COURSE DESCRIPTION CARD - SYLLABUS

Course name

Manufacturing and processing of materials (foundry, metal plastic forming, machining)

Course

Field of study

Aerospace 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

30

Other (e.g. online)

Tutorials

Projects/seminars

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

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Prerequisites

Student has Basic knowledge of mathematics, physics and materials science. Has acquire information from literature survey and internet and analyzing technology with executive devices and he or she understand the necessity to learn, taking new knowledge and collaboration in a workgroup

Course objective

Knowledge of three basic technologies for the manufacturing of machine parts, i.e. metal plastic forming (methods of plastic forming of metals used in the manufacturing of parts and the operation of machines, and familiarization with machines and equipment for metal forming), foundry (casting methods and the basis of the simulation process of casting technology) and machining (machining methods, cutting tools, process run and its physical, technological and economic effects).

Course-related learning outcomes

Knowledge

1. Has expanded knowledge necessary to understand profile subjects and specialist knowledge about structure, methods of construction, manufacturing of products, operation, aircraft control, safety systems, economic, social and environmental impact in the field of aviation engineering for selected specialties.

2. Has basic knowledge about metal, non-metallic and composite materials applied in machine construction, in particular about their structure, properties, methods of manufacturing machine parts, including metal plastic forming, foundry and machining.

3. Has basic knowledge of the strength of materials, including the basics of the theory of elasticity and plasticity, strain hypotheses, methods for calculating beams, shafts, joints and other simple structural elements, as well as methods for testing material strength and the state of deformation and stress in structures and destructive and non-destructive methods.

Skills

1. Has the ability to self-study using modern teaching tools, such as remote lectures, websites and databases, teaching programs, electronic books.

2. Is able to assess material and environmental costs and work outlays on the implementation of aviation modules and on board equipment.

3. 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. Understands the need for a critical assessment of own knowledge and continuous learning.

2. Is aware of the importance and understands the non-technical aspects and effects of engineering activities, including its impact on the environment and the associated responsibility for decisions.

3. Is aware of the social role of a technical university graduate, and in particular understands the need for formulation and transfer to the public, in particular through the mass media, information and

opinions on the achievements of technology and other aspects of engineering activities; makes efforts to provide such information and opinions in a commonly understandable way.

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% - 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:

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

Programme content

I) PART I. Metal Plastic Formning

Lecture:

1. Basic theoretical information about plastic forming of metals and their alloys (plasticity conditions, plastic deformation mechanism).

2. Technological operations of shaping products from sheet metal (cutting, bending, stamping) and rods (forging, rolling, extrusion, drawing).

3. Materials susceptible to plastic working.

4. Change of material properties during shaped products by plastic working methods.

5. Defects in products and methods of prevention, and examples of technological processes,

Laboratory:

1. Cutting metal sheets with guillotine and circular shears.

2. Stamping a cylindrical deep drawn with a hydraulic press.

3. Volumetric plastic forming processes - forging and extrusion.

4. Rectangular stamping deep drawn using a hydraulic press.

5. Longitudinal and transverse rolling by means of laboratory rolling mills.

II) PART II. Foundry

Lecture:

1. Main and auxiliary moulding materials and methods for testing moulding sand properties.

2. Methods of castings manufacturing in sand and permanent moulds.

3. Introduction to casting design.

4. Technological properties of selected casting alloys. Crystal structure of foundry alloys.

5. Methods for destructive and non-destructive testing of castings.

Laboratory:

1. Testing of selected properties of moulding sand and cores.

2. MAnufacturing of casting by hand molding.

3. Die-casting.

4. Computer simulation of selected foundry processes.

5. Identification and assessment of casting characteristics obtained by various methods.

III) PART III. Machining

Lecture

1. Types of cutting methods and varieties. Cutting conditions (material decohesion).

2. Technological and geometric cutting parameters and the basis for their selection.

3. Materials for edges and cutting tools. Edge wear and durability.

4. Accuracy and real and theoretical roughness of the machined surface.

5. Selected tribological aspects. Machinability of various machined materials. Characteristics of the surface layer.

Laboratory

1. Technological possibilities of milling and drilling machines (machine tool, tools, process)

2. Technological possibilities of lathes and grinders (machine tool, tools, process).

3. Construction of cutting tools and analysis of tool materials

4. Assessment of geometrical and physical features of the surface layer after various treatment methods

5. Machinability assessment of processed materials

PART-66

MODULE 6. MATERIALS AND EQUIPMENT

6.1 Iron-containing aircraft construction materials

a) Characteristics, properties and identification of commonly used alloy steel used in aircraft; Heat treatment and use of alloy steel.[2]

6.2 Iron-free aircraft construction materials

a) Characteristics, properties and identification of non-iron materials used to build aircraft; Heat treatment and use of non-iron materials; [2]

Teaching methods

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

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

Bibliography

Basic

I) PART I. Metal plastic forming

1. Erbel S., Kuczyński K., Marciniak Z.:Obróbka plastyczna. Warszawa: PWN 1986.

2. Morawiecki M., Sadok L., Wosiek E.: Teoretyczne podstawy technologicznych procesów przeróbki plastycznej, Wyd. Śląsk, 1986

3. Z. Marciniak: KONSTRUKCJA TŁOCZNIKÓW, Ośrodek Techniczny A. Marciniak, Warszawa, 2002.

II) PART II. Foundry

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

III) PART III. Machining

1. Dul-Korzyńska B.: - Obróbka skrawaniem i narzędzia. Oficyna Wydawnicza Politechniki Rzeszowskiej 2009.

2. Erbel J. (red.): Encyklopedia technik wytwarzania w przemyśle maszynowym. Tom II. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2001.

3. Filipowski R., Marciniak.: Techniki obróbki mechanicznej i erozyjnej. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2000.

4. Kosmol J. (red.): Techniki wytwarzania. Obróbka wiórowa i ścierna. Wydawnictwo Politechniki Slaskiej, Gliwice 2002.

5. Olszak W.: Obróbka skrawaniem. WNT Warszawa 2008.

6. Wysiecki M.: Nowoczesne materiały narzędziowe WNT Warszawa 1997.

7. Żebrowski H. : Techniki wytwarzania. Obróbka wiórowa, ścierna i erozyjna. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2004.

Additional

I) PART I. Metal plastic forming

1. Erbel S.,Golatowski T.,Kuczyński K., Marciniak Z. i inni: Technologia obróbki plastycznej na zimno. Warszawa: SIMP-ODK 1983. Muster A.: KUCIE MATRYCOWE,

2. Muster A.: KUCIE MATRYCOWE Projektowanie procesów technologicznych, Oficyna Wydawnicza Politechniki Poznańskiej, Warszawa 2002.

3. Zalecenia do obróbki plastycznej metali. Instytut Obróbki Plastycznej ? Poznań.

4. M. Ustasiak, P. Kochmański: OBRÓBKA PLASTYCZNA Materiały pomocnicze do projektowania, Politechnika Szczecińska, Szczecin, 2004.

II) PART II. Foundry

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

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

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

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

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

III) PART III. Machining

1. Cichosz P.: Narzędzia skrawające. WNT. Warszawa 2008.

2. Jemielniak K.: Obróbka skrawaniem. Oficyna Wydawnicza Politechniki Warszawskiej - Warszawa 1998.

3. Grzesik W.: Podstawy skrawania materiałów metalowych, WNT Warszawa 1998.

4. Shaw M.C.: Metal Cutting Principles. Oxford University Press, Oxford 1996.

Breakdown of average student's workload

	Hours	ECTS
Total workload	84	3,0
Classes requiring direct contact with the teacher	64	2,5
Student's own work (literature studies, preparation for laboratory classes, preparation for tests) [1]	20	0,5

[1] delete or add other activities as appropriate