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)

Mechatronics (comprehensive examination) ● Mechatronics (comprehensive examination)

1.2. Neptun code

BMEGEMIBMMS

1.3. Type

study unit without contact hours (criteria unit)

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

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

1.5. Type of assessments (quality evaluation)

comprehensive exam

1.6. ECTS

0

1.7. Subject coordinator

name:	Dr. Budai Csaba
post:	adjunct
contact:	budai@mogi.bme.hu

1.8. Host organization

Department of Mechatronics, Optics and Mechanical Engineering Informatics (https://www.mogi.bme.hu)

1.9. Course homepage

https://www.mogi.bme.hu/tantargyak/BMEGEMIBMMS

1.10. Course language

hungarian

1.11. Primary curriculum type

mandatory criteria

1.12. Direct prerequisites

Strong prerequisite:	BMEGEMIBMOO
Weak prerequisite:	-
Parallel prerequisite:	BMEGEMIBMMH
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 purpose of the non-credit type criterion requirement, which appears as a subject, is to assess and evaluate the student's knowledge and ability type competence. In the Mechatronics exam, the knowledge acquired in the second semester Modern tools in informatics (BMEGEMIBMCP), the third-semester Software tools of modeling and data acquisition (BMEGEMIBMMM), and the fourth-semester Mechatronics (BMEGEMIBMME) are taken into account.

2.2. Learning outcomes

Competences that can be acquired by completing the course:

A. Knowledge

- Is familiar with the following: algorithm creation, data models, basics of computer science, structure and operation of computers and peripherals, basic software, networks, computer graphics, spatial modeling, visualization, image processing.
- Knows the structures, the structure, and definition of object classes, how to specify data members and member functions, the constructor, the creation of static and dynamic objects, static data members, and member functions.
- Understands inheritance methods, access control, friend functions, operator overload, class and class hierarchy definition, early and late binding, reference classes, class templates, and standard library.
- Knows modeling and approximation methods, data storage and grouping, data cleaning and filtering, optimal search, graphical display (tools, mathematical background).
- Understands the principle of operation, applying the graphical programming environment symbolic and numerical calculation programs, programming of the LabVIEW system and its connection to external programs, software, and hardware resources.
- Identifies the basic methods used to solve numerical analysis simulation problems.
- Recalls the concepts and formal methods introduced in the first-semester course Introduction to mechatronics.
- Knows the methods of mathematically describing finite-dimensional dynamical systems, the classical control theory equations of SISO linear time-invariant systems, the state-space model of LTI systems, the graphical mappings of complex mechatronic systems.
- Is aware of the concepts of continuous-time impulse and step response, time domain convolution, Fourier and Laplace transform, solution of LTI systems in state-space, and with Laplace transform, the frequency response and transfer functions.
- Covers the spectra of periodic and general signals, the representations of the frequency response function, the properties of basic and complex systems, and analog filters' structure.

B. Ability

- Can create and manage a project in the Visual Studio environment, with headers, conditional compilation options, advanced function parameterization, function overload, generalized functions.
- Creates class definitions with constructors, destructors, data members, and member functions, striving to create and design reusable code using derived classes.

- Applies virtual member functions, generalized (template) classes, using the standard library's storage elements efficiently, to independently develop unique, goal-oriented windowed applications for solving technical problems.
- Can implement modeling and approximation methods by applying data storage methods, grouping the stored data in terms of use, filtering the data, using optimal search methods.
- Uses the graphical user interface, the introduced numerical and symbolic software, the programmed display of plane graphics.
- Uses LabVIEW to solve programming and measurement data acquisition tasks.
- Can graphically map complex mechatronic systems, solving linearly independent node and loop equations, transfer functions, state-space models in time, frequency, and operator domains.
- Graphically analyzes the operation of complex mechatronic systems in the frequency domain, using the appropriate rule in the Laplace transformed domain, calculating the continuous-time impulse and step response.
- Solves complex, computationally intensive mechatronic tasks using his/her IT knowledge.
- Expresses thoughts in an orderly form orally and in writing, applying the acquired knowledge in solving his/her tasks.

C. Attitude

- Initiates collaboration to expand knowledge.
- Expands his/her knowledge by continuous learning and orientation.
- Is open to the use of state-of-the-art information technology tools.
- Seeks to learn about and routinely use IT and mechatronic tools needed for solving mechatronic problems.
- Strives for accurate and error-free problem solving during his/her studies.

D. Independence and responsibility

- Performs the steps required to solve mechatronic tasks independently using only authorized resources.
- Accepts well-founded critical remarks and acts accordingly.
- Supports the systems approach in solving his/her tasks.
- Conscientiously checks his/her preparedness, work, and task solutions.
- Feels responsible for using resource efficient methods.

2.3. Teaching methodology

2.4. Support materials

a) Textbooks

-

b) Lecture notes

Modern tools in informatics (BMEGEMIBMCP) course material. 2020

Software tools of modeling and data acquisition (BMEGEMIBMMM) course material. 2020

Mechatronics (BMEGEMIBMME) coursematerial. 2020

c) Online materials

https://www.mogi.bme.hu/tantargyak/BMEGEMIBMMS

2.5. Validity of the course description

Start of validity:	2022. May 15.
End of validity:	2026. July 15.

II. SUBJECT REQUIREMENT

3. ACHIEVEMENT CONTROL AND EVALUATION

3.1 General rules

The student is entitled to pass the comprehensive examination if he/she has completed all the subjects given as a strong prerequisite. Subjects are given as a strong prerequisite, and the examination can be taken in the same semester. The Mechatronics comprehensive exam consists of a written and oral part composed of the following three courses: Modern tools in informatics, Software tools of modeling and data acquisition, and Mechatronics.

3.2 Assessment methods

A. Detailed description of mid-term assessments

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

Elements of the exam:

1. written partial exam

   obligation: does not apply

   description: Written performance partial exam requires the entire curriculum to be taken into account, 25% theoretical knowledge, 75% practical (computational) knowledge. Theoretical questions basically consist of simpler, short-answer questions. In practical problems, the task is to simplify and solve the complex problem by following theoretical principles and numerically and develop a solution strategy.

2. oral partial exam

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

   description: The oral part of the comprehensive exam measures and evaluates synthesized knowledge of the following three courses: Modern tools in informatics, Software tools of modeling and data acquisition, and Mechatronics.

3. practical partial exam

   -

4. inclusion of mid-term results

   -

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

identifier	**weight**

The condition for signing is that the score obtained in the mid-year assessments is at least **0%**.

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

type	**weight**
written partial exam	0 %
oral partial exam	100 %
practical partial exam	0 %
inclusion of mid-term results	0 %

3.5 Determination of the grade

grade • [ECTS]	the grade expressed in percents
very good(5) • Excellent [A]	above 90%
very good(5) • Very Good [B]	85% .. 90%
good(4) • Good [C]	70% .. 85%
satisfactory(3) • Satisfactory [D]	55% .. 70%
sufficient(2) • Pass [E]	40% .. 55%
insufficient(1) • Fail [F]	below 40%

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

3.6 Attendance and participation requirements

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).

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

new result overrides previous result

3.8 Study work required to complete the course

Activity	hours / semester
summary	**0**

3.9. Validity of subject requirements

Start of validity: 2023. February 1.

End of validity: 2026. 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:

Mechatronics 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 has the knowledge and application in context of the scientific and technical theories and causal relationships relevant to the profession of mechatronics engineer.
- Student has the knowledge of information and communication technologies relevant to the field.
- Student has the knowledge of the tools and methods for mathematical modelling and computer simulation of integrated mechanical, electrical and control systems in the various fields of mechatronics.

b) ability

- Student has the ability to design complex mechatronic systems globally, based on a systems- and process-oriented, theoretically sound way of thinking.

- Student has the ability to be creative in problem solving and flexible in complex tasks, as well as a lifelong learner, committed to diversity and value-based approaches.
- Student has the ability to apply student's comprehensive theoretical knowledge in practice in the field of equipment, processes and systems that integrate mechanics synergistically with electronics, electrical engineering and computer control.

c) attitude

- Student strives to carry out their work in a complex approach based on a systems and process-oriented mindset.
- Student strives to develop professional competences.
- Student is committed to high quality work and strives to communicate this approach to student's colleagues.

d) independence and responsibility

- Student shares gained knowledge and experience with those working in the field through formal, non-formal and informal information transfer.
- Student takes an independent and proactive approach to solving professional problems.

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)	-