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)

Modelling of Mechanical Engineering Systems • Modelling of Mechanical Engineering Systems

1.2. Neptun code

BMEGEÁTNG32

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	1	coupled
laboratory exercise	-	-

1.5. Type of assessments (quality evaluation)

mid-term grade

1.6. ECTS

3

1.7. Subject coordinator

name:	Dr. Szente Viktor Gyula (71958279813)
post:	adjunct
contact:	szente@ara.bme.hu

1.8. Host organization

Department of Fluid Mechanics (http://www.ara.bme.hu/)

1.9. Course homepage

http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATNG32

1.10. Course language

hungarian

1.11. Primary curriculum type

mandatory elective

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 aim of the course is to acquaint the students with the basics of numerical modeling of complex mechanical systems that may include mechanical, hydraulic, pneumatic, thermal and electric subsystems. Students will learn about the general and subsystem-specific factors that influence the end result of numerical modeling. The course guides the student through the steps of performing numerical modeling and evaluating the results.

2.2. Learning outcomes

Competences that can be acquired by completing the course:

A. Knowledge

- Has adequate theoretical and practical training as well as methodological knowledge for the design, manufacture, modeling, operation and management of complex mechanical systems and processes.
- Becomes familiar with general concepts used in system modeling.
- Organizes system simulation procedures according to different aspects.
- Understands the advantages and disadvantages of various system simulation methods, application limitations.
- Understands the types, categorization and search methods of system components with different physics.
- Has a comprehensive knowledge on the characteristics of fluids that can be used in hydraulic and in pneumatic system components, their modeling principles, and limitations of applicability.
- Informed about the structure of basic mechanical, control engineering, hydraulic and pneumatic system components, their operating and modeling principles.
- Familiar with various methods of evaluating the results of system simulation, including the possibilities of 2D and 3D animation.
- Familiar with modern experimental and numerical modeling techniques.
- Knows the modeling of transient processes of machines and mechanical systems, the analysis of the processes.

B. Ability

- Selects a modeling method suitable for modeling the given system.
- Able to select the appropriate material modeling method and the associated standard taking into account the material, geometry, etc.
- Able to rank material modeling methods by taking into account the system simulation behavior, flow characteristics, and numerical errors.
- Explores the factors that influence the definition of a given system feature.
- Selects the components needed to generate the system simulation model.
- Interprets the geometrical, physical, etc. parameters, variables, their relationships in the description of system components.
- Creates the system model needed to perform the system simulation.
- Able to evaluate the results of the simulation and determine system characteristics from it.
- Independently applies modern experimental and numerical modeling techniques.

- Evaluates the modeling of transient processes of machines and mechanical systems, the analysis of processes.

C. Attitude

- Constantly monitors the progress, results and conclusions.
- Expands the knowledge of system modeling by continuously acquiring knowledge.
- Open to the use of information technology tools.
- Seeks to learn about and routinely use the toolkit required for system modeling.
- Develops ability to provide accurate and error-free problem solving, engineering precision and accuracy.
- Strives to get to know the observable phenomena as thoroughly as possible, to describe and explain their laws by applying the acquired modeling knowledge.
- Seeks to carry out the work in a complex approach based on a systems-based and process-oriented mindset.

D. Independence and responsibility

- Collaborates with the instructor and fellow students to expand knowledge.
- Accepts well-founded professional and other critical remarks.
- Makes a responsible, well-founded decision based on the analyses, using the acquired knowledge,
- Carries out activities in the field of mechanical engineering modeling with a high degree of independence and responsibility.
- Committed to the principles and methods of systematic thinking and problem solving.

2.3. Teaching methodology

The teaching of the subject consists of lectures and laboratory practices. The lectures basically introduce the students to the information determined by the knowledge competence elements using the technique of frontal education. The application and skill-level acquisition of knowledge takes place in laboratory practices, where the problems must be modeled on the basis of the available documentation. The results of the system simulation model should be gradually analyzed using increasingly advanced evaluation methods.

2.4. Support materials

a) Textbooks

Tamás Lajos: The basics of fluid dynamics. (2015) ISBN: 9789631228854

b) Lecture notes

Viktor Szente: Modeling of mechanical systems. Subject guide, 2018.

c) Online materials

http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATNG32

2.5. Validity of the course description

Start of validity:	2020. March 3.
End of validity:	2024. August 31.

II. SUBJECT REQUIREMENT

3. ACHIEVEMENT CONTROL AND EVALUATION

3.1 General rules

Learning outcomes are assessed on the basis of a mid-year written summary performance measurement as well as a partial performance measurement. Summative academic performance appraisal is a complex, written way of assessing the knowledge and ability type competence elements of a subject in the form of an in-house test, which requires the necessary lexical knowledge to be taken into account during performance appraisal. Partial performance evaluation (system modeling task): a complex way of evaluating the knowledge, ability, attitude, independence and responsibility type competence elements of the subject, the form of which is the independently prepared system simulation model and its evaluation.

3.2 Assessment methods

A. Detailed description of mid-term assessments

1. Mid-term assessment

type: summative assessment

count: 1

purpose, description: Summative assessments collectively examine and assess students' learning outcomes defined by knowledge and ability type competencies. Accordingly, each summative assessment assesses the extent to which the designated theoretical knowledge has been acquired, the existence of knowledge gained in practice, and the application of skills. Each summative assessment focuses 65% on theoretical knowledge and 35% on application skills. It will be completed on the date specified in the academic performance evaluation plan, expected to be in the 13th week of education. Up to 50 points can be earned with this task. A minimum of 40% is to be achieved.

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 evaluate a system modeling task that will be created independently. The content and form requirements and evaluation principles of the prepared system modeling task will be included in the task description. It will be completed on the date specified in the study performance assessment plan, expected to be in the 14th week of education. Up to 50 points can be earned with this task. A minimum of 40% is to be achieved.

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	50 %
2 . Mid-term assessment	50 %

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 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 **70%** the exercises (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:

retake or grade-improving exam not possible

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

3.8 Study work required to complete the course

Activity	**hours / semester**
participation in contact classes	28
mid-term preparation for practices	7
preparation for summary assessments	16
elaboration of a partial assessment task	30
additional time required to complete the subject	9
summary	**90**

3.9. Validity of subject requirements

Start of validity: 2020. March 3.

End of validity: 2024. August 31.

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.
- Student has the knowledge and understanding of computer modelling and simulation tools and methods relevant to the field of engineering.
- Student has the detailed knowledge of the rules for the preparation of technical documentation.

b) ability

- Student has the ability to apply the general and specific mathematical, scientific and social principles, rules, relationships and procedures acquired in solving problems in the field of engineering.
- Student has the ability to apply the theories and related terminology in an innovative way when solving problems in a given field of engineering.
- Student has the ability to deal with problems creatively, to solve complex problems in a flexible way, and to engage in lifelong learning and commitment to diversity and value-based approaches.

c) attitude

- Student strives to meet and enforce quality standards.
- Student strives to plan and carry out tasks to a high professional standard, either independently or in a team.
- 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.

- Student takes initiative in solving technical problems.
- Student takes responsibility for the sub-processes under student's management.

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)	-