COURSE DESCRIPTION CARD - SYLLABUS

Course name
CAE in material processing [S1IMat1>WKwPM]

Course

Field of study
Materials Engineering

Year/Semester
3/5

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
15

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
15

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Student has basic knowledge of physics and materials science (including heat transfer, flows, stresses, materials science, crystallization, phase transformations), CAD geometry systems and the basics of manufacturing engineering. Has also skills in Acquiring information from literature survey and internet, is able to use the acquired knowledge to choose a technology selection strategy and understand the necessity to learn, taking new knowledge and collaboration in a workgroup.

Course objective

Student should obtain knowledge about the application of the theory of energy and mass flow in modeling and simulation of processes in material technologies (on examples of casting process).

Course-related learning outcomes

Knowledge:
1. student has basic knowledge of engineering design, allowing to design objects and processes, apply engineering calculations, select and evaluate solution variants; use modeling and computer aided design process - [k_w05, k_w06
2. has basic knowledge of computer science that allows the use of computer-aided engineering (cae)

systems - [k_w04]
3. has detailed knowledge of material process technology. can describe techniques of processing metals and their alloys - [k_w12]
4.has knowledge of numerical methods for simulating physical phenomena and processes, modeling, simulation and prediction of the structure and properties of engineering materials - [k_w15]

Skills:
1.is able to plan and carry out experiments, including measurements and computer simulations, interpret the results and draw conclusions; can use computer aids to solve technical tasks - [k_u08]
2. can use simulation and experimental methods to solve engineering tasks. can formulate problems and use mathematical methods in the analysis of technical issues- [k_u10]
3. can design engineering objects and technical processes using cad, use thermodynamics to describe physical phenomena and mathematical modeling of heat transfer in technological processes - [k_u17]

Social competences:
1. can work on a given task independently and cooperate in a team - [k_k03]
2. understands the need for continuous training to improve professional qualifications - [k_k01]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Lecture: Written test carried out on the end of the term (in case of a credit min. 50.1% correct). Up to 50.0% - 2.0, from 50.1% to 60.0% -3.0, from 60.1% to 70.0% - 3.5, from 70.1 to 80 - 4.0, from 80.1% to 90.0% - 4.5, from 90.1% - 5.0
Design:
- 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 and changing the structure (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 and changing the structure (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 and changing the structure (over 90%) rating - 5.0.

Programme content

Lecture
Principles of formulating mathematical and physical models. Identification of models in the technological process. The certain conditions in terms of the necessary model simplifications. Analytical and numerical solutions. Macro and micro modeling of phenomena. Theoretical basis of flows. The basics of heat flow. Tthe basics of diffusion. An outline of the basics of filtration. Direct and inverse modelling. Material and physical coefficients determined from inverse problems. Modeling of coupled phenomena. Modeling in application to computer simulation. Outline of the basics of the state of stress and strain. Examples of applications in material processing technologies.
Design:
Development of a design for a casting technology with a specific structure using a CAD system and simulation code. Independent preparation of the CAD model of the cast-mold system and transfer of the solid model to the simulation program. Import a solid model in the simulation code and define the certain conditions. Implementation of the simulation of the casting process. Analysis of simulation results. Creation of the casting concept and preparation and execution of the next simulation.

Teaching methods

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

Bibliography

Basic

1. M. Perzyk i inni, Odlewnictwo. WNT, Warszawa 2004.
2. E. Fraś, Krystalizacja metali PWN Warszawa 2003.
3. M. Perzyk i inni, Materiały do projektowania procesów odlewniczych. PWN Warszawa 1990.
Additional
1. B. Mochnacki, J. Suchy Modelowanie i symulacja krzepnięcia odlewów, , PWN, 1993
2. J. Braszczyński, Teoria procesów odlewniczych, PWN, Warszawa, 1989
3. B. Mochnacki Poradnik Odlewnictwo, tom II (rozdz. XVII) , PWN, Warzawa, 1986
4. E. Chlebus Techniki komputerowe CAx w inżynierii produkcji, WNT, 2000
5. W. Przybylski, M. Deja Komputerowe wspomagane wytwarzanie maszyn. Podstawy i zastosowanie, , WNT, 2007.

Breakdown of average student's workload

	Hours	ECTS
Total workload	60	2,00
Classes requiring direct contact with the teacher	35	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	25	1,00