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)

Materials engineering • Materials engineering

1.2. Neptun code

BMEGEMTBMA1

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	-	-
laboratory exercise	1	coupled

1.5. Type of assessments (quality evaluation)

exam

1.6. ECTS

4

1.7. Subject coordinator

name:	Dr. Mészáros István Attila (71956336901)
post:	university professor
contact:	meszaros@eik.bme.hu

1.8. Host organization

Department of Material Science and Engineering (http://www.att.bme.hu/)

1.9. Course homepage

http://www.att.bme.hu/oktatas/BMEGEMTBMA1

1.10. Course language

hungarian

1.11. Primary curriculum type

mandatory

1.12. Direct prerequisites

Strong prerequisite: -

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 main objective of the subject is to describe the structural properties of metallic structural materials, magnetic materials, conductive, semiconductor and insulating materials used in mechatronic engineering practice, and to review the methods for changing the properties. In connection with the subject, the basic technological procedures and the failure processes of structural materials are described, as well as the basic material testing procedures.

2.2. Learning outcomes

Competences that can be acquired by completing the course:

A. Knowledge

- The student knows the role of metals and alloys in mechatronic practice.
- The student knows the chemical bonds, the structure of ideal crystals and crystallic calculations.
- The student understands the characteristics of a real crystal, lattice defects, the mechanism of plastic deformation, the plastic deformation of single crystal and polycrystalline, the recrystallization process.
- The student understands the thermal behavior of metals and alloys, the cooling curve, state diagrams, and the handling of state diagrams.
- The student understands the state diagram of iron-carbon, the equilibrium and non-equilibrium transformations of iron alloys, the basics of heat treatment, the methods of increasing strength.
- The student understands the meaning of stress and strain characteristics and tensile testing.
- The student describes the fatigue, fracture, creep processes, the effect of alloys on the properties of steels, the grouping of steels, the hardenability, the hardenability and the heat treatment of different steel types.
- The students are familiar with the methodology and principles of material and technology selection.
- The student understands the basic concepts of plastic forming, plastic forming methods, their characteristics and their application.
- The student includes non-ferrous and light metals, ceramics and composites.
- The student is aware of the electrical conduction properties and characteristics of metallic materials, semiconductors and insulators.
- The student was informed about the basics of the magnetic behavior of materials, the basic magnetic properties.
- The student describes the most important soft and hard magnetic materials used in mechatronic practice.

B. Ability

- The student interprets the role of metals and alloys in mechatronic practice.
- The student analyzes chemical bonds, the structure of ideal crystals, and crystallographic calculations.
- The student uses the characteristics of the crystal, lattice defects, the mechanism of plastic deformation, the plastic deformation of single crystal and polycrystalline, the recrystallization process.
- The student uses the thermal behavior of metals and alloys, the cooling curve, the state diagrams.
- The student handles the state diagram of iron-carbon, the equilibrium and non-equilibrium transformations of iron alloys, the basics of heat treatment, and the methods of increasing strength.

- The student analyzes the meaning of stress and strain characteristics and tensile testing.
- The student examines the fatigue, fracture, creep processes, the effect of alloys on the properties of steels, the grouping of steels, the hardenability, the hardenability and the heat treatment of different steel types.
- The student makes a proposal to choose the material and technology needed to manufacture the products.
- The student manages the basic concepts of plastic forming, plastic forming procedures.
- The student separates iron-based alloys, non-ferrous and light metals, ceramics and composites.
- The student distinguishes between the electrical conductivity properties of metallic materials, semiconductors and insulators.
- The student evaluates materials magnetic for basic magnetic properties.
- The student ranks the most important soft and hard magnetic materials used in mechatronic practice.

C. Attitude

- The student constantly monitors its work, results and conclusions.
- The student expands its knowledge about magnetic materials and insulators through continuous acquisition of knowledge.
- The student is open to the use of information technology tools.
- The student seeks to become familiar with and routinely use the equipment required to perform material testing measurements.
- The student develops your ability to provide accurate and error-free problem solving, engineering precision and accuracy.
- The student publishes its opinions and views without offending others.

D. Independence and responsibility

- The student collaborates with the instructor and fellow students to expand knowledge.
- The student accepts well-founded professional and other critical remarks.
- In some situations, as part of a team, the student works with fellow students to solve tasks.
- With his knowledge, he makes a responsible, informed decision based on his analyzes.
- The student is committed to the principles and methods of systematic thinking and problem solving.

2.3. Teaching methodology

The subject is taught in the form of lectures and laboratory exercises. The lectures basically introduce the competence elements of knowledge to the students using the technique of frontal education. The lectures review the advanced materials of mechatronic applications, their technology and research possibilities. The lectures are complementary to the available written study materials, and individually they are not sufficient to achieve adequate preparation.

2.4. Support materials

a) Textbooks

István Mészáros: Materials Science (digital textbook) Akadémiai Kiadó, 2019. ISBN: 978 963 05 9956 6

Ginsztler-Hidasi-Dévényi: Applied Materials Science, University Textbook, Technical University Publishing House 2000. (ISBN 963 420 611)

BD Cullity, CD Graham: Introduction to magnetic materials, 2009, ISBN 978-0-471-47741-9

b) Lecture notes

-

c) Online materials

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2.5. Validity of the course description

Start of validity:	2021. April 26.
End of validity:	2026. April 26.

II. SUBJECT REQUIREMENT

3. ACHIEVEMENT CONTROL AND EVALUATION

3.1 General rules

Learning outcomes are assessed on the basis of a year-end written performance measurement (exam). To pass the exam, you must achieve at least 40% of the points. On the one hand, the exam asks for the necessary lexical knowledge, and on the other hand, it focuses on the application of the acquired knowledge, thus focusing on problem recognition and solution. During the performance evaluation, the candidate must apply the knowledge acquired during the laboratory exercises.

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

   description: Learning outcomes are assessed on the basis of a year-end written performance measurement (exam). To pass the exam, you must achieve at least 40% of the points. On the one hand, the exam asks for the necessary lexical knowledge, and on the other hand, it focuses on the application of the acquired knowledge, thus focusing on problem recognition and solution. During the performance evaluation, a specific problem related to its mechatronic applications must be solved or make suggestions for solutions.

2. oral partial exam

   -

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 **40%**.

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

type	weight
written partial exam	100 %
oral partial exam	0 %
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 85%
very good(5) ● Very Good [B]	85% .. 85%
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

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

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).

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

new result overrides previous result

Completion of unfinished laboratory exercises:

missed laboratory practices must be performed in the repeat period

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	42
preparation for laboratory practices	14
exam preparation	28
additional time required to complete the subject	36
summary	**120**

3.9. Validity of subject requirements

Start of validity: 2021. April 26.

End of validity: 2024. April 26.

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 of the main properties and applications of mechanical and electrical materials used in mechatronics.

b) ability

- Student has the ability to develop independently the theoretical knowledge and to apply new theory to the practical solution of complex mechatronic design problems of an unconventional nature.

c) attitude

- Student strives to develop professional competences.

d) independence and responsibility

- Student takes the initiative in solving technical 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)	-