Finite Element Modelling - BMEEOTMMB-1

I. Subject Specification

1. Basic Data

1.1 Title

Finite Element Modelling

1.2 Code

BMEEOTMMB-1

1.3 Type

Module with associated contact hours

1.4 Contact hours

Type	Hours/week / (days)
Lecture	1
Seminar	2

1.5 Evaluation

Exam

1.6 Credits

4

1.7 Coordinator

name	Dr. Németh Róbert Károly
academic rank	Associate professor
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1.8 Department

Department of Structural Mechanics

1.9 Website

https://epito.bme.hu/BMEEOTMMB-1
https://fiek2.mywire.org/course/view.php?id=3574

1.10 Language of instruction

hungarian and english

1.11 Curriculum requirements

Compulsory in the Construction Information Technology Engineering (MSc) programme

1.12 Prerequisites

1.13 Effective date

1 September 2022

2. Objectives and learning outcomes

2.1 Objectives

The aim of the subject is to acquaint the student basics of statics, elasticity, material models and Finite Element method used in the civil engineering practice, furthermore the basic terms and principles used in the design of structures.

2.2 Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge

1. Knows the general principles, rules, and methods of mathematics, natural sciences, and information technology required to practice engineering tasks related to construction, facility design, and implementation.
2. Knows the IT principles necessary for the development of technical systems and process automation.
3. knows the basic operations to be processed on forces and the possible results
4. knows the internal forces and geometric properties of the cross-section of a beam
5. knows the basic concept of elasticity: stresses, strains, equilibrium, linear elasticity, kinematic equations,
6. know the basic work and energy theorems of elasticity and the main steps of Finite Element Analysis
7. knows the principal mechanical material models
8. knows the principles of the partial safety factors,
9. knows the limit states analyzed in the design process of buildings,
10. knows the appearance of non-linearities in the design process,
11. knows the basic steps of design and checking of structures
12. knows the failure modes of structural elements

B. Skills

1. Is able to apply the necessary scientific and IT-principles in the design and construction process of buildings,
2. Effectively applies the information and communication technologies required for the design and construction of buildings
3. calculates the reactions of simple planar structures,
4. draws the internal force diagrams of simple structures,
5. calculates the stresses and the deformations in a cross-section from simple and complex internal forces,
6. determines the principal stresses and principal directions in a given point of a cross-section,
7. is able to position the loads and determine the authoritative combinations,
8. is able to follow the transfer of the horizontal and vertical loads over the structure and find the maximal internal forces,
9. performs basic design and checking tasks in the typical limit states,
10. is able to make orderly, traceable structural calculations,
11. is able to express and summarize the basic assumptions of their calculations and results,

C. Attitudes

1. Is open to the application of hew IT tools, methods, and procedures in their field.
2. Endeavors to extend their knowledge in their field,
3. endeavors to the precise and error-free problem solving,
4. aspires to prepare well-organized documentation in writings,
5. works together with the tutor/lecturer and fellow students while learning,

D. Autonomy and Responsibility

1. is open to accepting well-founded critical comments.
2. is ready for the independent use of design aid documents,
3. forms an individual opinion on structural issues, and discuss it with their peers.

2.3 Methods

Lectures and practices in mixed order, with problem solutions in various numerical environments.

2.4 Course outline

Week	**Topics of lectures and/or exercise classes**
1.	Statics I.
2.	Statics II.
3.	Strength of materials I.
4.	Strength of materials II.
5.	Elasticity I.
6.	Elasticity II.
7.	Ritz-method:
8.	Bar in tension/compression
9.	Plane membranes
10.	3D solid problems
11.	Beams
12.	Plates and shells
13.	Combination of structural models in finite element analysis
14.	Summary

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

- Beer F.P., Johnston, E.R., Mazurek, D. F., Vector Mechanics for Engineers: Statics, McGraw-Hill, 2012
- Beer F.P., Johnston, E.R., DeWolf, J.T., Mazurek, D. F., Mechanics of materials, McGraw-Hill, 2011
- Zienkiewicz, O.C., Taylor, R. L., Zhu, J.Z.: The Finite Element Method: Its Basis and Fundamentals,

Elsevier, 2005
- Kollár, L.P., Basis of structural design, BME, 2015

2.6 Other information

2.7 Consultation

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 the learning outcomes is based on three assignments, one midterm test, and an oral exam.
The midterm test below 50% result is regarded as unsuccessful.

3.2 Assessment methods

Evaluation form	Abbreviation	Assessed learning outcomes
Assignment 1	A1	A.1-A.3; B.1-B.4
Assignment 2	A2	A.4-A.5; B.5
Assignment 3	A3	A.1-A.8; B.1-B.8; C.1-C.5; D.1-D.3
Midterm Test	MT	A.1-A.8; B.1-B.8
Oral Exam	E	A.1-A.12; B.1-B.11; C.1-C.5; D.1-D.3

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
IA1	10%
IA2	10%
IA3	15%
MT	15%
E	50%
Sum	**100%**

3.4 Requirements and validity of signature

The signature is obtained, if all of the following requirements are met:
The midterm test must be successful.
All assignments must be submitted and accepted.
The weighted average of the assignments and the midterm test must reach at least 50%.

3.5 Grading system

Students with a signature must attend an oral exam, where the explanation of their assignments is followed by a technical talk.
An unsuccessful oral exam yields a "failed" exam grade.
In case of a successful exam, the final grade of the subject is calculated from the P weighted average (see 3.2) of the assessments, according to the following table:

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

3.6 Retake and repeat

Unsuccessful or not submitted assignments can be submitted two weeks after the original deadline for a fee.
The unsuccessful midterm test can be repeated in a single retake.
There is no second retake option in this subject.

3.7 Estimated workload

Activity	**Hours/semester**
Preparation for the lectures	14
Lectures, practices	42
Assignments	35
Preparation for Test	15
Preparation for the exam	14
Sum	**120**

3.8 Effective date

1 September 2022

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