



SUBJECT DATA SHEET AND REQUIREMENTS

last modified: 31st August 2014

HEAT TRANSFER

MŰSZAKI HŐTAN II.

1	Code	Semester Nr. or fall/spring	Contact hours/week (lect.+semin.+lab.)	Requirements p / e / s	Credit	Language
	BMEGEENAEHK	fall	2+2+0	e	4	English

2. Subject's responsible:

Name:	Position:	Affiliation (Department):
Gyula Gróf, PhD	Associate professor	Dept. of Energy Engineering

3. Lecturer:

Name:	Position:	Affiliation (Department):
Balázs Czél, PhD	Assistant professor	Dept. of Energy Engineering

4. Thematic background of the subject:

Basic forms of heat transfer. Fundamental equations. General differential equation of heat conduction. Steady state and transient conduction. Thermal resistance. Extended surfaces, fin performance. Continuously operating heat sources. Numerical methods. Convection; concepts and basic relations, boundary layers, similarity concept. Free convection, forced convection, boiling and condensation. Empirical formulas. Dimensioning of heat exchangers, efficiency. Radiation heat transfer.

5. Compulsory / recommended prerequisites:

Compulsory: Mathematics A3 for Mechanical Engineers, BMETE90AX10

6. Main aims and objectives, learning outcomes of the subject:

This subject is designed to provide basic knowledge of heat transfer for energy and mechanical engineering students.

The objective of this subject is to introduce the basic principles of heat transfer via real-world engineering examples, to show students how heat transfer is applied in engineering practice.

This subject builds the foundation for preparing students to work in the area of heat transfer including heat conduction in solids, heat transfer between solids and fluids in case of natural flow, forced flow and phase change, basic calculations of heat exchangers.

7. Method of education:

This subject is based on lectures, providing theoretical background and seminars, helping students to put their knowledge into practice. (lecture 2h/w, seminar 2h/w, laboratory 0h/w)

8. Detailed thematic description of the subject:

Date of class	Topics to be discussed, readings required for the class
Week 1	Modes of heat transfer
Week 2	Steady state heat conduction
Week 3	Thermal resistances
Week 4	Fins
Week 5	Transient heat conduction
Week 6	Finite difference method
Week 7	Heat exchangers
Week 8	Heat exchangers
Week 9	Convective heat transfer
Week 10	Forced and natural convection
Week 11	Condensation and boiling
Week 12	Radiation
Week 13	Radiation
Week 14	Review

9. Requirements and grading

a) in term-period

According to academic regulations, students may miss a maximum of 25% of the seminars. After having missed 25% of the seminars, the final grade is automatically *R* (refused, no credit).

Compulsory homework will not be assigned.

During the semester, there will be two mid-term exams (80min, problem solving) and two quizzes (20min, short questions connected to the lectures). Maximum points for the tests and quizzes are:

Mid-term exam 1 (8th week)	300
Mid-term exam 2 (12th week)	200
Quiz 1 (3rd week)	100
Quiz 2 (9th week)	100

resulting a maximum of 700 points, which will be considered 100%.

There will be one mid-term retake exam (optional) in the Late submission week of the semester (the week after the 14th). The mid-term retake exam includes all topics of the course

(problem solving and questions connected to the lectures) and a maximum of 700 points can be earned. The semester result (*SR*) will be the sum of the results of the mid-term exams and quizzes or the result of the mid-term retake exam.

The semester result (*SR*) must be at least 40% to get the *S* (signed) grade and the permission to take the final exam.

A final grade will be offered without taking the final exam if one of the following requirements are met:

Each mid-term test and quiz is better than	<i>SR</i> is greater than or equal to	Final grade offered (without taking the final exam)
50%	60%	D
65%	70%	C
72%	80%	B
85%	90%	A

If the offered final grade is not accepted by the student, then it is necessary to take the final exam to get the final grade.

b) in examination period

The final exam will be written, and will contain problem solving and questions connected to the lectures. The final result (*FR*) will be calculated from the semester result (*SR*) and the result of the final exam (*ER*) as follows:

$$FR=0.4 \cdot SR+0.6 \cdot ER$$

Grading is based on the final result (*FR*) according to the following table:

<i>FR</i>	Hungarian grade	ECTS equivalent	Explanation for the Hungarian grade
85-100	5	A	Excellent
72-84	4	B	Good
65-71	3	C	Satisfactory
50-64	2	D	Pass
0-49	1	F	Fail
	Nem jelent meg	DNA	Did not attend (no credit)
	Nem vizsgázott	I	Incomplete (no credit)
	Aláírva	S	Signed (no credit)
	Megtagadva	R	Refused (no credit)

c) Disciplinary Measures Against the Application of Unauthorized Means at Mid-Terms, Term-End Exams and Homework

Supplement to 1/2013. (I. 30.) Dean's Order (Codicil): The following students are subject to disciplinary measures.

- (a) Those students who apply unauthorized means (book, lecture notes, etc.), different from those listed in the course requirements and/or adopted by the lecturer in charge of the course assessment, in the written mid-term exams taken, and/or invite/accept any assistance of fellow students, with the exception of borrowing authorized means,

will be disqualified from taking further mid-term exams in the very semester as a consequence of their action. Further to this, all of their results gained in the very semester will be void, can get no term-end signatures, and will have no access to Late Submission option. Final term-end results in courses with practical mark will automatically become Fail (1), the ones with exam requirements will be labelled Refused Admission to Exams.

- (b) Those students whose homework verifiably proves to be of foreign extraction, or alternatively, evident results or work of a third party, are referred to as their own, will be disqualified from taking further assessment sessions in the very semester as a consequence of their action. Further to this, all of their results gained in the very semester will be void, can get no term-end signatures, and will have no access to Late Submission options. Final term-end results in courses with practical mark will automatically become Fail (1), ones with exam requirements will be labelled Refused Admission to Exams.
- (c) Those students who apply unauthorized means (books, lecture notes, etc.), different from those listed in the course requirements and/or adopted by the lecturer in charge of the course assessment, in the written term-end exams taken, and/or invite/accept any assistance of fellow students, with the exception of borrowing authorized means, will immediately be disqualified from taking the term-end exam any further as a consequence of their action, and will be inhibited with an automatic Fail (1) in the exam. No further options to sit for the same exam can be accessed in the very same exam period.
- (d) Those students who alter, or make an attempt to alter the already corrected, evaluated, and distributed test or exercise/problem,
 - i.) as a consequence of their action, will be disqualified from further assessments in the respective semester. Further to this, all of their results gained in the very semester will be void, can get no term-end signatures, and will have no access to Late Submission options. Final term-end results in courses with practical mark will automatically become Fail (1), the ones with exam requirements will be labelled Refused Admission to Exams;
 - ii.) and will immediately be inhibited with an automatic Fail (1) in the exam. No further options to sit for the same exam can be accessed in the very same exam period.

10. Retake and repeat

For the retake of the mid-term exams and quizzes see Section 9.a.

Retake of the final exams is according to the Code of Studies and Exams of BME.

11. Consulting opportunities:

Consultation hours: please visit <http://www.energia.bme.hu/english/schedule> and look for the consultation hours of your lecturer.

12. Reference literature (compulsory):

Chapters assigned by the lecturer from:

J. H. Lienhard IV, J. H. Lienhard V: A heat transfer textbook, 4th edition, Phlogiston Press, Cambridge, MA, USA, 2012. (downloadable from: ahtt.mit.edu)

13. Home study required to pass the subject:

Contact hours	56	h/semester
Home study for the courses	14	h/semester
Home study for the mid-semester checks	20	h/ semester
Preparation of mid-semester homework	0	h/homework
Home study of the allotted written notes	14	h/semester
Home study for the exam	16	h/semester
Totally:	=30×4=120	h/semester

14. The data sheet and the requirements are prepared by:

Name:	Title:	Affiliation (Department):
Balazs Czél, PhD	Assistant professor	Dept. of Energy Engineering