Course unit title: ***Structure and properties of engineering materials*** **Struktura i właściwości materiałów inżynierskich**			
Field of study: **Materials (Glass, paper, plastic and wood)**			Course unit code:
Type of course unit: **obligatory**	Level of study: **study-II level**	Form of study: **stationary studies**	Year: **I-III** Semester: I-VI
Teaching methods: **Lecture, Seminar, Laboratory, Project Tutorials**	Number of hours/week: **2, 1, 1, 0, 0**		Number of ECTS credits: **ECTS 6**

Course guide

I COURSE CARD

COURSE PURPOSES

C1. This course introduces engineering students to the progressive trends in materials and technologies in engineering area
C2. Students will gain an understanding of development of modern methods and technologies and utility properties of modern materials

INITIAL REQUIREMENT FOR THE KNOWLEDGE, ABILITIES AND OTHER COMPETENCES

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

THE EFFECTS OF EDUCATION

EK 1 – Student knows the various technologies to obtain modern and advanced materials.
EK 2 – Student has a working knowledge of properties of advanced materials.
EK 3 – Student knows the essential components of structure and construction of materials.
EK 4 - Provides practical experience in laboratory methods and reporting.

COURSE CONTENT

Teaching method – LECTURE	
W1,2 - Classification and characteristics of the modern materials.	4h
W 3 – Structural application of non-conventional structural material (composites, smart materials) in engineering structures.	2h
W 4,5 – Divide and characterize materials useful in medical applications New materials for bone regeneration and for orthopedic implants.	4h
W 6 – Classification and uses of protective and regenerative coatings	2h
W 7– Select the method of surface modification of materials suitable for the selected	2h

materials	
W 8 – Corrosion and Protection of the Metallic Materials	2h
W 9 – Nanomaterials and nanotechnologies-properties and applications	2h
W 10,11 – New technology in powder metallurgy	4h
W 12,13 – Innovative joining technologies	4h
W 14 – New materials for energy industry	2h
W 15 – Analysis of the benefits and risks resulting from new material technologies	2h
Teaching method – Laboratory	
L 1,2,3 – Microscopic and mechanical analysis of the modern materials.	3h
L 4,5,6 – Characterization of porous materials (powder metallurgy, HIP,SPS method)	3h
L 7,8 – Characterization of materials useful in medical applications	2h
L 9,10 – Identify various classes of ultra-light materials, their processing, properties and applications	2h
L 11,12– Identification of the materials suitable for application at elevated temperatures and coatings suitable for protection applications.	2h
L13,14 - Characterization of the properties of the materials after joining	2h
L15 - Corrosion and degradation of materials	1h
Teaching method – SEMINAR	
T 1,2 – Structural intermetallics: microstructure, properties and possibility of their application in high temperature.	2h
T 3,4 – Titanium and aluminum alloys for applications in the energy and aeronautics	2h
T 5,6 – Heat-resistant coatings: diffusion coatings, MCrAlY and TBC	2h
T 7,8 – Materials for nuclear application (fission, HTGR and fusion reactors): reduced activation ferritic (RAF) ODS steels, tungsten and tungsten refractory alloys.	2h
T 9 – Single crystal (cast) nickel-base superalloys.	1h
T 10 – Wrought nickel-, iron- and cobalt-base superalloys	1h
T 11,12 – Materials for energy systems and aeronautics: classification, properties, microstructure and its stability during operation, life-time.	2h
T 13 – Joining technologies	1h
T 14 – Inorganic Nanomaterials	1h
T 15 – Materials of Solar Energy	1h

TEACHNING TOOLS

1. – Lecture with the use of audiovisual media
2. – Tutorials –discussion in group supported by a teacher
3. – Laboratory – student examines the structure and properties of the new materials and advanced technologies

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

F1. – assessment of preparing to tutorials
F2. – assessment of the skills to use the knowledge during tutorials
F3. – assessment of the preparation of topic to practical research during laboratory
F4. – assessment of the student's active involvement during the course
P1. – assessment of knowledge gained during tutorials
P2. – assessment 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	**30W 15T 15 lab 60 h**
Getting Acquainted with the indicated literature	**30 h**
Preparing to tutorials	**20 h**
Preparing to laboratory	**40 h**
Preparing to pass the course	**10 h**
Total number of hours	**∑ 160 h**
TOTAL NUMBER OF ECTS CREDITS FOR THE COURSE	**6 ECTS**

BASIC AND SUPPLEMENTARY LITERATURE

1. R.W. Cahn, P. Haasen, E.J. Kramer: Materials Science and Technology, VCH, New York, 8,2005..
2. J.R. Davies: „Metallurgy, Processing and Properties of Superalloys", Heat Resistant Materials, ASM Specialty Handbook, 1997.
3. Biomaterials Science, An Introduction to Materials in Medicine, Edited by B.D. Ratner, A.S. Hoffman, F.J. Sckoen, and J.E.L Emons, Academic Press, second edition, 2004 •
4.Handbook of Materials for Medical Devices, Edited by J. R. Davis, ASM international, 2003

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

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

MATRIX OD 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	Teachning tools	Ways of assessment
EK1	K_W06, K_W08, K_W10, K_W11	C1, C2	W 1-15, L1-15, T1-15	1-3	F1-F4 P1-P2
EK2	K_W16, K_W18, K_U19	C1,C2	W 1-15, L1-15, T1-15	1-3	P1-P2 F1-F4
EK3	K_U22, K_U23, K_U25	C1, C2	W 1-15, L1-15, T1-15	1-3	F1-F4 P1-P2
EK4	K_W19, K_U03, K_U04, K_U10, K_U18	C1, C2	L1-15	3	P2 F3

II.ASSESSMENT FORM – DETAILS

	For grade 2	For grade 3	For grade 4	For grade 5
EK 1 Student knows the various technologies to obtain modern and advanced materials	Student does not know the various technologies to obtain modern and advanced materials	Student knows some the various technologies to obtain modern and advanced materials	Student knows the various technologies to obtain modern and advanced materials	Student knows in detail the various technologies to obtain modern and advanced materials
EK 2 Student has a working knowledge of properties of advanced materials	Student does not have a working knowledge of properties of advanced materials	Students will have a basic working knowledge of properties of advanced materials	Students will have a working knowledge of properties of advanced materials	Students will have excellent working knowledge of properties of advanced materials
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 WIPiTM 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).