Strengthening of Structures - BMEEOHSMT63

I. Subject Specification

1. Basic Data

1.1 Title

Strengthening of Structures

1.2 Code

BMEEOHSMT63

1.3 Type

Module with associated contact hours

1.4 Contact hours

Type	Hours/week / (days)
Lecture	1
Seminar	1

1.5 Evaluation

Midterm grade

1.6 Credits

3

1.7 Coordinator

name	Dr. Koris Kálmán
academic rank	Assistant professor
email	koris.kalman@emk.bme.hu

1.8 Department

Department of Structural Engineering

1.9 Website

https://epito.bme.hu/BMEEOHSMT63
https://fiek2.mywire.org/course/view.php?id=2456

1.10 Language of instruction

hungarian and english

1.11 Curriculum requirements

Optional in the Structural Engineering (MSc) programme

1.12 Prerequisites

1.13 Effective date

5 February 2020

2. Objectives and learning outcomes

2.1 Objectives

The objective of the subject is the presentation of the diagnostic of existing structures with different materials and structural systems, the possible causes of structural damages, methods of reinforcement and the most common building materials. According to this, the tools and steps of the diagnostic of existing structures, the verification of the structure's load bearing capacity, the basic principles of qualification, the required content of expertise, the methods of reconstruction and reinforcement, the most common ways of structural damages (direct and indirect) and the different structural systems of existing residential buildings are presented during the semester. Case studies are also introduced.

2.2 Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge

1. will learn the diagnostic of existing structures, the verification of the structure's load bearing capacity, the basic principles of qualification,
2. will learn the methods of reinforcement of structures with different materials (concrete, reinforced concrete, masonry, steel, timber),
3. will learn the steps of loading tests and the required content of expertise,
4. will learn the most typical forms of structural damages,
5. will learn the typical structural systems of existing residential buildings in Hungary,
6. will learn the reconstruction methods of slabs and stairs,
7. will learn the types of slab systems in Hungary.

B. Skills

1. will be able to do diagnostic and verify the load bearing capacity of existing structures, and to do the reinforcement of a structure,
2. will be able to choose the proper method of diagnostic and reinforcement depending on the structural material,
3. will be able to determine the required tasks of loading tests,
4. will be able to recognize the type of structural damage,
5. will be able to recognize the most typical types of structural systems,
6. will be able to choose the proper method of diagnostic and reinforcement of different types of slabs and stairs,
7. will be able to recognize the different types of slab systems in Hungary (according to their material, dimensions, shape and location).

C. Attitudes

1. continuously extends his/her knowledge,
2. is open to the application of modern diagnostic and reinforcement technics,
3. is intent on learning and using the tools of diagnostic and reinforcement,
4. is intent on precise and error-free problem solving.

D. Autonomy and Responsibility

1. is able to autonomously evaluate the different methods of reinforcement, diagnostic and recognize the different structural systems and damages,
2. is open to new reconstruction and reinforcement methods and design procedures related to these.

2.3 Methods

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

2.4 Course outline

Week	**Topics of lectures and/or exercise classes**
1.	General rules and methods for examination, verification, qualification and strengthening of existing load-bearing structures. Principles of load testing. The content of the expertise - 1.
2.	General rules and methods for examination, verification, qualification and strengthening of existing load-bearing structures. Principles of load testing. The content of the expertise - 2.
3.	Structural damages and deteriorations of existing buildings 1: direct damages.
4.	Structural damages and deteriorations of existing buildings 2: indirect damages.
5.	Strengthening methods 1: Application of anchored and bonded steel plates.
6.	Strengthening methods 2: Application of FRP materials for strengthening.
7.	Strengthening methods 3: Concrete jacketing, application of sprayed concrete.
8.	Diagnostics, examination and reconstruction of masonry structures.
9.	Diagnostics, examination and reconstruction of reinforced concrete structures - 1.
10.	Diagnostics, examination and reconstruction of reinforced concrete structures - 2.
11.	Diagnostics, examination and reconstruction of steel structures.
12.	Diagnostics, examination and reconstruction of timber structures.
13.	Diagnostics, examination and reconstruction of floor

	slabs, stairs and foundations.
14.	Case studies.

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

b) Online materials
Kálmán Koris - Examination and classification of damaged structures, electronic lecture note.
Kálmán Koris - Structural damages, electronic lecture note.
Kálmán Koris - Strengthening methods I. – Anchored and bonded steel plates, electronic lecture note.
Kálmán Koris - Strengthening methods II. – Application of FRP materials, electronic lecture note.
Kálmán Koris - Strengthening methods III. – Sprayed concrete, electronic lecture note.
Kálmán Koris - Strengthening of reinforced concrete, masonry, steel and timber structures, electronic lecture note.

2.6 Other information

2.7 Consultation

The instructors are available for consultation during their office hours, as advertised on the department website.

This Subject Datasheet is valid for:

Inactive courses

II. Subject requirements

Assessment and evaluation of the learning outcomes

3.1 General rules

The assessment of the learning outcomes specified in clause 2.2. above and the evaluation of student performance occurs via 3 tests.

3.2 Assessment methods

Evaluation form	Abbreviation	Assessed learning outcomes
1. midterm test	ZH1	A.1-A.3; B.1-B.3; C.1-C.4; D.1-D.2
2. midterm test	ZH2	A.4-A.5; B.4-B.5; C.1-C.4; D.1-D.2
3. midterm test	ZH2	A.6-A.7; B.6-B.7; C.1-C.4; D.1-D.2

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

3.3 Evaluation system

Abbreviation	Score
ZH1	50%
ZH2	50%
ZH3	50%
Total achievable during the semester	100%
Sum	**100%**

Criterion for completion of the subject is to collect the 50% of the points from the two better tests (15 points).

3.4 Requirements and validity of signature

Signature can't be obtained.

3.5 Grading system

Grade	Points (P)
excellent (5)	26 p ≤ P
good (4)	22 p ≤ P ≤ 25.99 p
satisfactory (3)	18 p ≤ P ≤ 21.99 p
passed (2)	15 p ≤ P ≤ 17.99 p
failed (1)	P < 15 p

3.6 Retake and repeat

There is no minimum requirement for the individual tests, therefore the repetition of the tests is not possible.

3.7 Estimated workload

Activity	Hours/semester
contact hours	14×2=28
preparation for the tests	3×16=48
home studying of the written material	14×1=14
Sum	**90**

3.8 Effective date

5 February 2020

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Inactive courses