

**AGH**AGH UNIVERSITY OF SCIENCE
AND TECHNOLOGY

Code: UBPJO-091 Module name: Casting design and manufacturing

Academic year: 2014/2015 Semester: Spring ECTS credits: 5

Programme: AGH UST International Courses

Course homepage: <https://intstudies.agh.edu.pl> Lecture language: English

Responsible teacher: dr hab. inż. Maj Maria (mmaj@agh.edu.pl)

Academic teachers: dr inż. Wertz Jan (ijwertz@op.pl)

Descriptions of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Method of learning outcomes verification (form of completion)
Social competence		
M_K001	Student is able to work as a team member over the task assigned to a team. Student is able to discuss the different aspects of casting design process considering the both casting materials and casting application/manufacturing requirements.	Activity during classes, Involvement in teamwork
Skills		
M_U001	Student is able to perform the fatigue test using the MTS machine under supervision of a teacher.	Activity during classes, Execution of laboratory classes
M_U002	Student is able to perform a calibration of the photolastic material, to determine the level of residual stresses in casting and in model using photolastic method as well as to determine the boundry stresses.	Execution of laboratory classes
Knowledge		
M_W001	Student posses the basic knowledge about casting design including the specific properties of different casting materials	Activity during classes

FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes								
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Others	E-learning
Social competence										
M_K001	Student is able to work as a team member over the task assigned to a team. Student is able to discuss the different aspects of casting design process considering the both casting materials and casting application/manufacturing requirements.	+	-	+	-	-	-	-	-	-
Skills										
M_U001	Student is able to perform the fatigue test using the MTS machine under supervision of a teacher.	+	-	-	-	-	-	-	-	-
M_U002	Student is able to perform a calibration of the photolastic material, to determine the level of residual stresses in casting and in model using photolastic method as well as to determine the boundry stresses.	+	-	+	-	-	-	-	-	-
Knowledge										
M_W001	Student posses the basic knowledge about casting design including the specific properties of different casting materials	+	-	+	-	-	-	-	-	-

Module content

Lectures

Application of design rules to casting manufacturing process

Fundamentals of casting materials properties, selection and application of casting materials. Material requirements according to working conditions of casting. Casting design rules; meaning of castability, analysis of castability.

Influence of mechanical and physical properties of casting materials on life time of cast components

Economical criteria of casting material selection, availability. Evaluation of material properties and selected testing methods according to material application. Types of casting materials, mechanical properties. Design of cast parts / components. Casting design considering structural inhomogeneity in different parts of casting. Casting design considering strength and rigidity. Casting design considering fatigue strength issues. Casting design considering specific material properties. Casting design considering arising and development of stresses, deformations and cracks.

Classification and characteristics of residual stresses. Thermal stresses. Beam- and frame-shape casting design. Plate-shape casting design. Shell-shape casting design. Design of die castings, pressure castings, investment castings and shell mould castings. Example of correct and incorrect casting design.

Residual stress analysis method.

Methoding (Method Engineering) and Concurrent Engineering

Preparation of manufacturing process including computer simulations. Collaboration between casting designer and foundry technologist. Concurrent engineering – modern tool of casting designer. Casting position for pouring. Gating and risering, application of chills. Design of patterns and core-boxes, pattern materials and manufacturing. Selection of moulding materials, moulding technology. Pouring, solidification and cooling down. Casting shake-out, fettling & cleaning, lay-out and quality control.

Statistical Process Control in application to casting manufacturing process

Application of International Standards and local customer requirements to casting design. Foundry capacity, Statistical Process Control in application to casting manufacturing processes.

Casting Quality control, RCA (Root Causes Analysis) and CA (Corrective Action)

Casting quality issues. Casting defects and methods of investigation/detection. Ultrasonic testing, Magnetic testing, Dye penetrant test, radiography. Root causes analysis and Corrective Action, Casting repair methods and application. Basic knowledge of Environmental protection in foundry processes

Laboratory classes

Manufacturing and preparation of artificial resin materials, photolastic materials. Calibration of photolastic materials – determination of the material constants. Determination of boundary stresses. Determination of mechanical properties – MTS. Model Tech Method. Analysis of thermal stresses. Analysis of residual stresses. Casting wall junctions. Rapid prototyping.

Method of calculating the final grade

The average of mark including lectures, classes reports and papers.

Prerequisites and additional requirements

Prerequisite is not required

Recommended literature and teaching resources

1. M. Skarbiński, J. Skarbiński "Technologiczność konstrukcji maszyn", WNT W-wa 1982
2. M. Dietrich, "Podstawy konstrukcji maszyn", WNT, W-wa 2008
3. M.F. Aschby, "Materiały inżynierskie" WNT, W-wa 2008
4. A. Tabor, J. Rączka, "Projektowanie odlewów i technologii form", W-wa 1998
5. John Campbell, Casting, Butterworth - Neinemann, 2000
6. Stephen Istvan Karsay, Ductile Iron Production Practices, AFS Inc. Publication, 1994
7. Stephen Istvan Karsay, Ductile Iron III, Gating and Risering, QIT - Fer et Titane Inc, 1981
8. Ductile Iron Data for Design Engineers, SORELMETAL®, QIT - Fer et Titane Inc, 1990
9. Roehmeld & Moelle, Innovative Solutions in Cast Iron, Sonderdruck aus Konstruktionen + Giessen, 02/2007

Additional information

The non-attendance at 20% of lectures/classes is allowed

Student workload (ECTS credits balance)

Student activity form	Student workload
preparation for classes	25 h
additional contact hours	15 h
participation in lectures	15 h
participation in laboratory classes	15 h
examination or final test	4 h
preparation of report, written work, presentation, etc.	18 h
individual study of the subject of classes	35 h
Summary student workload	127 h
Module ECTS credits	5 ECTS