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)

Thermal physics ● Thermal Physics

1.2. Neptun code

BMEGEENNWTP

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. Kovács Róbert Sándor
post:	associate professor
contact:	kovacsrobert@energia.bme.hu

1.8. Host organization

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

1.9. Course homepage

http://energia.bme.hu/~czel/BMEGEENNWTP/

1.10. Course language

english

1.11. Primary curriculum type

optional

1.12. Direct prerequisites

Strong prerequisite: -
Weak prerequisite: -
Parallel prerequisite: -
Milestone prerequisite: -
Excluding condition: BMEGEENMWTP
(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 get acquainted with the mathematical and physical description of thermal conduction tasks, its application to technical problems. Discusses the meaning of material parameters and various related measurement options required to describe thermal conduction processes. It presents the numerical solutions of the differential equations describing the thermal conductivity processes, emphasizing their advantages and disadvantages. It introduces the relevant experimental methods and their analytical and numerical evaluation possibilities. In addition to specific thermal engineering phenomena and related technical tasks, it provides generally useful modeling and problem-solving knowledge.

2.2. Learning outcomes

Competences that can be acquired by completing the course:

A. Knowledge

- Be familiar with the physical and mathematical background of heat conduction as a phenomenon.
- Be familiar with the boundary conditions for thermal conduction tasks.
- Be familiar with the material parameters required for thermal engineering calculations and their meaning.
- Be familiar with the analytical solution of the 1-dimensional, steady-state heat conduction phenomenon.
- Understand the numerical method based on finite differences.
- Be familiar with the thermal engineering role and measurement possibilities of the thermal conductivity factor.
- Understand the thermal engineering role and measurement possibilities of the thermal conductivity factor.
- Be familiar with the thermal engineering role and measurement possibilities of specific heat.
- Understand methods for measuring the temperature dependence of material parameters.
- Be familiar with the approach required for thermal engineering calculations.
- Understand the solution of inverse thermal conduction problems.

B. Ability

- Find the math tools needed for the solution.
- Based on the collected information, analyze the solution process of complex thermal engineering tasks.
- From the various solutions, find the best path for the task.
- The student is able to describe real systems with abstract heat transfer models.
- Perform multi-aspect analysis of thermal engineering systems and processes.
- Critically evaluate the numerical and analytical solutions obtained.
- The student is able to experimentally determine the required thermal parameters.
- Apply basic programming knowledge of numerical solutions.
- Solve computationally intensive thermal engineering tasks.
- The student is able to express his / her thoughts in an orderly form orally and in writing, to use the relevant jargon consistently.
- Differentiate between different numerical methods.

C. Attitude

- The student constantly monitors his work, results and conclusions.
- It continuously expands your knowledge of thermal engineering measurement procedures.
- Open to the use of mathematical programming tools.
- Strive to learn about and routinely use the tools needed to solve thermophysical problems.
- Improve the ability to provide accurate and error-free problem solving, engineering precision and accuracy.
- Be familiar with the approach needed to solve thermophysical problems.
- Ppublish his/her results in accordance with his professional rules.
- Publish his/her opinions and views without offending others.

D. Independence and responsibility

- Collaborates with the instructor and fellow students to expand knowledge.
- Accept well-founded professional and other critical remarks.
- In some situations, as part of a team, you work with your fellow students to solve tasks.
- With his knowledge, the student makes a responsible, well-founded decision based on his analysis.
- Committed to the highest level of work expected.
- Perform thermal engineering modeling tasks independently.
- Support efficient work as part of a team.

2.3. Teaching methodology

The teaching of the subject is partly a lecture and partly a computer lab. During the lectures, the most important theoretical concepts and mathematical elements are introduced, which must be fully utilized in laboratory-type computer sessions. During computer exercises, the acquisition of basic mathematical programming skills (in a Matlab environment) takes place together with the instructor. The knowledge acquired in this way is deepened by the compulsory homework to be completed at the end of the semester, which requires independent thinking and work.

2.4. Support materials

a) Textbooks

Özisik, MN: Finite Difference Methods in Heat Transfer, CRC Press, 1994, Boca Raton, Florida, ISBN 9781482243451,

b) Lecture notes

There is no note for the subject when filling in the form, its earliest publication date is 2020.

c) Online materials

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

http://energia.bme.hu/~czel

2.5. Validity of the course description

Start of validity:	2019. September 1.
End of validity:	2025. July 15.

II. SUBJECT REQUIREMENT

3. ACHIEVEMENT CONTROL AND EVALUATION

3.1 General rules

Learning outcomes are assessed on the basis of a mid-year written performance appraisal and a partial performance appraisal. Summarizing academic performance evaluation: a complex, written way of evaluating the competence-type competence elements of the subject and knowledge in the form of a midterm test. The test focuses on the application of the acquired knowledge, so it focuses on problem recognition and solution, on the other hand, it asks for the necessary lexical knowledge during the performance appraisal, the available working time is 90 minutes. Partial performance assessment (homework): a complex way of evaluating the knowledge, ability, attitude, as well as independence and responsibility type competence elements of the subject, the form of which is the individual homework.

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 acquisition of the designated theoretical knowledge as well as the existence of knowledge and the application of skills acquired in practice. At least sufficient completion of the performance evaluation is a condition for admission to the exam, which requires a 50% result.

2. Mid-term assessment

type:	formative assessment, project-based, complex
count:	1
purpose, description:	The basic aim of the partial performance assessment is to examine the existence of attitudes and learning outcomes belonging to autonomy and responsibility competences. The way to do this is to numerically model an independently chosen thermophysical problem or to get to know an experimental - measurement procedure, to explore its literature and to summarize the information gathered in documentation. 50% completion of partial performance is required for signing.

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 90%
very good(5) • Very Good [B]	85% .. 90%
good(4) • Good [C]	72% .. 85%
satisfactory(3) • Satisfactory [D]	65% .. 72%
sufficient(2) • Pass [E]	50% .. 65%
insufficient(1) • Fail [F]	below 50%

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 **70% 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:

the summative assessments can be retaken or improved only combined

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:

out of multiple results, the best one is to be taken into account

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 repeat period, 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
summary	**88**

3.9. Validity of subject requirements

Start of validity: 2019. September 1.

End of validity: 2025. 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 modern experimental and numerical modelling techniques.
- Student has the knowledge of economic and management problems related to systems thinking and of the principles, tools and methods needed to solve them.

b) ability

- Student has the ability to apply and put into practice the knowledge acquired, using problem-solving techniques.
- Student has the ability to communicate and apply new scientific findings.
- Student has the ability to understand and solve problems to be solved and to generate original ideas.

c) attitude

- Student has the ability to plan and carry out tasks to a high professional standard, either independently or in a team.
- In the course of student's work, Student will explore the possibility of setting research, development and innovation objectives and strive to achieve them.
- Student is open and receptive to new, modern and innovative processes and methods in engineering modelling.

d) independence and responsibility

- Student acts independently and proactively in solving technical problems.
- Student has the ability to take responsibility for managing the professional work of a small or large group.

- Student independently selects and applies relevant problem-solving methods when solving professional tasks.

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)	-