SUBJECT DATASHEET

I. SUBJECT SPECIFICATION

1 BASIC DATA

1.1 Title

STABILITY OF STRUCTURES

1.2 Code

BMEEOHSMT-2

1.3 Type

Module with associated contact hours

1.4 Contact hours

type	hours/week
lectures	2
seminars/exercise classes	1

1.5 Evaluation

examination

1.6 Credits

4

1.7 Coordinator

name: Dr. Kövesdi Balázs Géza
academic rank: associate professor
email: kovesdi.balazs@epito.bme.hu

1.8 Department

Department of Structural Engineering (http://www.epito.bme.hu/hidak-es-szerkezetek-tanszek)

1.9 Website

http://www.epito.bme.hu/BMEEOHSMT-2

1.10 Language of instruction

Hungarian and English

1.11 Curriculum requirements

Compulsory in the Specialization on Numerical Modelling and Specialization on Structures, Optional in the other specializations of the Structural engineering (MSc) programme

1.12 Prerequisites

Recommended subjects

Structures 1 (BMEEOHSMS51)

1.13 Effective date

September 1, 2017.

2 OBJECTIVES AND LEARNING OUTCOMES

2.1 Objectives

The objective of the subject is the presentation of the most important problems in the stability analysis and stability design of steel structures. The student will learn the terminology of theory of engineering stability and theory of torsion of thin-walled members, as well as their practical importance and applicability. The most relevant modes of instabilities of engineering steel structures will be presented (flexural buckling, flexural-torsional buckling, lateral-torsional buckling, plate buckling). To each instability mode the student will learn the background and mathematical bases, as well as the Eurocode design procedures and their practical applications.

2.2 Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge
   1. will know the terminology of engineering stability theory,
   2. will know the basics of engineering torsion theory of thin-walled members,
   3. will know the two- and three-dimensional instability phenomena typical to columns and beams,
   4. will know the design procedures for the determination of the resistance of columns/beams against stability,
   5. will know the stability behaviour and post-critical behaviour of unstiffened plates,
   6. will know the stability behaviour and post-critical behaviour of stiffened plates,
   7. will know the specialities of the design of unstiffened plates.

B. Skills
   1. will be able to calculate stresses from St.Venant and Vlasov torsion theories,
   2. will be able to calculate the critical loads for simple structures made of rigid bodies and elastic springs,
   3. will be able to calculate the buckling resistance to flexural-torsional buckling of columns with mono-symmetric thin-walled cross-sections,
   4. will be able to determine the critical load parameters to plate buckling and to global buckling of structural members,
   5. will be able to calculate the critical moment to lateral-torsional buckling of beams with arbitrary thin-walled cross-sections,
   6. will be able to calculate the plate buckling resistance of longitudinally stiffened plates subjected to membrane loading effects,
   7. will be able to apply finite element and finite strip based computer software to calculate critical load parameter.

C. Attitudes
   1. cooperates with the tutor/lecturer and with fellow students,
   2. is ready to apply numerical computational tools,
   3. is intent on learning and applying the relevant tools of stability design,
   4. is intent on precise and error-free problem solving,

D. Autonomy and responsibility
   1. able to autonomously evaluate instability phenomena and able to autonomously complete design calculations based on the literature,
   2. is open to new design procedures, and autonomously evaluates the correctness and applicability of new design procedures,

2.3 Methods

Lectures, exercises, written and oral communications, application of IT tools and techniques, assignments solved individually or, optionally, in teams.

2.4 Course outline

week: Topics of lectures and/or exercise classes

1. Basics of engineering stability theory.
2. Engineering torsion theory of thin-walled members, consideration of warping
3. Stability analysis of compressed columns (elastic buckling).
4. Stability analysis and EC3-based design of compressed columns.
5. Elastic restraints. Compressed members on elastic foundation.
6. Analysis of and design for flexural-torsional buckling of columns.
7. Analysis of and design for lateral-torsional buckling of beams.
8. Linear buckling analysis of frames. Geometric stiffness matrix of frames.
9. Elastic buckling and post-critical behaviour of single plates.
10. Elastic buckling and post-critical behaviour of plated structures.
11. Stability design for unstiffened and stiffened plates.
12. Stability design for unstiffened and stiffened plated structures.
13. Reduced stress method and its practical application.
14. Current research topics of plated structures.

The above programme is tentative and subject to changes due to calendar variations and other reasons specific to the actual semester. Consult the effective detailed course schedule of the course on the subject website.

2.5 Study materials

a) Textbooks

1. Kollár L: A mérnöki stabilitáselmélet különleges problémái
2. Iványi Miklós: Stabilitástan
3. ECCS: Commentary and worked examples to EN 1993-1-5 „Plated Structural Elements"
4. Ádány S, Dulácska E., Dunai L., Fernezelyi S., Horváth L., Kövesdi B: Acélszerkezetek, Tervezés az Eurocode alapján – Általános eljárások,
5. Ádány S, Dulácska E., Dunai L., Fernezelyi S., Horváth L.: Acélszerkezetek, Tervezés az Eurocode alapján – Speciális eljárások
6. Yu Wei-Wen: Cold-formed steel design, 2000
7. Timoshenko, Gere: Theory of elastic stability.

b) Online materials

1. Papp F: Stabilitáselmélet – egyetemi jegyzet
2. órai anyagok, előadásfóliák
3. Kovács N: Stabilitásfüggvények – egyetemi jegyzet
4. Ádány, Dunai, Kövesdi: Lecture notes.

2.6 Other information

1) Attendance to lectures and exercise classes is compulsory. The signature and credits from the subject will be refused to students missing more than allowed by the Code of Studies and Exams of BME.
2) Students are evaluated based on their actual individual performance. Students are required to show evidence of their own knowledge and skills. Submitting a work of others, obtaining or giving unauthorized help (e.g. during an exam or test) cheating and plagiarism in any form is unacceptable. Whoever violate the respective Regulations of the University will be

given a failing grade (1), without the possibility of retake and repeat, and will be reported to the Dean's Office.

2.7 Consultation

The instructors are available for consultation during their office hours, as advertised on the department website. Special appointments can be requested via e-mail.

II. SUBJECT REQUIREMENTS

3 ASSESSEMENT AND EVALUATION OF THE LEARNING OUTCOMES

2.1 General rules

The student performance will be evaluated, based on the learning outcomes specified in clause 2.2., via a test, a homework assignment, and examination.

2.2 Assessment methods

Evaluation form	abbrev.	**assessed learning outcomes**
Test #1	ZH1	A.1-A.4; B.1-B.3;
Assignment #1	HF1	A.5-A.7; B.4; B.6-B.7; C.1-C.4;
Oral exam	V	A.1-A.7, B.1-B.7; D.1-D.2

The dates of midterm tests and deadlines of assignments/homework can be found in the detailed course schedule on the subject's website.

2.3 Evaluation system

Evaluation	**score**
Test #1	20%
Assignment #1	20%
During the semester	**40%**
Exam	60%
Altogether	**100%**

Criterion for completion of the subject is to collect at least 50% of the total points of the Test, and at least 50% of the total points of the Assignment. Moreover, unsatisfactory performance during the Exam will lead to a final mark 'failed' (1) independently of the results of the Test and Assignment.

2.4 Requirements and validity of signature

Criterion for the signature is to collect at least 50% of the total points of the Test, and at least 50% of the total points of the Assignment.

Results of the Test and Assignment can be considered in the determination of the final mark for maximum 6 semesters.

2.5 Grading system

If the student satisfies the attendance criteria, his/her mark will be determined as follows.
The final mark is calculated on the basis of the weighted average of the Test, Assignment and Exam (with the weights shown in the table of Section 3.3), as shown in the following table:

grade	**points (P)**
excellent (5)	80<=P
good (4)	70<=P<80%
satisfactory (3)	60<=P<70%
passed (2)	50<=P<60%
failed (1)	P<50%

2.6 Retake and repeat

3 The midterm test can be repeated – once without fee – at a previously determined date given in the course schedule.

4 In case of repetition of the test, the better result will be taken into account for the calculation of the final grade.

5 If the first repetition is also unsatisfactory (failed), then the test can be repeated once more on the repetition week by paying a fee.

3.7 Estimated workload

activity	**hours/semester**
contact hours	14×3=42
preparation for the courses	14×1=14
preparation for the tests	1×8=8
homework	24
home studying of the written material	8
preparation for the examination	24
in total	**120**

3.8 Effective date

September 1, 2017.