant biodiversity.  Introduction to microbial culture methods: microscopy.								5	
T-W-1		History of Biology. Definition. Division of Biological Sciences.								2	
T-W-2	An introduction to Classification and taxonomy.									2	
T-W-3	Biological Law/ Cer	Biological Law/ Central dogma of biology								3	
T-W-4	Cellular assemblies - From single cell to multi-cellular organisms									3	
T-W-5	An introduction to genetics, heredity and evolution.									3	
T-W-6	Environmental biosafety, bioresources, biodiversity.									2	
Student	workload - forms of	f activ	rity							Number of hours	
A-A-1 Participation in recit			<u> </u>							30	
A-A-2	studing literature								10		
A-A-3	preparing of written reports								10		
A-A-4	consultations								10		
A-W-1	participating in lectures								15		
A-W-2	individual consultations								1		
A-W-3	-3 prepartion for tests									3	
Teaching	g methods / tools										
M-1	power point preser	ntation	lectures								
M-2	disscusion during t	disscusion during the lectures									
M-3	recitation class	recitation class									



			racuity of Chemi	icai rechn	ology an	a Engine	eerm	ig					
Teaching	method	ds / tools	5										
M-4	private	vate study , tutorials, learning materials											
Evaluation	n metho	ods (F - <sub>I</sub>	progressive, P - final)										
S-1	F	multiple	tiple choice test										
S-2	F	evaluati	ion of reports										
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 content	Teaching methods	Evaluation methods				
Knowledg	e												
Skills													
Social con	npeten	ces											
Outcomes		Grade	Evaluation criterion										
Knowledg	e												
Skills													
Other soc	ial com	petence	?S										
Required	reading	7											
	rry, Micl		ain, Steven A. Wasserman, P	eter V. Minorsky,	Jane B. Reece	e, Campbell B	iology ir	r Focus, Global	Edition	,			
2. Karen Ho 2011, 5	opkin, Al	lexander	D Johnson, David Morgan, M	lartin Raff, Keith	Roberts,, Esse	ential Cell Bio	logy, W.	W. Norton & C	ompany	/;,			
3. Kristi Lev	w, Taxor	nomy: Th	e Classification of Biological	Organisms (Here	dity and Gene	etics), Enslow	Publishi	ng, 2018					
			<u> </u>	·				·					

### 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
- 3. Biology Journals, 2010, Frontiers in Biology, PLoS Biology, Journal of Theoretical Biology, Biological Reviews