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)

Dynamic simulation of energy engineering systems • Dynamic simulation of energy engineering systems

1.2. Neptun code

BMEGEENNWSE

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	-	-

1.5. Type of assessments (quality evaluation)

mid-term grade

1.6. ECTS

3

1.7. Subject coordinator

name:	Dr. Szücs Mátyás
post:	adjunct
contact:	szucsmatyas@energia.bme.hu

1.8. Host organization

Department of Energy Engineering (http://www.energia.bme.hu/)

1.9. Course homepage

https://edu.gpk.bme.hu/

1.10. Course language

english

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 students with the systematic process of building a complete (dynamic and steady state) concentrated parameter model. It introduces the Matlab / Simulink interactive modeling and simulation environment as a tool for performing specific (concentrated, instational) tasks. Case studies are also presented: construction and simulation of selected simple and complex energy processes. Each student of the subject selects an energetic (sub) system and designs its modeling process in the form of an independent task - with or without an integrated control system.

2.2. Learning outcomes

Competences that can be acquired by completing the course:

A. Knowledge

- The student has a comprehensive knowledge of the most important dynamic modeling tasks in energy.
- Within this, the student has an overview of the modeling tasks and conventional solutions of conventional and renewable energy production units.
- Knows the steps of the systematic process of dynamic, concentrated parameter modeling.
- The student knows the concept of the equation of state in different cases as well.
- The student also knows the concept of the creative equation in different cases.
- The student has a basic knowledge of energetically important instational tasks.
- The student is aware of energy dynamics modeling tasks and tools.
- Understands the concepts and tools related to basic dynamic modeling.
- The student is familiar with the basic possibilities and goals of dynamic modeling and simulation of energy systems.
- He is aware of the most important concepts and categorizations used in energy dynamics modeling and simulation.

B. Ability

- Apply your well-known and widely used modeling system for the given energy system.
- Apply modeling tasks for conventional and renewable power generation units.
- Apply the basics of concentrated parameter modeling.
- The student also handles the concept of the equation of state in different cases.
- The student also calculates the concept of the forming equation in different cases.
- Use your knowledge of energy dynamics modeling tasks.
- Evaluates energy modeling tasks and tools.
- Develops basic modeling concepts and tools.
- Use the dynamic modeling toolkit of energy systems.
- Describes key concepts and categories used in energy and energy management.

C. Attitude

- The student constantly monitors his work, results and conclusions.
- The student expands your knowledge of energy process control by continuously acquiring knowledge.
- Open to the use of information technology tools.
- The student seeks to learn about and use the tools needed to solve energy regulatory problems.
- The student develops your ability to provide accurate and error-free problem solving, engineering precision and accuracy.

D. Independence and responsibility

- Collaborates with the instructor and fellow students to expand knowledge.
- Accepts well-founded professional and other critical remarks.
- 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.
- Accepts and incorporates well-founded professional and other critical comments.

2.3. Teaching methodology

The lectures basically introduce students to the information defined by the knowledge competence elements using the technique of frontal education. Lectures include pre-published materials so students can add their own notes to the lecture. The lectures are complementary to the main (on-line) written study materials, and are not sufficient to achieve adequate preparation.

2.4. Support materials

a) Textbooks

Lennart LJUNG and Torkel GLAD: Modeling of dynamic systems. Prentice Hall, 1994. ISBN: 0-13-597097-0

Bohdan T. Kulakowski, John F. Gardner, J. Lowen Shearer: Dynamic Modeling and Control of Engineering Systems. Cambridge University Press, 2012, ISBN: 9780511805417

b) Lecture notes

Szentannai, P. (Ed.): Power Plant Applications of Advanced Control Techniques (to be bublished by ProcessEng Engineering GmbH in 2010), ISBN: 978-3-902655-11-0book or note, with earliest publication date 2020.

c) Online materials

ftp://ftp.energia.bme.hu/pub/Dynamic_simulatiom_of_energy_engineering_systems

2.5. Validity of the course description

Start of validity:	2024. July 1.
End of validity:	2028. July 15.

II. SUBJECT REQUIREMENT

3. ACHIEVEMENT CONTROL AND EVALUATION

3.1 General rules

Learning outcomes are assessed on the basis of two mid-year written performance measures, which are emphatically complemented by the design of our own model. Summarizing academic performance evaluation: a complex, written way of evaluating the competence-type competence elements of the subject and knowledge in the form of an indoor dissertation, the dissertation focuses on the application of the acquired knowledge, thus focusing on problem recognition and solution during.

3.2 Assessment methods

A. Detailed description of mid-term assessments

1. Mid-term assessment

type:	summative assessment
count:	2
purpose, description:	Summative assessments collectively examine and assess students 'learning outcomes defined by knowledge and ability type competencies. Accordingly, each summative assessment assesses the acquisition of the designated theoretical knowledge as well as the existence of the knowledge and skills acquired in practice. They will be completed on the date specified in the academic performance evaluation plan.

2. Mid-term assessment

type:	formative assessment, project-based, complex
count:	1
purpose, description:	An important task is to use the knowledge gained during the transfer of information through the practice of modeling work planning. This can be done individually or in groups, of which the extra expense from working in the group and the (expected) much higher surplus result will be included in the valuation as a surplus in itself. The task to be modeled is an individual or an energy task selected by the group that also has a dynamic property. When designing a model for this task, students should review the systematic path of modeling and design a system model. The final presentation must be presented at two intermediate stations during the modeling, and the teacher's instructions and professional help must be taken into account.

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	80 %
2 . Mid-term assessment	20 %

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 95%
very good(5) • Very Good [B]	90% .. 95%
good(4) • Good [C]	75% .. 90%
satisfactory(3) • Satisfactory [D]	60% .. 75%
sufficient(2) • Pass [E]	40% .. 60%
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 **60%** (rounded down) of lectures.

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?

NO

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

NO

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
preparation for summary assessments	32
elaboration of a partial assessment task	30
additional time required to complete the subject	2
summary	**92**

3.9. Validity of subject requirements

Start of validity:	2024. July 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 modelling

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 theoretical and practical knowledge and methodological skills to design, manufacture, model, operate and manage complex engineering systems and processes
- Student has the knowledge of the scientific theories (mathematical, mechanical, fluid mechanics, thermal and electronic) and computational methods relevant to mechanical engineering research and development.
- Student has the knowledge of modelling and analysis of time-varying processes in machines and mechanical systems.

b) ability

- Student has the ability to apply and put into practice the knowledge acquired, using problem-solving techniques.
- Student has the ability to understand and solve problems to be solved and to generate original ideas.
- Student has the ability to plan and carry out tasks independently and to a high professional standard.

c) attitude

- Student strives to meet the requirements of sustainability, economy and energy efficiency.
- Student strives to carry out their work in a complex approach based on a systems and process-oriented thinking.

d) independence and responsibility

- Student acts independently and proactively in solving technical problems.
- Student has a demonstrated responsibility for sustainability and environmental awareness.

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)	-