



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Subtractive manufacturing [S1Mech2>TU]

Course

Field of study
Mechatronics

Year/Semester
2/4

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
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

Familiarization students with practical aspects of subtractive manufacturing. The ability to operate simple technical devices, capability of making use of information retrieved from different sources.

Course objective

Familiarization students with practical aspects of subtractive manufacturing.

Course-related learning outcomes

Knowledge:

The student knows how to recognize basic methods and types machining operations.

The student is able to characterize the kinematics of various cutting methods.

The student knows how to describe design features and application of cutting tools.

The student knows how to characterize technological capabilities of hand powered metalworking, lathe, milling and drilling machines or grinders.

The student knows how to describe energetic and tribological phenomena in cutting.

The student knows how to characterize the surface layer after machining.

The student is able to describe the properties of tool materials.

Skills:

The student is able to choose the appropriate subtractive technology to give a specific surface shape.
The student is capable of setting cutting parameters.
The student is capable of mounting and using cutting tools for different types of machining.
The student is able to determine the economic and efficient cutting speed.

Social competences:

The student acquires skills of teamwork.
The student is able to obtain information from the Internet and technical literature.
He has the ability to self-educate. Able to cooperate in a group.
The student is aware of importance of machining for contemporary economics and society.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired during lectures is verified in the exam. The exam is in written form. 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.

Programme content

1. Review of subtractive technologies and their application in industry.
2. Kinematics and cutting parameters.
3. Overview of cutting methods.
4. Construction and application of various cutting tools.
5. Materials used for cutting tool wedges.
6. Practical application of the subtractive manufacturing for shaping various products.
7. Technological effects of machining and physical phenomena occurring in the cutting process.
8. Economics of the machining process.

Course topics

Scope of lecture:

- characteristics and purpose of machining in modern manufacturing technology,
- methods and types of machining, cutting kinematics,
- modern materials for wedges and cutting tools, anti-wear coatings,
- cutting wedge geometry and the machining process and effects,
- mechanics of the cutting process - minimum thickness of the cutting layer, chip shaping,
- selected physical phenomena occurring in the cutting process (heat, diffusion, adhesion, friction),
- energy issues: cutting forces, power and moments,
- machinability of construction materials,
- tribological considerations in the tool operation process - wear, durability and reliability of tool wedges,
- processed surface and its geometric condition - characteristics of the surface layer and its role in modern technology,
- economics and optimization of the cutting process,
- modern technologies for subtractive manufacturing (HM, HSM, HPC, DM, MQL, etc.).

The laboratory consists of two series of exercises.

In the first series of exercises, students:

make machine elements on machine tools in the scope of various subtractive operations: turning, milling, drilling, reboring, counterboring, reaming and grinding.

In the second series of exercises, students will learn:

- 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.

Teaching methods

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

Bibliography

Basic:

Dul-Korzyńska B.: Obróbka skrawaniem i narzędzia. Oficyna Wydawnicza Politechniki Rzeszowskiej 2009.
 Praca zbiorowa pod red. Erbla J., Encyklopedia technik wytwarzania w przemyśle maszynowym. Tom II - obróbka skrawaniem, montaż. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2001.
 Filipowski R., Marciniak M., Techniki obróbki mechanicznej i erozyjnej. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2000.
 Praca zbiorowa pod red. Laber A., Wybrane zagadnienia z inżynierii wytwarzania. Obróbka ubytkowa. Oficyna Wydawnicza Uniwersytetu Zielonogórskiego, Zielona Góra 2008.
 Olszak W.: Obróbka skrawaniem. WNT Warszawa 2008.
 Wysiecki M.: Nowoczesne materiały narzędziowe WNT Warszawa 1997.
 Praca zbiorowa pod redakcją Żebrowskiego H., Techniki wytwarzania. Obróbka wiórowa, ścierna i erozyjna, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2004.

Additional:

Cichosz P.: Narzędzia skrawające. WNT Warszawa 2006.
 Praca zbiorowa pod red. Cichosza P., Techniki wytwarzania - obróbka ubytkowa. Laboratorium. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2002.
 Grzesik W.: Podstawy skrawania materiałów konstrukcyjnych, WNT Warszawa 2010.
 Jemielniak K.: Obróbka skrawaniem. Oficyna Wydawnicza Politechniki Warszawskiej - Warszawa 1998.
 Praca zbiorowa pod red. Kosmola J., Techniki wytwarzania, obróbka wiórowa i ścierna, Wydawnictwo Politechniki Śląskiej, Gliwice 2002.
 Shaw M.C.: Metal Cutting Principles. Oxford University Press, Oxford 1996.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00