COURSE DESCRIPTION CARD - SYLLABUS

Course name
Metallurgy and foundry

Course

Field of study
Mechanical and Automotive Engineering

Year/Semester
1/2

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
15

Number of credit points

5

Lecturers

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Prerequisites

Student has basic knowledge in the field of chemistry and physics of solid, liquid and gas state,

metallurgy and foundry and metallurgy. Has skills of logical thinking and use of information sources (library, Internet) and understand the need to learn and acquire new knowledge.

Course objective

Understanding the methods of classical casting technology and the basics of the simulation process of casting technology.

Course-related learning outcomes

Knowledge

1. Has basic, ordered knowledge about metal materials used in the construction of machines, such as iron, aluminum, copper etc. used in machine construction, in particular about their structure, properties, manufacturing methods, heat and thermochemical treatment and the impact of plastic forming on their strength

2. Has basic knowledge of manufacturing techniques used in the machine industry, such as casting, plastic working, loss and incremental machining, welding and other techniques of joining materials, cutting, coating and surface treatments

3. Has basic knowledge of the strength of materials, including the basics of the theory of elasticity and plasticity, stress hypotheses, calculation methods for beams, membranes, shafts, joints and other simple structural elements, as well as methods of testing the strength of materials and the state of deformation and stress in mechanical structures.

Skills

1. Is able to search in catalogs and on manufacturers' websites ready machine components for use in own projects

2. Is able to draw a schematic and a simple machine element in accordance with the principles of technical drawing

3. Can prepare a technical descriptive and drawing documentation of an engineering task.

Social competences

1. Is ready to critically evaluate own knowledge and content

2. Is ready to initiate actions for the public interest.

3. Is willing to think and act in an entrepreneurial manner.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written exam carried out at the end of the semester (credit if at least 50.1% of correct answers are obtained). Up to 50.0% - unsatisfied, from 50.1% to 60.0% - satisfies, from 60.1% to 70.0% - satisfies+, from 70.1 to 80.0 - good, from 80.1% up to 90.0% - good+, from 90.1% - very good.

Laboratory classes:

Crediting based on the oral or written answer regarding the content of each laboratory, report on each laboratory according to the instructions of the teacher. To pass all Laboratory must be passed (positive assessment of answers and reports).

Project:

- project made correctly, there are small calculation errors and drawings, the student can answer questions about the content of the project, can partially describe the process of filling the mold, supplying the casting (50%) assessment -3.0,

- project made correctly, the student can answer questions about the content of the project, can describe the process of filling the mold, supplying the casting (70-90%) assessment - 4.0,

- project made correctly, the student can answer questions about the content of the project, can describe the process of filling the mold, supplying the casting (over 90%) rating - 5.0.

Programme content

Lecture:

Definition of metallurgy. Basic concepts related to metallurgy. Stages of producing metals and alloys. Metallic compounds. Primary and secondary metals. Ores, their characteristics and methods of processing. Ways of enriching ores. Initial metallurgical process (methods). Characteristics of the raw metal. Contaminants in metals and alloys: origin, form and properties. Refining processes, their purpose, methods, course and effect. Refined metal (characteristics, properties, purpose). Ingots and ingots and their processing. Ferrous metallurgy. Great oven. Blast furnace input, process course and its products. Salad. Steelmaking process. The stages of the process and its course and effect. Steel casting. Obtaining aluminum, raw materials and their processing. Al2O3 electrolysis. Raw and refined aluminum cell. Casting of ingots and ingots. Electrolytic aluminum. Obtaining copper, ore, their processing. Stages in the production of pure copper and its alloys. Obtaining other selected non-ferrous metals (Cr, Zn, Pb, Ti). Basic concepts related to foundry.

Casting materials (basic characteristics and application). Foundry molds. Shaping of a casting in a casting mold. The gating system - elements, purpose, operation. Metal flow through the gating system and filling the mold. Formation of the casting surface layer. The solidification and cooling of the metal. The cristalization process. Desorption of impurities. Shrinkage phenomena before and after casting solidification. Power contraction. Feeding of castings - rules. Control of the coagulation process. Lugs and coolers. Foundry shrinkage. Free and inhibited contraction. Removal of castings from molds. Final treatment of castings. The quality of castings. Casting inspection and repair. Overview of casting manufacturing methods. Features of castings and methods of their production.

Laboratory classes:

1. Test on selected properties of molding / core sand.

2. Manufacturing of castings using the manual forming method.

3. Die casting.

4. Production of shell sand molds.

5. Investment casting technology. The method of wax models.

6. Computer simulation of selected foundry processes.

7. Identification and evaluation of casting characteristics obtained with different methods.

Project:

Development of the casting technology design (project content: structural drawing of the part, drawing of the raw casting, number of springs, minimum module (s) of the sprue (s), dimensions of the sprue (s) and its solidification module, calculation of the pouring time and cross-sectional area of the filler system, drawing concept of casting technology.

Teaching methods

Lecture: multimedia presentation, illustrated with examples on the board.

Laboratory classes: performance of tasks given by the teacher - practical exercises.

Project: multimedia presentation, illustrated with examples on the board, performance of tasks given by the teacher.

Bibliography

Basic

1. Praca zbiorowa red. J. Jackowski, Podstawy odlewnictwa. Ćwiczenia laboratoryjne. Wyd.PP, Poznań 1993.

2. Szweycer M., Nagolska D., Metalurgia i odlewnictwo, Wyd. PP, Poznań 2002.

3. Perzyk M. i inni , Odlewnictwo, WNT Warszawa 2004.

4. Tabor A., Odlewnictwo , Wyd. Politechniki Krakowskiej, Kraków 2007.

5. M. Perzyk i inni, Materiały do projektowania procesów odlewniczych. PWN Warszawa 1990

Additional

1. Praca zbiorowa red. J.Sobczak, Poradnik Odlewnika. Odlewnictwo współczesne. Tom I Materiały, Wyd. STOP, 2013.

2. J. Campbell, Complete Casting Handbook, Metal Casting Processes, Metallurgy, Techniques and Design,wyd.2, Elsevier Butterworth-Heinemann, 2015.

3. Braszczyński J., Teoria procesów odlewniczych, PWN Warszawa 1989

4. Górny Z., Odlewnicze stopy metali nieżelaznych, Przygotowanie ciekłego metalu, struktura i właściwości, WNT Warszawa 1992

5. Ignaszak Z., Bazy danych i walidacja, Wyd. Politechniki Poznańskiej, Poznań 2002

6. Ashby M. i in., Materiały inżynierskie tom I i II, WNT, 1996

Breakdown of average student's workload

	Hours	ECTS
Total workload	120	5,0
Classes requiring direct contact with the teacher	60	3,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	60	2,0

[1] delete or add other activities as appropriate