BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS
FACULTY OF MECHANICAL ENGINEERING

SUBJECT DATASHEET

I. SUBJECT DESCRIPTION

1. GENERAL DATA

1.1. Subject name (in Hungarian, in English)

Metal-cutting machine tools and industrial robots • Metal-cutting machine tools and industrial robots

1.2. Neptun code

BMEGEGTBG61

1.3. Type

study unit with contact hours

1.4. Course types and number of hours (weekly / semester)

course type	number of hours (weekly)	nature (connected / stand-alone)
lecture (theory)	2	-
exercise	2	coupled
laboratory exercise	1	coupled

1.5. Type of assessments (quality evaluation)

exam

1.6. ECTS

6

1.7. Subject coordinator

name:	Németh István
post:	associate professor
contact:	nemeth.istvan@gpk.bme.hu

1.8. Host organization

Department of Manufacturing Science and Engineering (https://manuf.bme.hu/)

1.9. Course homepage

https://manuf.bme.hu/?page_id=517

1.10. Course language

hungarian

1.11. Primary curriculum type

mandatory

1.12. Direct prerequisites

Strong prerequisite:	BMEGEGTBG01
Weak prerequisite:	-
Parallel prerequisite:	-
Milestone prerequisite:	-
Excluding condition:	-

(the subject cannot be taken if you have previously completed any of the following subjects or groups of subjects)

2. AIMS AND ACHIEVEMENTS

2.1. Aim

The aim of the course is to acquaint students with the structure, structural elements, different types, technological and operational characteristics of modern metal-cutting machine tools and industrial robots, as well as the selection criteria of machine tools and robots, the basics of their design and structural units. Students can deepen their acquired theoretical knowledge through designing and laboratory exercises.

2.2. Learning outcomes

Competences that can be acquired by completing the course:

A. Knowledge

- He is aware of the motion system of the machine tools, their structural elements, the variations of the construction of the components on top of each other, the types of spindles and their main characteristics.
- Informed about the components of machine tools (sliding, rolling and hydrostatic lines; linear drives: ball spindle, linear motor, gear rack; rotary drives: worm gear, gear, torque motor; encoders, etc.).
- Knows the basics of pneumatic and hydraulic drives and their application in machine tools and industrial robots.
- He is aware of lathe-like machine tools (universal, mechanically program-controlled, CNC lathes and turning centers, turning cells), their technological characteristics, resp. with automated tool and workpiece supply solutions.
- He is aware of the different types, structural and technological characteristics of planers, chisels, drills, milling machines.
- He learned about CNC drilling and milling machining centers, milling cells, their technological features, and automated tool and workpiece supply solutions.
- He knows the principle of CNC integration, the electric drives of machine tools (basics of motors, servo control circuits).
- He is aware of the different types, structural and technological characteristics of grinding machines and EDM machines.
- He is familiar with machine tools for the production of cylindrical teeth.
- He is informed about the structure of different machine tools with parallel and hybrid kinematics and industrial robots with parallel kinematics, their different types, their advantages and disadvantages compared to machines with serial kinematics.
- He owns the application technical characteristics of industrial robots, the criteria system of robot selection.
- He is aware of robotic assembly systems, providing the conditions for assembly, overcoming obstacles in the assembly process, the types of peripherals serving the robotic assembly cell and their characteristics.
- It possesses the principles of on-site product design.
- He knows the types of welding robots, the implementation of welding technologies with special industrial robots, the criteria for the selection of robots, peripherals and devices.

B. Ability

- It interprets the motion system of the machine tools, their structural elements, the variations of the construction of the components on top of each other, the characteristics of the spindles.
- It selects the building blocks for servo drives (e.g., servomotor, ball screw, rolling line, bearings, clutches) and compiles a 3D model and assembly drawing of the drive system.
- Identifies pneumatic and hydraulic drives found in machine tools and industrial robots.
- It identifies CNC lathes, turning centers, turning cells, their structural and technological characteristics, and automated tool and workpiece supply solutions.
- Uses what has been learned about different types, structural and technological characteristics of planers, chisels, drills, milling machines.
- It identifies CNC drilling and milling machining centers, milling cells, their structural and technological features, and automated tool and workpiece supply solutions.
- He interprets the principle of CNC integration, what he has learned about the electric drives of machine tools.
- Uses what has been learned about the different types, structural and technological characteristics of grinding machines and EDM machines.
- He interprets what he has learned about machine tools for making cylindrical teeth.
- It uses what has been learned about the structure, different types, advantages and disadvantages of parallel and hybrid kinematic machine tools and parallel kinematic industrial robots.
- Use what you have learned about application techniques and robot selection in industrial robots.
- Creates the complete system work of a robotic assembly cell (eg selection of robot, pallet transport system, vibrating feeder).
- Able to redesign a product with a robotic assembly.
- Use what you have learned about the types of welding robots, the implementation of welding technologies with special industrial robots, the selection of robots, peripherals and devices.

C. Attitude

- It is open to collaboration with the instructor and fellow students as the knowledge expands.
- It expands your professional knowledge by constantly acquiring knowledge.
- Open to the use of information technology tools.
- It seeks to learn about and routinely use the system of tools needed to solve problems.
- It strives for an accurate and error-free solution.

D. Independence and responsibility

- She independently thinks through tasks and problems and solves them based on specific resources.
- Accepts well-founded professional and other critical remarks.
- In some situations, as part of a team, you work with your fellow students to solve tasks.
- With his knowledge, he makes a responsible, informed decision based on his analyzes.
- He feels responsible for the design and operation of machine tools and industrial robots.

2.3. Teaching methodology

The teaching of the subject consists of lectures, exercises and laboratory exercises. The lectures basically introduce students to the information defined by the knowledge competence elements using the technique of frontal education. The slide shows used in the lectures can be downloaded from the online interface of the subject. The practical sessions, in connection with the lectures, basically promote the application and skill-level acquisition of knowledge through two planning tasks. The topics of the laboratory exercises are also related to the lectures, during which the students apply

the acquired knowledge in practice.

2.4. Support materials

a) Textbooks

-

b) Lecture notes

-

c) Online materials

https://manuf.bme.hu/?page_id=517

2.5. Validity of the course description

Start of validity:	2023. September 1.
End of validity:	2028. July 15.

II. SUBJECT REQUIREMENT

3. ACHIEVEMENT CONTROL AND EVALUATION

3.1 General rules

The assessment of learning outcomes consists of two mid-year partial performance assessments and a year-end exam. The two partial performance assessments consist of two homework assignments made individually by the students. The exam asks for the knowledge of the lectures. The exam consists of two parts: a compulsory written part and an optional oral part. To obtain a signature and to be eligible for the exam, you must complete the two submitted design assignments, each corresponding to a performance of at least 40%, and complete all laboratory exercises.

3.2 Assessment methods

A. Detailed description of mid-term assessments

1. Mid-term assessment

type: formative assessment, simple

count: 1

purpose, description: A complex way of evaluating the knowledge, ability, attitude, and autonomy and responsibility type competence elements of the subject, the form of which is an individually designed design homework; the design task is the mechanical design of a servo drive. With the planning task you can get a minimum of 6 points and a maximum of 15 points, but it is also possible to get extra points. At least 40% completion of the task is required to obtain a signature. The result of the task is included in the result of the exam. The detailed content of the assignment, the requirements, the deadline for submission, and the method of assessment - which will be announced in the first class of the semester - are determined jointly by the person in charge of the subject and the instructors of the subject.

2. Mid-term assessment

type: formative assessment, simple

count: 1

purpose, description: A complex way of evaluating the knowledge, ability, attitude, and autonomy and responsibility type competence elements of the subject, the form of which is an individually designed design homework; the design task is to make a system plan for a robotic assembly cell. With the planning task you can get a minimum of 6 points and a maximum of 15 points, but it is also possible to get extra points. At least 40% completion of the task is required to obtain a signature. The result of the task is included in the result of the exam. The detailed content of the assignment, the requirements, the deadline for submission, and the method of assessment - which will be announced in the first class of the semester - are determined jointly by the person in charge of the subject and the instructors of the subject.

B. Detailed description of assessments performed during the examination period (if relevant)

Elements of the exam:

1. written partial exam

obligation: mandatory (partial) exam unit, failing the unit results in fail (1) exam result

description: The written part of the exam is mandatory. The written exam measures the level of learning of students determined by knowledge and ability type competencies. The written exam focuses in part on theoretical knowledge and in part on the application skills acquired during the exercises and laboratory exercises. A maximum of 70 points can be obtained in the written exam, and the exam results of students who perform below 40% (28 points) are insufficient. Examiners score 40% or more based on the written dissertation and the design assignments. To determine the recommended exam mark, a minimum of 2x6 = 12 points and a maximum of 2x15 = 30 points can be obtained from the two planning assignments (but it is also possible to earn extra points during the semester) and a minimum of 28 points and a maximum of 70 points can be obtained in the written exam.

2. oral partial exam

obligation: (partial) exam unit chosen by the student, the exam result assessed by other partial exam unit can be changed unrestrictedly

description: The oral part of the exam is not obligatory, the student can take an oral exam after obtaining the offered grade in the hope of getting a better result. The oral examination may cover both theoretical knowledge and the application skills acquired during the exercises or laboratory exercises. The oral exam can be not only corrective but also degrading. The student is given preparation time for the questions received in the oral exam, during which he / she can also take notes.

3. practical partial exam

obligation: does not apply

description:

4. inclusion of mid-term results

obligation: mandatory (partial) exam unit, but failing the unit does not results in fail (1) exam result

description: The exam grade includes the mid-year performance evaluation, ie the result of the two planning tasks. To determine the grade offered after the written exam, a minimum of 2x6 = 12 points and a maximum of 30 points can be obtained from the design assignments, to which is added the score obtained in the written exam (provided that the written exam was successful). As extra points can be earned with the design tasks, their value also increases the score that can be obtained in the exam.

3.3 The weight of mid-term assessments in signing or in final grading

identifier	**weight**
1 . Mid-term assessment	50 %
2 . Mid-term assessment	50 %

The condition for signing is that the score obtained in the mid-year assessments is at least **40%**.

3.4 The weight of partial exams in grade (if relevant)

type	**weight**
written partial exam	70 %
oral partial exam	70 %
practical partial exam	0 %
inclusion of mid-term results	30 %

3.5 Determination of the grade

grade ● [ECTS]	**the grade expressed in percents**
very good(5) ● Excellent [A]	above 91%
very good(5) ● Very Good [B]	86% .. 91%
good(4) ● Good [C]	71% .. 86%
satisfactory(3) ● Satisfactory [D]	56% .. 71%
sufficient(2) ● Pass [E]	40% .. 56%
insufficient(1) ● Fail [F]	below 40%

The lower limit specified for each grade already belongs to that grade.

3.6 Attendance and participation requirements

Must be present at at least **70%** (rounded down) of lectures.

At least **70%** the exercises (rounded down) must be actively attended.

At least **100% of** laboratory practices (rounded down) must be actively attended.

3.7 Special rules for improving, retaken and replacement

The special rules for improving, retaken and replacement shall be interpreted and applied in conjunction with the general rules of the CoS (TVSZ).

Can the submitted and accepted partial performance assessments be resubmitted until the end of the replacement period in order to achieve better results?

yes

Taking into account the previous result in case of improvement, retaken-improvement:

new result overrides previous result

The way of retaking or improving a partial assessment for the first time:

partial assesment(s) in this group can be improved or repeated once up to the end of the repeat period

Completion of unfinished laboratory exercises:

missed laboratory practices must be performed in the teaching term at pre-arranged appointment

Repetition of laboratory exercises that performed incorrectly (eg.: mistake in documentation):

incorrectly performed laboratory practice (e.g. Incomplete/incorrect report) can be corrected upon improved re-submission

3.8 Study work required to complete the course

Activity	**hours / semester**
participation in contact classes	70
mid-term preparation for practices	14
preparation for laboratory practices	14
elaboration of a partial assessment task	8
exam preparation	42
additional time required to complete the subject	32
summary	**180**

3.9. Validity of subject requirements

Start of validity:	2023. September 1.
End of validity:	2028. July 15.

4. ADDITIONAL INFORMATION

4.1 Primary course

The primary (main) course of the subject in which it is advertised and to which the competencies are related:

Mechanical engineering

4.2 Link to the purpose and (special) compensations of the Regulation KKK

This course aims to improve the following competencies defined in the Regulation KKK>

a) knowledge

- Student is familiar with the general and specific mathematical, scientific and social principles, rules, contexts and procedures needed to operate in the field of engineering.

b) ability

- Student has the ability to approach and solve specific problems within student's field of specialisation in a multi-disciplinary and interdisciplinary manner.

c) attitude

- Student is open and receptive to learning, embracing and authentically communicating professional, technological development and innovation in engineering.

d) independence and responsibility

- Student has the ability to work independently on engineering tasks.

4.3 Prerequisites for completing the course

Knowledge type competencies	
(a set of prior knowledge, the existence of which is not obligatory, but greatly facilitates the successful completion of the subject)	-

Ability type competencies	
(a set of prior abilities and skills, the existence of which is not obligatory, but greatly contributes to the successful completion of the subject)	-