COURSE DESCRIPTION CARD - SYLLABUS

Course name
Subtractive manufacturing [S1MiBM2>TeU2]

Course

Field of study
Mechanical Engineering

Year/Semester
1/2

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
30

Other (e.g. online)
0

Tutorials
15

Projects/seminars
0

Number of credit points

5,00

Coordinators

Lecturers

Prerequisites

Basic knowledge of the methods and kinematics of cutting, the cutting tools used and the construction of machine tools. The ability to operate simple technical devices, capability of making use of information retrieved from different sources.

Course objective

Practical knowledge of technological and physical aspects of machining, tool materials and geometry of cutting tools. Getting to know the current solutions of tool systems and their exploitation, setup of tools for machining operations, implementation of new tooling systems in manufacturing plant.

Course-related learning outcomes

Knowledge:
The student is able to describe the structure of tools and the properties of tool materials.
The student is able to describe energetic and tribological phenomena in cutting.
The student is able to characterize the surface layer after machining.
The student knows how to recognize basic types of cutting tool holding systems and can describe its exploitation proprieties.
The student knows how to describe and identify types of tools and cutting tool materials according to ISO standard.

Skills:
The student is able to determine the area of application of individual machining technologies.
The student is able to characterize the production technology and indicate its strengths and weaknesses.
The student is able to make a preliminary economic analysis of the use of a given technology in a specific case.
The student is capable of analysis of economical viability of introduced tooling system.
The student is capable of choosing proper tooling system for given machining operation.
The student is capable of applying computer software to aid tool management and selection process.

Social competences:
The student acquires skills of finding solution for technical problems by himself/herself through search of knowledge in literature and on the Internet.
The student acquires skills of teamwork and forming inquiry questions.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired during the lectures is verified at the end of the semester, in the form of a mixed test, a single choice of 36-40 questions. The pass threshold is 50%.
Skills acquired in the laboratory classes are verified by evaluating student activity and skills to solution basic problems. The skill to present and analyze research results is checked in the form of experience reports.
The knowledge acquired during the tutorials is verified during the semester in the form of two tests. The test consists of computational tasks. The pass threshold is 50%.

Programme content

Scope of lecture:
- design and classification of cutting tools based on different criteria,
- identification of cutting tools, cutting wedge and cutting materials according to ISO standard,
- the genesis of tool systems,
- definitions, types, basic elements and functions of the tool system,
- economic aspects of using tool systems,
- overview of the design, physical and exploitation properties of the clamping: cutting tools, tool systems and interfaces,
- static and dynamic properties (stiffness and damping) of modular tools,
- systems for clamping of indexable inserts cutting tools,
- identification and coding of cutting tools in the ESW, measuring principles and setting the cutting tools to size outside the machine tool (wedge corner position in the tolerance field, wear compensation),
- selection of tooling system for HSM machining - preparation of tool for HSM machining.

The laboratory consists of two series of exercises.
The first series of exercises includes:
- construction and geometry of cutting tools (tools with specific geometry and abrasive tools) and materials for wedges and cutting tools,
- assessment of the geometric features of the surface layer after various processing methods,
- assessment of machinability of various materials based on measurement of cutting force and temperature,
- assessment of the geometry and physical phenomena of the drilling process with a twist drill,
- comparison of machinability of various tool materials.

In the second series of exercises, students:
- get acquainted with the construction and properties of various solutions of modular tool systems,
- conduct research on the influence of geometric features of modular tools on their physical properties,
- conduct research on the influence of the design features of various interfaces for their operational properties,
- analyze the construction of indexable insert tools with particular emphasis on the systems of clamping cutting wedges,
- set the modular tool to size outside the machine tool.

During the tutorials, students perform basic calculations in the field of:

- cutting kinematics,
- geometry of various cutting tools,
- geometric parameters of the cut layer during turning, drilling and milling,
- kinematic-geometric mapping of the wedge in the processed material,
- energy quantities such as: components of the total force, cutting torque and cutting power.

Course topics

none

Teaching methods

Lecture: multimedia presentation illustrated with examples, animations and short films, discussion.
Laboratory classes: execution of experimental studies, solving problem, discussion, teamwork.
Tutorials: solving tasks, discussion, teamwork

Bibliography

Basic:
Cichosz P., Narzędzia skrawające. Wydawnictwa Naukowo-Techniczne, Warszawa 2006.
Praca zbiorowa pod red. P. Cichosza, Techniki wytwarzania, obróbka ubytkowa, laboratorium, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2002
Kawalec M.: Ćwiczenia z podstaw skrawania. wyd. II Wydawnictwo Politechniki Poznańskiej. Poznań 1984.
Kawalec M., Kodym J., Jankowiak M.: Laboratorium z podstaw skrawania. Wydawnictwo Politechniki Poznańskiej. Poznań 1984.
Kosmol J., Automatyzacja obrabiarek i obróbki skrawaniem. Wydawnictwa Naukowo-Techniczne, Warszawa 2000.
Meldner B., Darlewski J., Narzędzia skrawające w zautomatyzowanej produkcji. Wydawnictwa Naukowo-Techniczne, Warszawa 1991.
Olszak W.: Obróbka skrawaniem. WNT Warszawa 2008.

Additional:
Filipowski R., Marciniak M., Techniki obróbki mechanicznej i erozyjnej, Oficyna Wydawnicza Pol. Warszawskiej, Warszawa 2000.
Honczarenko J., Elastyczna automatyzacja wytwarzania. Obrabiarki i systemy obróbkowe. Wydawnictwa Naukowo-Techniczne, Warszawa 2000.
Stephenson D.A., Agapiou J.S., Metal cutting. Theory and practice. Second edition. CRC Press Taylor & br/ >Francis Group. 2006.
Stós J., Składane systemy narzędziowe. Prace Instytutu Obróbki Skrawaniem. Seria: Opracowania analityczno-syntetyczne, Nr1/1991, Kraków 1991.

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
Classes requiring direct contact with the teacher	62	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	63	2,50