

Course unit title: MATERIALS INVESTIGATION METHODS Metody badania materiałów			
Field of study: Materials (Glass, paper, plastic and wood)			Course unit code: IM.KK.C3
Type of course unit: obligatory	Level of study: study-II level	Form of study: stationary studies	Year: I Semester: II
Teaching methods: Lecture, Tutorials, Laboratory, Seminar, Project		Number of hours/week: 1, 1, 1, 0, 0	Number of ECTS credits: ECTS 4

Course guide

I COURSE CARD

COURSE PURPOSES

- C1. This course introduces engineering students to the fundamentals relating composition, structure and processing of materials to their mechanical properties.
- C2. Students will gain an understanding of how to select materials for specific applications, taking into consideration cost, durability, and environmental impact.

INITIAL REQUIREMENT FOR THE KNOWLEDGE, ABILITIES AND OTHER COMPETENCES

1. Basic knowledge of the subjects: mathematic, chemistry, and physics
2. Ability to work independently and in a group.
3. Ability to use literature resources and internet resources.

THE EFFECTS OF EDUCATION

- EK 1 – Student knows the various assessment tools used for methods materials investigation.
- EK 2 – Students will have a working knowledge of properties of metals, ceramics, polymers, and composites.
- EK 2 – Student knows the essential components of structure and construction of materials
- EK 3 – Student knows the methodology for materials properties investigation.
- EK 4 - Provide practical experience in laboratory methods and reporting.

COURSE CONTENT

Teaching method – LECTURE	
W1 - Classification of materials and usage in today's advanced engineered systems	1h
W 2 – Microscopic analysis – optical, SEM, AFM	1h
W 3,4 – Mechanical Testing and Properties (Tensile test, Bend test).	2h
W 5,6 – The hardness test.	2h

W 7,8 – The Impact Test. The Fatigue test.	2h
W 9 – Tribology test	1h
W 10 – Quantitative description of the microstructure of materials	1h
W 11,12 – X-ray analysis	2h
W 13 – Fracture toughness	1h
W 14 – Tests in surface engineering	1h
W 15 – Corrosion and degradation of materials: mechanisms, forms of corrosion, and methods of prevention.	1h
Teaching method – Laboratory	
L 1,2,3,4 – Microscopic analysis – optical, SEM, AFM	4h
L 5,6 – Mechanical Testing and Properties (Tensile test, Bend test).	2h
L 7,8 – Quantitative description of the microstructure of materials	2h
L 9,10 – X-ray analysis	2h
L 11,12 – Scratch Test, profilometer	2h
L13,14 - The Hardness measurements methods	2h
L15 - Corrosion and degradation of materials	1h
Teaching method – TUTORIALS	
ĆW 1,2 – Structures of crystalline solids: concepts of close packing, critical radius ratio, unit cell, crystal system, polymorphism, crystal anisotropy. Calculations of linear, planar and bulk densities, and atomic packing factors.	2h
ĆW 3,4 – Thermal properties of materials - thermal conductivity, thermal expansion, thermal stresses	2h
ĆW 5 – Calculate the extent of diffusion-driven composition changes based upon composition, time, and temperature.	1h
ĆW 6,7 – Mechanical Testing and Properties – stress-strain curve	2h
ĆW 8 – X-ray analysis – qualitative analysis, Bragg's law	1h
ĆW 9 – X-ray analysis - quantitative phase analysis	1h
ĆW 10,11 – Fracture toughness, Fatigue test parameters	2h
ĆW 12 – Quantitative description of the microstructure of materials	1h
ĆW 13 – Physicochemical properties	1h
ĆW 14,15 – Magnetic properties	2h

TEACHING TOOLS

1. – Lecture with the use of audiovisual media
2. – Tutorials – problems solving with help of teacher and discussion in group
3. – Laboratory – student knows the methodology for materials properties investigation

WAYS OF ASSESSMENT (F – FORMING, P – SUMMARY)

F1. – assessment of preparing to tutorials
F2. – assessment of the skills to apply the knowledge during tutorials
F3. – assessment of the preparation of topic to practical research during laboratory
F4. – assessment of the activity during the course
P1. – assessment of knowledge gained during tutorials – final test
P2. – assessment of the ability of the practical skills in materials investigations

STUDENT WORKLOAD

Form of activity	Average number of hours to complete the activity
Contact hours with the teacher	15W 15T 15 lab 45 h
Getting Acquainted with the indicated literature	20 h
Preparing to tutorials	10 h
Preparing to laboratory	20 h
Preparing to pass the course	10 h
Total number of hours	Σ 105 h
TOTAL NUMBER OF ECTS CREDITS FOR THE COURSE	4 ECTS

BASIC AND SUPPLEMENTARY LITERATURE

1. G. Golański, A. Dudek, Z. Bałaga: Metody badania właściwości materiałów. Wyd. Politechnika Częstochowska 2011.
2. P. Kossakowski: Materiały pomocnicze dla laboratorium wytrzymałości materiałów. Wyd. Politechnika Świętokrzyska, Kielce 2008.
3. K. Gołoś: Własności i wytrzymałość materiałów. Wyd. Politechnika Warszawska, Warszawa 2008
4. S. Wolny: Wytrzymałość materiałów. Część IV-Ćwiczenia laboratoryjne. Wyd. AGH, Kraków 2005.
5. J. Lis: Laboratorium z nauki o materiałach, Wyd. AGH, Kraków 2003.
6. J. Okrajni: Laboratorium mechaniki materiałów. Wyd. Politechnika Śląska, Gliwice 2003.
7. L.A. Dobrzański: Podstawy nauki o materiałach i metaloznawstwo. Materiały inżynierskie z podstawami projektowania materiałowego. WNT, Warszawa 2002.
8. T. Broniewski, J. Kapko, W. Płaczek, J. Thomalla: Metody badań i ocena właściwości tworzyw sztucznych. WNT, Warszawa 2000.
9. M. Banasiak: Ćwiczenia laboratoryjne z wytrzymałości materiałów. PWN, Warszawa 2000.
10. G. Wróbel, A. Leonowicz, A. Pusz, M. Rojek, H. Rydarowski, J. Stabik, K. Walczak: Ćwiczenia laboratoryjne z przetwórstwa tworzyw sztucznych. Wyd. Politechnika Śląska 1999.

LEADING TEACHER (NAME,SURNAME, ADRES E-MAIL)

1. dr hab. inż. Agata Dudek, prof. P.Cz dudek@wip.pcz.pl

MATRIX OF REALIZATION OF EFFECTS OF EDUCATION

The effects of education	The reference of the effect to the effects defined for the entire program	Course purposes	Course content	Teaching tools	Ways of assessment
EK1	K_W06, K_W08, K_W10, K_W11	C1	W 1-7, 10-15	1, 2	P2
EK2	K_W16, K_W18, K_U19	C2	W1-4,8,9, 11,12 L1-15	1-3	P2 F2
EK3	K_U22, K_U23, K_U25	C1	W 1-15 L 1-15	1-3	F1 F2 P1
EK4	K_W19, K_U03, K_U04, K_U10, K_U18	C1	W 1-6, 8,9,11,13 L 1-15	1-3	F2 F3 F4

II.ASSESSMENT FORM – DETAILS

	For grade 2	For grade 3	For grade 4	For grade 5
EK 1 Student knows the various assessment tools used for methods materials investigation	Student does not know the various assessment tools used for methods materials investigation	Student knows some various assessment tools used for methods materials investigation	Student knows the various assessment tools used for methods materials investigation	Student knows in detail the various assessment tools used for methods materials investigation
EK 2 Students will have a working knowledge of properties of metals, ceramics, polymers, and composites.	Student does not have a working knowledge of properties of metals, ceramics, polymers, and composites.	Students will have a basic working knowledge of properties of metals, ceramics, polymers, and composites.	Students will have a working knowledge of properties of metals, ceramics, polymers, and composites.	Students will have excellent working knowledge of properties of metals, ceramics, polymers, and composites
EK 3 Student knows the essential components of structure and construction of materials	Student does not know the essential components of structure and construction of materials	Student knows the basic essential components of structure and construction of materials	Student knows the essential components of structure and construction of materials	Student knows the excellent essential components of structure and construction of materials
EK 4 Student provides practical experience in laboratory methods and reporting	Student is not able to provide practical experience in laboratory methods and reporting	Student provides some practical experience in laboratory methods and reporting	Student provides practical experience in laboratory methods and reporting	Student provides in detail practical experience in laboratory methods and reporting

III. OTHER USEFUL INFORMATION ABOUT THE COURSE (web site WIPMiFS PCZ)

1. Information where presentation of classes, instruction, subjects of laboratory can be found, etc.
2. Information about the location of the classes,
3. Information about the date of the course (day of the week/time).
4. Information about the consultation (time + place).