COURSE DESCRIPTION CARD - SYLLABUS

Course name
Manufacturing and processing of materials [S1Lot2-SLiPL>WiOM]

Course

Field of study
Aviation

Year/Semester
2/4

Area of study (specialization)
Aircraft Engines and Airframes

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge of mathematics, physics and materials science. Logical thinking skills, using information sources (library, Internet) and understanding the need to learn and acquiring new knowledge.

Course objective

Learning about the three basic technologies for producing machine parts, i.e. plastic processing (methods metal forming in the production of parts and operation of machines, and introduction with machines and equipment for metal forming), foundry (casting methods and basics of the casting technology simulation process) and machining (machining methods, cutting tools, process course and its physical, technological and economic effects).

Course-related learning outcomes

Knowledge:
has an extended and in-depth knowledge of mathematics and physics useful for formulating and solving complex technical tasks related to aviation and modeling real problems
has a structured and theoretically founded general knowledge in the field of key technical issues and detailed knowledge in the field of selected issues related to air transport

has knowledge of the method of presenting test results in the form of tables and graphs, performing the analysis of measurement uncertainties
has basic knowledge of research methods and how to prepare and conduct scientific research, and knows the rules of editing a scientific work
has technical knowledge related to aerospace engineering such as aerospace materials and fuels
has a basic knowledge of environmental protection in transport, is aware of the risks associated with environmental protection and understands the specificity of the impact of mainly air transport on the environment
has the ability to self-study with the use of modern teaching tools, such as remote lectures, internet websites and databases, teaching programs, e-books

Skills:
can obtain information from various sources, including literature and databases, both in Polish and in English, integrate them properly, interpret and critically evaluate them, draw conclusions and exhaustively justify their opinions
is able to properly use information and communication techniques, applicable at various stages of the implementation of aviation projects
is able to properly plan and perform experiments, including measurements and computer simulations, interpret the obtained results, and correctly draw conclusions from them
can, when formulating and solving tasks related to civil aviation, apply appropriately selected methods, including analytical, simulation or experimental methods
is able to properly select materials for simple aviation constructions, to indicate the differences between fuels used in aviation
is able to communicate using various techniques in the professional environment and other environments using the formal notation of construction, technical drawing, concepts and definitions of the scope of the field of study studied
can design elements of means of transport using data on environmental protection
the student knows how to use theoretical probability distributions. The student is able to analyze and interpret statistical data. The student is able to use the methods and tools of mathematical statistics in engineering practice
can use the language of mathematics (differential and integral calculus) to describe simple engineering problems.
the student is able to make a comprehensive assessment of the ecological parameters of an aircraft propulsion unit based on the values of emission factors for harmful gaseous compounds and particulate matter
is able to prepare a short research paper while maintaining the basic editorial rules. He can choose the appropriate methods for the conducted research and is able to carry out a basic analysis of the results
is able to organize, cooperate and work in a group, assuming various roles in it, and is able to properly define priorities for the implementation of a specific task
is able to plan and implement the process of own permanent learning and knows the possibilities of further education (2nd and 3rd degree studies, postgraduate studies, courses and exams conducted by universities, companies and professional organizations)

Social competences:
understands that in technology, knowledge and skills very quickly become obsolete
is aware of the importance of knowledge in solving engineering problems and knows examples and understands the causes of faulty engineering projects that have led to serious financial and social losses or to serious loss of health and even life
is aware of the social role of a graduate of a technical university, in particular understands the need to formulate and convey to the society, in an appropriate form, information and opinions on engineering activities, technological achievements, as well as the achievements and traditions of the engineer profession
correctly identifies and resolves dilemmas related to the profession of an aerospace engineer

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:
Written assessment carried out at the end of the semester (pass if obtaining at least 50.1% correct answers). Up to 50.0% - ndst, from 50.1% to 60.0% - dst, from 60.1% to 70.0% - dst+, from 70.1

up to 80.0 - db, from 80.1% to 90.0% - db+, from 90.1% - very good.
Lab:
Assessment criteria based on oral or written answer regarding the content of each activity
laboratory exercise, report on each laboratory exercise as indicated
conducting laboratory exercises. To pass the laboratories, all exercises must be completed
be passed (positive grade for answers and reports).

Programme content

Information about plastic shaping of metals and their alloys. Technological operations for shaping products
from sheets and bars. Properties of materials when shaping products using plastic processing methods.
Defects in products and methods of prevention as well as examples of technological processes.
Molding sands. Production of castings in disposable and permanent molds.
Casting design. Casting alloys. Destructive and non-destructive testing of castings.
Types and varieties of cutting. Conditions for cutting to occur. Cutting parameters and the basis for their selection. Materials for blades and cutting tools. Blade wear and durability. Tribological aspects.
Machinability. Top layer.

Course topics

I) PART I. Forging
Lecture:
1. Basic theoretical knowledge about the plastic shaping of metals and their alloys (conditions
plasticity, 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 processing.
4. Changing the properties of materials when shaping products using plastic forming methods.
5. Defects in products and methods of prevention as well as examples of technological processes,
Lab:
1. Cutting sheet metal using guillotine and circular shears.
2. Pressing a cylindrical extrudate using a hydraulic press.
3. Volumetric plastic working processes - forging and extrusion.
4. Pressing a rectangular extrusion using a hydraulic press.
5. Longitudinal and transverse rolling using laboratory rolling mills.
II) PART II. Foundry
Lecture:
1. Main and auxiliary molding materials and methods of testing the properties of molding sands.
2. Methods of producing castings in disposable and permanent molds.
3. Introduction to casting design.
4. Technological properties of selected casting alloys. Crystal structure of alloys
foundry.
5. Methods of destructive and non-destructive testing of castings.
Lab:
1. Research on selected properties of molding/core sands.
2. Making castings by hand molding.
3. Die casting.
4. Computer simulation of selected foundry processes.
5. Identification and assessment of features of castings obtained by various methods.
III) PART III. Machining
Lecture
1. Types and varieties of cutting. Conditions for cutting to occur (material decohesion).
2. Technological and geometric cutting parameters and the basis for their selection.
3. Materials for blades and cutting tools. Blade wear and durability.
4. Accuracy and actual and theoretical roughness of the machined surface.
5. Selected tribological aspects. Machinability of various workpiece materials. Characteristic
3
top layer.

Lab
1. Technological capabilities of milling and drilling machines (machine tool, tools, process)
2. Technological capabilities of lathes and grinders (machine tool, tools, process).
3. Construction of cutting tools and analysis of tool materials
4. Assessment of the geometric and physical features of the surface layer after various processing methods
PART - 66 (THEORY - 3.75 hours, PRACTICE 11.25 hours)
MODULE 6. MATERIALS AND EQUIPMENT
6.2 Aircraft construction materials not containing iron
a) Characteristics, properties and identification of non-ferrous materials
used to build aircraft;
Heat treatment and use of iron-free materials; [2]

Teaching methods

Lecture: multimedia presentation, illustrated with examples given on the board.
Laboratory: performing tasks given by the teacher - practical exercises.

Bibliography

Basic:
I) CZĘŚĆ I. Obróbka plastyczna
1. Matysiak W., Plančak M. Equipment for metal forming processes (Poznań University of Technology Press, 2023, ISBN 978-83-7775-700-0, 220 pages).
2. Matysiak W., Plančak M. Terminology of plastic working (terminology handbook PL/EN/DE; edition available at the PUT bookshop).
3. Tomczak J., Bartnicki J., Machines and equipment for plastic working, Lublin University of Technology, Lublin 2012.
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6. Z. Marciniak: KONSTRUKCJA TŁOCZNIKÓW, Ośrodek Techniczny A. Marciniak, Warszawa, 2002.
II) CZĘŚĆ II. Odlewnictwo
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) CZĘŚĆ III. Obróbka skrawaniem
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.
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4. Kosmol J. (red.): Techniki wytwarzania ? obróbka wiórowa i ścierna. Wydawnictwo Politechniki Slaskiej, Gliwice 2002.
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Additional:
I) CZĘŚĆ I. Obróbka plastyczna
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) CZĘŚĆ II. Odlewnictwo
1. Praca zbiorowa red. J.Sobczak, Poradnik Odlewnika. Odlewnictwo współczesne. Tom I Materiały, Wyd. STOP, 2013.
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III) CZĘŚĆ III. Obróbka skrawaniem
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	50	2,00
Classes requiring direct contact with the teacher	30	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	0,50