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)

Fundamentals of cyberphysical system informatics ● Fundamentals of cyber-physical system informatics

1.2. Neptun code

BMEGEMIBMKI

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)	1	-
exercise	-	-
laboratory exercise	1	coupled

1.5. Type of assessments (quality evaluation)

mid-term grade

1.6. ECTS

3

1.7. Subject coordinator

name:	Dr. Fekete Róbert Tamás
post:	adjunct
contact:	frt@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/BMEGEMIBMKI

1.10. Course language

hungarian

1.11. Primary curriculum type

mandatory

1.12. Direct prerequisites

Strong prerequisite:	BMEGEMIBMGP, BMEGEMIBMAB, BMEGEMIBMMM
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

Within the course, students get acquainted with the following topics: Architecture of Cyberphysical Systems, Spatial Environments (VR / AR / MR) and their role; Basic concepts of 3D visualization; spatial transformations; Using and programming the MAXWHERE VR environment; Creation of 3D content; CAD content management; Development of MAXWHERE extensions; Manipulation of spatial elements; Interaction management; Interactions via web interfaces; Runtime manipulation of 3D models; Digital twin concept.

2.2. Learning outcomes

Competences that can be acquired by completing the course:

A. Knowledge

- Knowing the basics of the architecture of cyberphysical systems.
- Being informed in 3D visualization and the basics of computer graphics.
- Being familiar with the topic of 3D transformations, in the transition between coordinate systems.
- Knowing how to use and program the MAXWHERE environment at a basic level.
- Beeing aware of creating and inserting 3D content into virtual spaces.
- Being Familiar yourself with managing CAD content.
- Being informed about the development of MAXWHERE extensions and components.
- Understanding the basics of manipulating Nodes.
- Understanding the basics of interactions through web interfaces.
- Understanding the basic knowledge of the concept of a digital twin pair.

B. Ability

- Having the ability to apply the basics of cyberphysical systems in real situations.
- Having the ability to apply 3D visualization and computer graphics elements to solve real problems.
- Being capable of 3D transformations, transition between coordinate systems in your calculations.
- Applying your knowledge of using the MAXWHERE environment to solve real-world problems.
- Applying the knowledge of 3D content creation to problem solving.
- Performing CAD content management tasks during task resolution.
- Developing MAXWHERE extensions and components independently.
- Performing manipulations associated with Nodes during task solving.
- Managing interactions through web interfaces.
- Applying the basic knowledge of the concept of a digital twin pair.

C. Attitude

- Having the receptivity to expanding knowledge with the instructor and fellow students.
- With the help of available resources, striving for the continuous expansion of knowledge.
- Being open to the use of database-related information technology tools.
- Seeking to learn about and routinely use the tools needed to resolve storage access issues.

- Striving for an accurate and error-free solution.

D. Independence and responsibility

- Independently thinking through data warehousing IT tasks and problems and solving them based on specific resources.
- Accepting well-founded critical remarks and acting accordingly.
- In some situations, as part of a team, collaborating with fellow students to solve tasks.
- In own mindset, making a decision according to a systematic approach.
- Feeling a responsibility to use resource efficient methods.

2.3. Teaching methodology

The course relies on the tradition of frontal education in the form of lectures and laboratory exercises. In addition, communication takes place in writing and in person, using IT tools and techniques, during consultations. The instructors make possible to perform optional tasks prepared independently and in group work, during which the acquired knowledge is better recorded and they also gain insight into work organization techniques.

2.4. Support materials

a) Textbooks

-

b) Lecture notes

-

c) Online materials

https://cg.iit.bme.hu/~szirmay/grafika/graf.pdf

https://unity3d.com/

https://www.oculus.com/

2.5. Validity of the course description

Start of validity:	2022. September 1.
End of validity:	2027. July 15.

II. SUBJECT REQUIREMENT

3. ACHIEVEMENT CONTROL AND EVALUATION

3.1 General rules

Assessment of learning outcomes is based on a mid-year written performance appraisal and an independent assignment. In written examinations, only the topics defined by the instructor are taken into account, and the use of aids defined by the instructor is allowed. During this performance assessment, students are examined for the knowledge and ability competences acquired during the semester. During the independent task, students are tested for their competencies in independence and attitude, as well as their task organization skills.

3.2 Assessment methods

A. Detailed description of mid-term assessments

1. Mid-term assessment

type: summative assessment

count: 1

purpose, description: The summary academic performance evaluation is a complex, written way of evaluating the knowledge and ability type competence elements of the subject in the form of a closed assessment, the assessment basically focuses on the application of the acquired knowledge, the part of the curriculum on which the assessment is based is determined by the lecturer of the subject.

2. Mid-term assessment

type: formative assessment, project-based, complex

count: 1

purpose, description: The basic aim of partial performance assessment is to examine the existence of learning outcomes belonging to the attitude and autonomy and responsibility competence group. The way to do this is to complete and document a project issued by the instructor during the semester. In solving the task, students must apply what they have learned during the course in the practice. The completed assignment is presented to students at the end of the semester.

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

Elements of the exam:

1. written partial exam
   -
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
1 . Mid-term assessment	60 %

2 . Mid-term assessment	40 %

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

type	**weight**
written partial exam	0 %
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 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

Must be present at at least **0%** (rounded down) of lectures.

At least **80% 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).

Need mid-term assessment to individually complete?

yes

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

yes

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

each summative assessment can be retaken or improved

Is the retaking-improving of a summary assessment allowed, and if so, than which form:

one single, combined retake or grade-improving exam is possible for all assesments

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 may be performed in the teaching term at pre-arranged appointment, non-mandatory

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	28
preparation for laboratory practices	14
preparation for summary assessments	16
elaboration of a partial assessment task	30
additional time required to complete the subject	2
summary	**90**

3.9. Validity of subject requirements

Start of validity: 2022. September 1.

End of validity: 2027. 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 acquired a theoretically sound, systems-oriented and practice-oriented engineering mindset.

b) ability

- Student has the ability to process and organise information collected during the operation of mechatronic systems and processes, to analyse it in different ways and to draw theoretical and practical conclusions.
- Student has the ability to design complex mechatronic systems globally, based on a systems- and process-oriented, theoretically sound way of thinking.

c) attitude

- Student strives to carry out their work in a complex approach based on a systems and process-oriented mindset.
- 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 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)	-