



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Foundry and metal forming [S1IBio1>OiOP]

### Course

Field of study

Biomedical Engineering

Year/Semester

2/3

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

### Number of hours

Lecture

30

Laboratory classes

30

Other

0

Tutorials

0

Projects/seminars

0

### Number of credit points

4,00

### Coordinators

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### Lecturers

### Prerequisites

Basic knowledge of chemistry, physics, mathematics and mechanics; skills of logical thinking; association of knowledge of many branches; getting and using information from library and internet; social expertise: needs of continuous learning, getting new knowledge

### Course objective

Getting knowledge about casting processes and metal forming applying in manufacturing and exploitation of machines elements; recognise tools and machines used for casting processes and metal forming.

### Course-related learning outcomes

Knowledge:

1. He/she has well-founded theoretical general knowledge about manufacturing technologies. He/she knows how to describe processes of manufacturing engineering materials, techniques of creating metals and alloys, machining and advanced technologies of subtractive machining, modern formation

techniques

2. He/she can describe the specificity of foundry processes and their importance for the properties of castings.
3. He/she can describe the basic casting technologies and the relationships between technologies and the characteristic features of castings.
4. He/she has basic knowledge of foundry machines and equipment.

Skills:

1. He/she knows how to assess usefulness of methods and tools routinely used to solve engineering tasks of a practical character typical for materials engineering and select and use the right methods and tools
2. He/she knows how to solve technical problems using laws of mechanics and carry out strength analyses of machine elements and mechanical systems
3. Is able to safely perform the casting process for the selected casting technology.
4. Is able to select the casting technology depending on the product requirements.

Social competences:

1. He/she is well aware of the necessity for continuous learning and knows how to inspire and organize the process of learning of other people.
2. He/she is well aware of the social role of a graduate of a technical university, understands the need to formulate and inform the public through mass media about technical achievements and of other aspects of engineering activity and makes sure that such information and opinions are conveyed in a way that is generally understood.
3. He/she knows how to cooperate and work in teams assuming various roles within.

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:

Written test of general questions (positive note for minimum 50.1% correct answers: <50% - ndst, [50.1% - 60.0%]- dst, [60.1% -70.0%]- dst+, [70.1% - 80 %]db, [80.1% - 90.0%] - db+, [90.1% - 100%]- bdb)

Laborium:

Oral or written test of questions related to each experiment done in laboratory, written report of each experiment (according to lecturer instructions). To get credit every exercise must be passed (test and report).

### Programme content

Foundry: Moulding materials, Physico-chemical phenomena during casting, Foundry technologies, Casting features, Foundry equipment

6. Features of castings and methods of their production.
7. Basic theoretical knowledge about plastic working of metals and their alloys (stress tensor, plasticity conditions, plastic strain mechanism).
8. Materials susceptible to plastic working.
9. Changing the properties of materials during shaped products by plastic working methods.
10. Technological operations of shaping sheet products (cutting, bending, stamping).
11. Technological operations of shaping products from bars (forging, rolling, extrusion, drawing).
12. General information about tool materials and technological lubricants (taking into account the aspects of friction in plastic working).
13. Defects in products and methods of their prevention.
7. Characteristics of metal forming machines.
8. Sheet cutting using guillotine and disc scissors.
9. Stamping of cylindrical workpiece using hydraulic press.
10. Open forging using gravity hammer and die forging using screw press; extrusion using hydraulic press.
11. Stamping rectangular workpiece using hydraulic press.
12. Longitudinal and transverse rolling.

### 13. Estimation of material characteristics (tensile test, Erichsen test).

#### Course topics

##### Forging

1. Forming processes, advantages and disadvantages of plastic processing.
2. Stress and strain tensor, yielding stresses, strain hypotheses
3. Material strengthening, change of material properties during plastic deformation
4. Shearing cutting, on presses, cutting process phases, cutting force.
5. Bending - phases of the process, the phenomenon of springing
6. Stamping - process phases, limiting phenomena (flange folding, bottom detachment)
7. Defects of products obtained in plastic working

##### Foundry

###### Lecture:

The subject covers the following topics:

1. Foundry molds - raw materials, methods of their production and characteristic features.
2. Physicochemical phenomena during filling molds with liquid casting material.
3. Influence of the cooling and solidification conditions of liquid metal on the properties and structure of the casting.
4. Review of casting methods. Features of castings and their production methods.
5. Review of machines and devices used in foundry.

###### Laboratory:

1. Preparation and testing of basic properties of molding masses.
2. Hand molding.
3. Permanent mold casting.
4. Special casting methods (casting using the investment metal casting method and casting in shell molds).
5. Application of computer technology in foundry.
6. Comparison of features of castings obtained using different methods.

#### Teaching methods

##### Lecture:

Multimedia presentation (images, graphs, videos, simulations)

##### Laboratory:

Perform of experiments - presentation of results, practical work of students, discussion.

#### Bibliography

##### Basic:

1. Szweycer M., Nagolska D.: Metalurgia i odlewnictwo. Wyd. PP, Poznań 2002
2. Jackowski J.: Podstawy odlewnictwa. Ćwiczenia laboratoryjne, Wyd. PP, Poznań 1993
3. Perzyk M., Waszkiewicz S., Kaczorowski M., Jopkiewicz A.: Odlewnictwo. WNT , Warszawa 2000
4. Tabor A.: Odlewnictwo. Wyd. Politechniki Krakowskiej, Kraków 2009
5. Erbel S., Kuczyński K., Marciniak Z.: Obróbka plastyczna. Warszawa: PWN 1986.
6. Morawiecki M., Sadok L., Wosiek E.: Teoretyczne podstawy technologicznych procesów przeróbki plastycznej, Wyd. Śląsk, 1986
7. Z. Marciniak: KONSTRUKCJA TŁOCZNIKÓW, Ośrodek Techniczny A. Marciniak, Warszawa, 2002.

##### Additional:

1. Braszczyński J. : Teoria procesów odlewniczych. PWN , Warszawa 1989
2. Łybacki W., Modrzyński A., Szweycer M. : Technologia topienia metali. Wyd. PP Poznań 1986
3. Erbel S., Gołatowski T., Kuczyński K., Marciniak Z. i inni: Technologia obróbki plastycznej na zimno. Warszawa: SIMP-ODK 1983. Muster A.: KUCIE MATRYCOWE,
4. Muster A.: KUCIE MATRYCOWE Projektowanie procesów technologicznych, Oficyna Wydawnicza Politechniki Poznańskiej, Warszawa 2002.
5. Zalecenia do obróbki plastycznej metali. Instytut Obróbki Plastycznej, Poznań.
6. M. Ustasiak, P. Kochmański: OBRÓBKA PLASTYCZNA Materiały pomocnicze do projektowania, Politechnika Szczecińska, Szczecin, 2004

#### Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,50