Structural Analysis I. - BMEEOTMAT43

I. Subject Specification

1. Basic Data

1.1 Title

Structural Analysis I.

1.2 Code

BMEEOTMAT43

1.3 Type

Module with associated contact hours

1.4 Contact hours

Type	Hours/week / (days)
Lecture	4

1.5 Evaluation

Exam

1.6 Credits

4

1.7 Coordinator

name	Dr. Lengyel András
academic rank	Associate professor
email	lengyel.andras@emk.bme.hu

1.8 Department

Department of Structural Mechanics

1.9 Website

https://epito.bme.hu/BMEEOTMAT43
https://fiek2.mywire.org/course/view.php?id=453

1.10 Language of instruction

hungarian and english

1.11 Curriculum requirements

Compulsory in the Civil Engineering (BSc) programme

1.12 Prerequisites

Strong prerequisites:

- Introduction to Strength of Materials (BMEEOTMAT42)
- Mathematics A1a - Calculus (BMETE90AX00)

Recommended prerequisites:

- Matematics A2a (BMEETE90AX02)

1.13 Effective date

1 September 2022

2. Objectives and learning outcomes

2.1 Objectives

The aim of the subject is to introduce the fundamental concepts of displacements of elastic bar structures, the calculation of displacements using the method of equivalent displacements and the method of virtual forces, the concept of influence lines, the calculation of influence lines of internal forces and displacements in the case of statically determinate structures, the application of influence lines for the calculation of envelope curves of internal forces, the fundamental characteristics of statically indeterminate structures, the application of the force method for statically indeterminate structures in the cases of fix loads and influence lines, the application of the classical displacement method for statically indeterminate structures in the case of fix loads.

2.2 Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge

1. knows the fundamental concepts and relationships of diasplacements of planar bar structures,
2. knows the method of equivalent displacements and the method of virtual forces,
3. knows the concept of influence lines and their properties,
4. knows the calculation methods of influence lines of internal forces and displacements,
5. knows the fundamental properties of statically indeterminate structures and their role in engineering,
6. knows the principle of the force method, the calculation procedure, and its application for planar bar structures in the cases of static loading and influence lines,
7. knows the principle of the displacement method, the calculation procedure, and its application for planar bar structures in the case of static loading,
8. knows the concept and calculation procedure of envelope curves of internal forces,

B. Skills

1. calculates the displacements of statically determinate bar structures under bending moments using the method of equivalent displacements,
2. calculates the displacements of statically determinate bar structures under bending moments and axial forces using the method of virtual forces,
3. is able to determine the influence lines of reaction forces and internal forces in statically determinate bar structures,
4. determines the influence lines of displacements in statically determinate bar structures under bending moments and axial forces,
5. is able to analyse statically indeterminate bar structures, and to determine the degree of indeterminacy,
6. applies the force method for the calculation of statically indeterminate bar structures in the case of fix loads,
7. applies the force method for the calculation of statically indeterminate bar structures in the case of influence lines,
8. applies the displacement method for the calculation of statically indeterminate bar structures in the case of fix loads,
9. is able to express his/her thoughts in an organized way in oral and written communication,

C. Attitudes

1. aims at learning and routinely using tools required for solving structural mechanics problems,
2. aims at accurate and flawless problem solving,
3. in written communication aims at producing organized, high-quality documentations fit for the standards of engineering society,

D. Autonomy and Responsibility

1. is able to individually think over structural mechanics problems and to solve them using the given resources,
2. applies a systematic approach in his/her reasoning.

2.3 Methods

Lectures with theoretical knowledge and computational examples, written and oral communication, use of IT devices and techniques, optional practice problems solved individually.

2.4 Course outline

Week	**Topics of lectures**
1.	Principle of small displacements, displacements of rigid bodies, displacements of elastic structures
2.	Calculation of displacements using the method of equivalent displacements
3.	Calculation of displacements using the method of virtual forces
4.	Influence lines of internal forces in statically determinate structures
5.	Influence lines of internal forces and displacements in statically determinate structures
6.	Calculation of statically indeterminate structures using the force method in the case of fix loads
7.	Calculation of statically indeterminate structures using the force method in the case of fix loads
8.	Calculation of statically indeterminate structures using the force method in the case of influence lines
9.	Calculation of statically indeterminate structures using the force method in the case of influence lines
10.	Calculation of statically indeterminate structures using the displacement method in the case of fix loads
11.	Calculation of statically indeterminate structures using the displacement method in the case of fix loads
12.	Calculation of statically indeterminate structures using the displacement method in the case of fix loads

13.	Calculation of statically indeterminate structures using the displacement method in the case of fix loads
14.	Most unfavourable internal forces, envelope curves of internal forces

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

Lecture notes: Lengyel A. - Hincz K.: Structural Analysis I.

2.6 Other information

- Students failing to prove to have attended at least 70% of the lectures based on their records of absences cannot obtain registry other than "Megtagadva" or "Nem teljesítette".
- Students attending checks must not communicate with others during the check without explicit permission, and must not hold any electronic or other communication device switched on.
- Students who have obtained a valid signature and have registered for a course other than examination course cannot lose their signature and eligibility for exam, but the final results are to be computed based on the new test results.

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: hortobagyi.zsolt@epito.bme.hu.

This Subject Datasheet is valid for:

2023/2024 semester I

II. Subject requirements

Assessment and evaluation of the learning outcomes

3.1 General rules

- Evaluation of learning outcomes described in Section 2.2. is based on three mid-term written checks and a written check in the examination period.
- The duration of each mid-term test is 60 minutes, the duration of the written exam is 105 minutes.
- The dates of the checks can be found in the "Detailed semester schedule" on the website of the subject.

3.2 Assessment methods

Evaluation form	Abbreviation	Assessed learning outcomes
1st mid-term test (summarizing check)	ZH1	A.1-A.4; B.1-B.3, B.9
2nd mid-term test (summarizing check)	ZH2	A.1-A.6; B.1-B.7, B.9
3rd mid-term test (summarizing check)	ZH3	A.1-A.2, A.5, A.7; B.1-B.2, B.8-B.9
written exam (summarizing check)	V	A.1-A.8; B.1-B.9; C.1-C.3; 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	15%
ZH2	15%
ZH3	15%
V	70%
Sum	**100%**

Only the best two mid-term test results are considered (that is why the sum of the weights above is not 100%).

3.4 Requirements and validity of signature

- Signature and eligibility for the exam is granted if the average of the best two mid-term test results is not less than 50%.
- A signature obtained previously will remain valid at a re-registering for the subject, but the new results are to be considered nevertheless.

3.5 Grading system

- In the case of complying with the requirements on attendance the results are determined as follows.
- No requirements are made on the successfulness of the tests.
- The semester performance is determined by the results of the best two mid-term tests.
- Written exam below 50% is regarded unsuccessful, the exam mark is "Failed".
- In the case of a successful exam the final result is computed by the weighted average A of the best two mid-term tests and the written exam as in section 3.3.:

Grade	**Points (A)**
excellent (5)	85%≤A
good (4)	75%≤A<85%
satisfactory (3)	65%≤A<75%
passed (2)	50%≤A<65%
failed (1)	A<50%

3.6 Retake and repeat

Mid-term test cannot be retaken in this subject.

3.7 Estimated workload

Activity	**Hours/semester**
contact lessons	28×2=56
preparation for lessons during the semester	28×1=28
preparation for the checks	6×2=12
preparation for the exam	24
Sum	**120**

3.8 Effective date

1 September 2022

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2023/2024 semester I