STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Metallurgy and Foundry**		Code **1010601121010200012**
Field of study **Mechanical Engineering**	Profile of study (general academic, practical) **(brak)**	Year /Semester **1 / 2**
Elective path/specialty **-**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **First-cycle studies**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **2** Classes: **2** Laboratory: **-** Project/seminars: **-**		No. of credits **4**
Status of the course in the study program (Basic, major, other) **(brak)**	(university-wide, from another field) **(brak)**	
Education areas and fields of science and art **technical sciences** **Technical sciences**		ECTS distribution (number and %) **4 100%** **4 100%**

Responsible for subject / lecturer:

Prof. dr hab. inż. Zenon IGNASZAK
email: zenon.ignaszak@put.poznan.pl
tel. 61 665 24 60
Wydział Budowy Maszyn i Zarządzania
ul. Piotrowo 3, 60-965 Poznań

Responsible for subject / lecturer:

Dr hab.inż. Andrzej MODRZYŃSKI
email: andrzej.modrzynski@put.poznan.pl
tel. 61 665 24 23
Wydział Budowy Maszyn i Zarządzania
ul. Piotrowo 3, 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Fundamentals of chemistry and physics of solids, liquids and gases bodies. Fundamentals of engineering drawing
2	**Skills**	Using literature (books and internet), ability to perceive the content of lectures
3	**Social competencies**	Awareness of the need to deepen the engineering knowledge and its place in everydays life

Assumptions and objectives of the course:

Provide students with basic knowledge of Metallurgy and Foundry through specific content suitable for course of study

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Identify the manufacturing processes of metals and alloys - [K_W02]
2. Identify the correlation between the structure of metallic materials and their properties - [K_W08]
3. Identify methods of shaping castings - [K_W09]
4. Indicate the relationships between different casting technologies and characteristics of the produced castings using these methods - [K_W09]

Skills:

1. Ability to analyze the relationship: cause - effect - [K_U01]
2. The use of different sources of technical information - [K_U01]
3. The ability to take the most favorable technical decision - [K_U13]
4. Using the gained knowledge - [K_U23]

Social competencies:

1. Open to discussion about technical problems - [K_K01]
2. Creativity in solving engineering problems - [K_K04]
3. Scepticism in research (experimental) - [K_K05]

Assessment methods of study outcomes

Lecture :

The written examination. Written test (mixed: multiple choice test and short written answers). A total of 40 questions rated from 1 to 5 points. The total maximum number of points ? 75. For 3,0 note student must obtain -30 points (40%).

Classes:

Student ought to present on all classes. Positive answers on written or oral questions of the teacher. Submit reports on the exercise and written final test

Course description

Lecture:

1. The essence of shaping products from materials in liquid state. The ability to control their properties and manufacture materials with gradient of properties
2. Global trends in foundry. Directions of development of metallurgy and technology of castings
3. Classification of metallurgical processes. Ores and their preparing . Methods for ores enrichment. Ore concentrate, agglomerate and furnace feed.
4. Preliminary metallurgical process. Characteristics of the so-called raw metal. Inclusions in metals and alloys: origin, form, properties and characteristics
5. Metallurgical processes (in melting furnaces) and outside . The term of the metallurgical system. Melting of pig iron, gray and ductile iron, cast steel and aluminum and cooper alloys .
6. Characteristics of casting methods. Casting alloys and their properties. Machinery and equipment for foundries. Molding and core materials, the construction of the mold and core. Manufacturability design of castings.
7. Basic physical and chemical processes accompany the formation of casting in permanent and non-permanent casting moulds. Fill the mould with molten metal (gating system), solidification process of casting (crystallization, shrinkage phenomena, gases and shrinkage porosity). Examples of supply casting made of cast steel, cast iron, ductile iron and Al-Si alloy.
8. Steering mechanical properties with application a metallurgical and technological parameters (grain size, type of non-metallic inclusions, microporosities, locality of mechanical properties, ? tolerance of damage ? in casting construction).
9. Virtualization casting processes - the modern way to optimize the design process of casting construction and concept of technology process .
10. Non-destructive testing of castings (quality control after production) and during exploitation in machines and vehicles

Clases:

Introduction. The study of basic properties of molding sand and screen analysis of foundry sands. Hand moulding. Cast into the permanent mould. Casting by lost wax models. Forming moulds with using Hot Box Process. Comparison of surface quality and accuracy of castings made by different methods.

Preparation of a concept a technological process for making the casting of a given shape with a specific alloy . Design rules . Allowances for machining, the linear shrinkage, tilt the selection and choice of the mould parting plane. Calculation of the gating and riser system . The preparation of the raw casting drawing. Consultation this project (leading design solutions) with teacher.Casting process simulation using CAD software

Basic bibliography:

1. Perzyk M. i inni , Odlewnictwo, WNT Warszawa 2000
2. Szweycer M., Nagolska D., Metalurgia i odlewnictwo, Wyd. Politechniki Poznańskiej Poznań 2002
3. Tabor A., Odlewnictwo , Wyd. Politechniki Krakowskiej, Kraków 2007

Additional bibliography:

1. Braszczyński J., Teoria procesów odlewniczych, PWN Warszawa 1989
2. Górny Z., Odlewnicze stopy metali nieżelaznych, Przygotowanie ciekłego metalu, struktura i właściwości, WNT Warszawa 1992
3. Ignaszak Z., Wirtual Prototyping w odlewnictwie. Bazy danych i walidacja, Wyd. Politechniki Poznańskiej, Poznań 2002

Result of average student's workload

Activity	Time (working hours)

1. Participation in lectures	30
2. The consolidation of the lecture	10
3. Consultations	4
4. Preparation for the exam	20
5. Participation in the exam	1
6. Prepare for classes	15
7. Participation in classes	30
8. Preparing to pass the classes	10
9. Credit the classes	1

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	121	4
Contact hours	30	0
Practical activities	30	0