# 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 (e.g. online)
0

Tutorials
0

Projects/seminars
0

## Number of credit points

4,00

## Coordinators

dr hab. inż. Piotr Mikołajczak
piotr.mikolajczak@put.poznan.pl

dr hab. inż. Anita Uściłowska
anita.uscilowska@put.poznan.pl

## Lecturers

## Prerequisites

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

## Course objective

Getting knowledge about casting processes and metal forming applying in manufacturing and exploatation 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 minimu 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)
Laboratorium:
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

Lecture:
1. Foundry molds - raw materials and methods of making them and characteristic features.
2. Physico-chemical phenomena when filling molds with liquid casting alloys.
3. The influence of cooling and solidification conditions of liquid alloy on the properties and structure of the casting.
4. Overview of casting methods. Features of castings and methods of their production.
5. Overview of machines and devices used in foundry.
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.
Laboratory:
1. Preparation and testing of the basic properties of molding sand.
2. Sand casting.
3. Die casting.
4. Special casting methods (lost wax method and casting in shell molds).

5. Application of computer technology in foundry.
6. Comparison of the features of castings obtained with different methods.
7. Charasteristics of metal forming machines.
8. Sheet cutting using guillotineand disc scissors.
9. Stamping of cylidrical drawpiece 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

none

## 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.,Golatowski 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 |