COURSE DESCRIPTION CARD - SYLLABUS

Course name
Technological machines [S1MiBM2>MT]

Course

Field of study
Mechanical Engineering

Year/Semester
3/5

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
45

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
15

Number of credit points

7,00

Coordinators

Lecturers

Prerequisites

Basic knowledge of mechanical engineering, machine parts, technical drawing, mechanics and strength of materials, metalworking technology, drives and controls, electrical engineering, cutting tools; structured theoretical knowledge of the field of study; skills in using literature, acquiring knowledge from various sources (e-resources, internet; has the ability to work in a team; understands the need to broaden one's qualifications, readiness to solve technical problems independently.

Course objective

Students should acquire basic knowledge of the construction and operation of conventional and numerically controlled machine tools for metal and the fundamentals of their operation, knowledge of kinematic chains, forming systems, knowledge of main and feed drives, control systems, programming of machining, as well as the ability to operate selected machine tools, including numerically controlled ones. Developing students' self-education skills with elements of independent knowledge acquisition and developing technical interests.

Course-related learning outcomes

Knowledge:
The student has general knowledge of manufacturing technologies used mainly in enterprises of the mechanical industry and which refers to metallurgy and casting, plastic forming, plastics processing,

heat treatment, heat and chemical treatment, welding, swarf machining, grinding and eroding.
The student has detailed knowledge relating to fundamental and auxiliary processes in the construction of machines. Has knowledge allowing to design production flow (forms of production flow). Has knowledge indispensable for organizing the work of a production system depending on its type. Has knowledge indispensable for the assessment of the work of a production system. Has knowledge indispensable for developing a technological process of typical parts of machines. Has knowledge enabling to evaluate the capabilities of a given process. Knows systems of computer aided process design

Skills:
Drawing upon norms, procedures and instructions, can write a simple program for the operation of a numerical control machine tool.
Able to select and apply manufacturing technologies to shape the form, structure and properties of products.
Able to select technological machines and devices to realize products manufacturing processes, analyze and evaluate their construction taking into account the principles of ergonomics, select machine parts, plan and supervise maintenance tasks to ensure reliable operation of machines and devices.

Social competences:
Understand the need for lifelong learning; able to inspire and organize learning process of other people.
Able to cooperate and working in the group, taking different roles.
Is open to discussion of complex technical problems and is capable of communicating its knowledge in an understandable way.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: acquired knowledge is verified by examination. The examination consists of open or test questions. Pass mark in the case of correct answers to at least half of the questions (threshold 50%).
Laboratory classes: acquired knowledge and skills are verified on the basis of an oral or written answer concerning the content of each laboratory exercise performed. A prerequisite for passing the laboratory is the completion and passing of all exercises (attendance and positive evaluation of the answers).
Project: pass on the basis of an individual project.

Programme content

Lecture:
Division and comparison of conventional machine tools and NC machine tools. Machine tool drives. Characteristics of drives and electric motors. Universal machine tools. Unit-construction machines. Machining centers and machine tool lines. Gear generating machines. Electrical Discharge Machining machines.
Trends in the construction of CNC machine tools. Kinematic and geometrical structures, construction, functional assemblies, additional machine tools options. Errors in machine tools. Thermal deformation. Control systems, Industry 4.0, intelligent machine tools, collisions in machine tools. Selected aspects of machine tool design. Installation issues and service aspects. Ergonomics of use. Optimization of shape and rigidity of machine tools. Cost structure of machine tools. Division, principles and methods of programming CNC machine tools. Structure and construction of control systems and systems. Programming using special functions, subroutines and machining cycles.
Laboratory classes:
Preparing and machining of parts on a CNC lathe
Preparing and machining of parts on a CNC milling machine.
Thread cutting by machine on CNC machine tools
Measurement of clearance in the mechanical gearbox of the rotary axis of machine tool feed drive
Testing the efficiency of the mechanical transmission
Cutting the cylindrical gears on the milling machine
Basics of dialog programming in the Heidenhain control system
Servo drive simulation tests
Research on the dynamics of rotary table positioning in the range of small displacements
Electronic gear
Controllers in NC machine tools Design

Project:
Programming the machining of simple shapes
Programming machining using tool radius compensation
Programming of machining using machining cycles
Programming machining in the ShopMill system
Programming multi-stage shaft machining
Programming shaping machining in the ShopTurn system

Course topics

none

Teaching methods

Lecture: multimedia presentation, discussion.
Laboratory classes: independent performance of practical exercises in contact with machine tools, devices, materials, tools, apparatus, measuring instruments, discussion.

Bibliography

Basic:
Wrotny L. T., Obrabiarki skrawające do metali, WNT, Warszawa 1979.
Honczarenko J., Obrabiarki sterowane numerycznie, WNT , Warszawa 2009.
Kosmol J., Automatyzacja obrabiarek i obróbki skrawaniem, PWN, Warszawa, 2000.
Kosmol J., Serwonapędy obrabiarek sterowanych numerycznie, WNT Warszawa, 1998.
Singh N.: CNC programming and control, by John Wiley & sons, Inc. London, 1996.
Metody twórczego rozwiązywania problemów inżynierskich, Branowski B., Wyd. WKT NOT, 1999.
Podstawy Konstrukcji Maszyn (tom 2), pod red. Marka Dietrycha, PWN, Warszawa, 1999.
Podstawy konstrukcji maszyn, Zbigniew Osiński, PWN 2012.
Krzysztof Netter, Maszyny i urządzenia technologiczne w obróbce ubytkowej. Laboratorium, Wydawnictwo Politechniki Poznańskiej, Poznań 2021.

Additional:
Poradnik inżyniera mechanika. T.3. Zagadnienia technologiczne, rozdz. III, VI, VII. WNT, Warszawa 1970.
Kosmol J., Napędy mechatroniczne, WNT Warszawa, 2013.
Pritschow G., Technika sterowania obrabiarkami i robotami przemysłowymi. Oficyna Wydawnicza Politechniki Wrocławskiej, 1995.
Pająk E., Zaawansowane technologie współczesnych systemów produkcyjnych, Wydawnictwo Politechniki Poznańskiej, Poznań 2000.
Programowanie ISO Podręcznik użytkownika Heidenhain, 1994 (w języku polskim, angielskim i niemieckim).
Kief Hans B.: NC/CNC Handbuch, Carl Hanser, Verlag Munchen, 1998.
Skoczyński W., Sensory w obrabiarkach CNC, Wydawnictwo Naukowe PWN SA, Warszawa,2018.
Gessner A., Fotogrametria i skanowanie w technologii korpusów obrabiarkowych, WPP, 2015.
Gessner A.,Teoretyczne i doświadczalne podstawy doboru korpusów w zespoły obrabiarkowe, WPP 2016.

Breakdown of average student's workload

	Hours	ECTS
Total workload	175	7,00
Classes requiring direct contact with the teacher	92	3,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	83	3,50