COURSE DESCRIPTION CARD - SYLLABUS

Course name

Casting and plastic forming

Course

Field of study

Product Lifecycle Engineerings

Area of study (specialization)

Level of study

Second-cycle studies

Form of study

full-time

Year/Semester

1/2

Profile of study

general academic

Course offered in

English

Requirements

elective

Year/Semester

1/2

Profile of study

general academic

Course offered in

English

Requirements

elective

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
10	20	
Tutorials	Projects/seminars	

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

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Faculty of Mechanical Engineering

Piotrowo Street No 3, 60-965 Poznań

Responsible for the course/lecturer:

Jakub Hajkowski, Ph.D. Eng.

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Faculty of Mechanical Engineering

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Prerequisites

The student has basic knowledge in the field of chipless technologies and about the machines and devices used in these technologies. In addition, he is able to obtain information from Polish and foreign literature and the Internet, is able to use the acquired knowledge to choose a strategy for choosing technology. Understanding the need to learn, acquire and synergy of new knowledge and cooperation in virtual and concurrent engineering design teams.

Course objective

Extention knowledge of selected chipless manufacturing technologies

Course-related learning outcomes

Knowledge

1. Has detailed knowledge of selected chipless technologies, knows modern trends and development directions of foundry and metal forming.

2. The student knows how to assess the concept of the designer in terms of assessing the accuracy of the choice of material and the technology of its processing, has the basis of knowledge to optimize construction solutions in terms of local properties of the material and the operational strain of the product.

3. Has detailed knowledge of destructive and non-destructive testing methods of zone identification in materials obtained by "high technology" techniques.

4. Has basic knowledge of quality management.

5. Has detailed knowledge of the methods of local improvement of product structures obtained in individual material technologies.

Skills

1. Student is able to choose the production technology for products shaped by material technologies.

2. Student is able to use rapid prototyping methods for the production of metal products.

3. Student is able to analyze objects and technical solutions, is able to search in the catalogs and on the manufacturers' websites final and semi-final products of machines and devices, including means of transport and storage, assess their suitability for use in their own technical and organizational projects.

Social competences

1. Student understands the need for continuous learning; can inspire and organize team members' learning process.

2. Student is able to interact and work in a team, taking on different roles in it.

3. Student is able to think and act in a creative and entrepreneurial way.

4. The student is open to discussion of technical issues.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:

Written test carried out at the end of the semester (credit if at least 50.1% of correct answers are obtained). 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 80.0 - 4.0, from 80.1% up to 90.0% - 4.5, from 90.1% - 5.0.

Laboratory:

Crediting based on the oral or written answer regarding the content of each laboratory exercise, report on each laboratory exercise as instructed by the laboratory. In order to get a credit for the laboratories, all exercises must be passed (positive assessment of responses and reports).

Programme content

Lecture:

Structure and trends in global casting production in various industries and economy. Directions of technology development and alloy metallurgy, special casting methods: high-pressure die-casting, thixotropic, investment casting. Casting as a specific composite product with a gradient of mechanical properties. Controlling local casting properties. Simulation of the casting process. Application of 3D printing in foundry: casting molds, foundry models. Examples of the use of rapid prototyping in foundry. Basic theoretical knownledge on the directions of development of metals and its alloys of plastic working processing, technological operations of shaping sheet metal products and volumetric machining. Changes in product properties after the forming process. Joining metal sheets by means of the clinching method and shaping the edges of the ovaries by friction rolling technology.

Laboratory:

1. Designing casting technology using CAD / CAE systems.
2. Computer simulation of the casting process in the NovaFlow & Solid code.
3. Production of precision castings using models made by the Rapid Prototyping method in artistic foundry and prototyping.
4. Centrifugal and vacuum casting.
5. Joining metal sheets by clinching method.
6. Shaping the edges of the holes with friction rolling technology.
7. Sheet metal bending.
8. Shaping sheet metal using rubber.

Teaching methods

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

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

Bibliography

Basic

1. Campbell J., Complete Casting Handbook. Metal Casting Processes, Metallurgy, Techniques and Design, 2nd Edition, Butterworth-Heinemann, 2015.

2. Campbell J., Castings Practice: The Ten Rules of Castings, Elsevier Butterworth-Heinemann, 2004.

3. Ignaszak Z., Popielarski P., Hajkowski J., Sensitivity of models applied in chosen simulation systems with respect to database quality for resolving the casting problems, Defect and Diffusion Forum, 2013, Vol. 336, pp.135-146.

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6. Maikranz-Valentin M., Weidig U., Schoof U., Becker H-H., Steinhoff K.: Components with Optimised Properties due to Advanced Thermo-mechanical Process Strategies in Hot Sheet Metal Forming, 2008

7. Barcellona A.: On The Influence of some Operative Parameters in the Conform Extrusion Process, Proc. of the IV Convegno AITEM, Brescia, Italy, 1999.

8. Reinikainen, T., Korhonen, A. S., Andersson K., and Kivivuori, S.: Computer-Aiede Modelling of a NEW Copper Extrusion Process, Annals of the CIRP, Vol. 42/1/1993.

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10. Theis H.E., Handbook of Metalforming Processes, Marcel Dekker, 1999.

11. Ramezani M., Ripin Z.M., Rubber-Pad Forming Processes: Technology and Applications, Woodhead Publishing, 2012.

Additional

1. Ashby M.F., JonesD.R.H., Engineering materials: an introduction to their properties and applications, Butterworth-Heinemann, 1995.

2. Ignaszak Z., Popielarski P., Hajkowski J., Prunier J-B., Problem of Acceptability of Internal Porosity in Semi-Finished Cast Product as New Trend – “Tolerance of Damage” Present in Modern Design Office, Defect and Diffusion Forum,Vols. 326-328, pp. 612-619, 2012.

3. Weidig U., Hübner K., Steinhoff K.: Bulk Steel Products with Functionally Graded Properties Produced by Differential Thermo-mechanical Processing, 2016.

4. Boljanovic V., Sheet Metal Forming Processes and Die Design, Industrial Press New York, 2004.

5. Benson S.D. , Press Brake Technology: A Guide to Precision Sheet Metal Bending, Society of Manufacturing Engineers, 1997.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	30	1,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	20	1,0

[1] delete or add other activities as appropriate