POZNAN UNIVERSITY OF TECHNOLOGY

EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

COURSE DESCRIPTION CARD - SYLLABUS

Course name
Precision machining and surface engineering [S2MiBM2>OPiIP]

Course

Field of study
Mechanical Engineering

Year/Semester
1/2

Area of study (specialization)
Virtual Engineering Design

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge of physics, mathematics, methods and kinematics of cutting, cutting tools used and the construction of machine tools. Ability to operate simple technical devices and use information obtained from various sources.

Course objective

To learn about current trends in machining, with a particular focus on precision products. To prepare the student for the implementation of new technologies in the industry.

Course-related learning outcomes

Knowledge:
The student knows contemporary trends and directions of development in the field of machining.
The student knows the possibilities of erosion processing, including: the use of individual techniques, processing parameters and geometric and physical indicators of the surface layer.
The student has knowledge of the importance and techniques of cooling the cutting zone.

Skills:

The student can find information about new manufacturing processes in mechanical engineering, integrate acquired information, interpret it, draw conclusions and formulate and justify opinions about it.
The student is capable to develop an opinion regarding the product manufacturing technology.
The student can select modern machining to implement production processes, increase the efficiency of production systems through integration activities.
The student is able to make a preliminary economic analysis of the undertaken engineering activities, especially the impact of cooling technology on the direct unit costs of cutting. The student assesses the environmental cost of machining cooling technology.
Is able to design, apply and research modern technologies in production processes typical of mechanics and machine construction.
Able to work individually and in a team. Is able to use information and communication techniques appropriate to carry out tasks, communicate using various techniques in a team and environment in the field of mechanics and machine construction, and conduct a debate. Is able to manage the work of a team of people. Is able to determine directions for further learning and implement the self-education process and guide others in this area

Social competences:
The student correctly identifies and resolves dilemmas related to the profession within the scope of the subject.
The student acquires the ability to work in a team, formulate questions and generate ideas.
Understands the need for lifelong learning; can inspire and organize the learning process of other people. Is able to determine the importance of knowledge in solving cognitive and practical problems and to seek the opinion of experts in case of difficulties in solving the problem independently. Able to think and act in a creative and entrepreneurial way.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired during lectures is verified at the end of the semester in the form of an exam. Passing threshold: 50%.
The skills acquired in the laboratory are verified directly during classes by assessing the student's activity and ability to solve problems posed during the exercises. The ability to present and analyze the obtained results is checked in the form of individually prepared reports from individual exercises.
Grades: very good - if the ratio of sums of achieved and total points is bigger than 90,1%; good plus - if the ratio of sums of achieved and total points is between 80,1-90%; good - if the ratio of sums of achieved and total points is between 70,1-80%; satisfactory plus - if the ratio of sums of achieved and total points is between 60,1-70%; satisfactory - if the ratio of sums of achieved and total points is between 50,1-60%; if the sum is smaller than 50% - unsatisfactory.

Programme content

Scope of lecture:
- introduction to the classification and essence of individual manufacturing techniques,
- smoothing treatments: lapping, smoothing with loose abrasive, abrasive embossing, abrasive jet machining, brushing,
- burnishing of responsible surfaces on cutting machines,
- high-efficiency machining (High-Speed Machining, High-Performance Machining, High-Feed Machining),
- new cutting tools (multi-tasking, for high-performance 3D surface machining, for removing burrs after machining, etc.),
- new cooling/lubrication techniques for the cutting zone (Minimal Quantity Lubrication, Minimum Quantity Cooling Lubrication, Stream Cooling, High-Pressure Coolant),
- complete machining (examples of construction and new machining cycles of modern turning and milling centers enabling: milling, grinding, slotting, machining of gears and cams),
- micromachining (etching, lithography + etching, LIGA technique, EFAB technique, microstereolithography, micromachining, picosecond and femtosecond laser machining),
- the use of lasers in manufacturing techniques (cleaning, structuring, engraving, marking, cladding, drilling, cutting, selective sintering, etc.),
- combined and hybrid machining (machining by cutting and electroerosion with ultrasonic assistance

UAM i EDUM, LAM laser-assisted machining, electrochemical grinding ECG, and others),
- improvement of shape errors and dimensional accuracy using the wedge path correction method,
- differences between machining and erosion machining; classification of erosion manufacturing techniques,
- surface layer after erosion machining,
- parameters and technological indicators of various erosion methods,
- tool materials in electrical and electrochemical discharge machining,
- erosion-jet machining (water-jet and water-abrasive cutting; plasma cutting; laser cutting with oxidation, fusion and evaporation; laser hole drilling: single-pulse, multi-pulse, terpanation and spiral; laser and photochemical texturing; electron beam machining, laser hardening , laser surface cleaning),
- construction, properties and applications of various types of lasers,
- conventional (flood) methods of tool and cutting zone cooling,
- the influence of cooling technological parameters on tool life,
- MQL technologies; cooling with high-pressure media; cooling with gases and cryogenic machining,
- designs of tools and cooling systems,
- ecological aspects of the use of cooling and lubricating liquids.

The laboratory consists of exercises in which students: learn about various precision machining techniques and the influence of machining conditions on the geometric and physical properties of the surface layer.

Course topics

none

Teaching methods

Lecture: multimedia presentation illustrated with examples, animations and short films, discussion.
Laboratory: performing experiments, solving tasks, discussion, team work.

Bibliography

Basic:
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Additional:
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WORKING DRAFT ISO/WD Contact-free cutting - Water jet cutting - Geometrical product specification and quality.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
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)	38	1,50