Basis of Design - BMEEOHSAT41

I. Subject Specification

1. Basic Data

1.1 Title

Basis of Design

1.2 Code

BMEEOHSAT41

1.3 Type

Module with associated contact hours

1.4 Contact hours

Type	Hours/week / (days)
Lecture	2

1.5 Evaluation

Midterm grade

1.6 Credits

3

1.7 Coordinator

name	Dr. Kovács Tamás
academic rank	Associate professor
email	kovacs.tamas@emk.bme.hu

1.8 Department

Department of Structural Engineering

1.9 Website

https://epito.bme.hu/BMEEOHSAT41
https://fiek2.mywire.org/course/view.php?id=324

1.10 Language of instruction

hungarian and english

1.11 Curriculum requirements

Compulsory in the Civil Engineering (BSc) programme

1.12 Prerequisites

Strong prerequisites:

- Basics of Statics and Dynamics (BMEEOTMAT41)

Recommended prerequisites:

- Introduction to strength of materials (BMEEOTMAT42)

1.13 Effective date

1 September 2022

2. Objectives and learning outcomes

2.1 Objectives

The primary aim of the course is to provide the students with basic knowledge on the process of civil engineering design and the structural behaviour. During the semester the following topics are discussed: engineering design, structural design process and methodology, hierarchic and spatial structures; modelling of structures (structural model); probabilistic background of structural design, partial (safety) factor method; actions on structures, selection of critical load case, design load; internal stress and strain, material laws, elastic and plastic resistance; analysis methods, geometrically linear and nonlinear analysis, linear and nonlinear material behaviour, superposition; limit states (ULS&SLS), structural failure modes; design of structural members (beams and columns), design of structures for horizontal actions; bracing systems; selection of structural form and material, thrust line; spatial structures; classification of structures according to their form and static behaviour.

2.2 Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge

1. knows the engineering fields,
2. knows the actions on structures and the ways of their determination,
3. knows the partial factor design method,
4. knows the verifications associated with ultimate and serviceability limit states,
5. knows the concept of geometrically linear and nonlinear structural behaviour as well as the linear and nonlinear material behaviour,
6. knows the basic steps of sizing and structural verification,
7. knows the main structural failure modes,
8. knows the boiler formula, the concept of thrust line and the flow of forces in spatial structures.

B. Skills

1. able to create the structural model of a real structure,
2. capable of defining the actions on structures according to the EC,
3. able to determine the critical load arrangement on structures and their critical combinations,
4. able to realize the flow of vertical and horizontal forces in structures and to calculate the extremities of internal forces or stresses in statically determined structures,
5. capable of performing ultimate and serviceability limit state verifications,
6. capable of elaborating ordered and checkable structural calculations,
7. able to summarize the basic assumptions of the calculations and to express the results in preliminary drawings.

C. Attitudes

1. open to use IT tools,
2. makes effort to perform exact and error-free calculations.

D. Autonomy and Responsibility

1. individually capable of modelling structures and realizing the flow of forces,
2. individually capable of performing basic structural calculations,
3. individually capable of using design manuals,
4. uses systematized thinking approach.

2.3 Methods

Lectures, individually performed homework (calculation tasks), written (forum) and oral (joint consultation) communication, use of IT tools and techniques (voting during lectures, searching in databases, online homework), optional individual and team work.

2.4 Course outline

Week	**Topics of lectures and/or exercise classes**
1.	Introduction, modelling of structures, design process. Structural form. Selection of form and material. Structural model.
2.	Introduction, modelling of structures, design process. Structural form. Selection of form and material. Structural model.
3.	Probabilistic background of structural design, partial (safety) factor method. Classification of actions. Actions on structures
4.	Probabilistic background of structural design, partial (safety) factor method. Classification of actions. Actions on structures
5.	Probabilistic background of structural design, partial (safety) factor method. Classification of actions. Actions on structures
6.	Material laws. Geometrically linear and nonlinear analysis, elastic and plastic resistance. Superposition.
7.	Material laws. Geometrically linear and nonlinear analysis, elastic and plastic resistance. Superposition.
8.	Beams and columns. Design of structures for horizontal actions, bracing systems.
9.	Beams and columns. Design of structures for horizontal actions, bracing systems.
10.	Beams and columns. Design of structures for horizontal actions, bracing systems.
11.	Beams and columns. Design of structures for horizontal actions, bracing systems.
12.	Thrust line, vaults. Spatial structures.
13.	Thrust line, vaults. Spatial structures.

14.	Classification of structures according to their form and static behaviour. Discussion of structural catastrophes.

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) Online materials:

- Downloadable abstracts based on Kollár, L.P.: Basis of structural design, 2015

2.6 Other information

1. Homework contain short tasks with the aim to give help preparing for the tests rather than providing new knowledge. Solutions will be available immediately after the relevant submission deadline before the relevant test. In order to model test conditions, the solution shall be hand-written without using any software (e.g. Mathcad).
2. Numerical results of homework shall be submitted in electronic form (upload of results through the website of the subject), furthermore, the hand-written solution (in scanned or photo form) shall be submitted until the relevant deadline. Any homework is considered to be completed if BOTH submissions have been successful.
3. Hand-written submission shall contain the solution of all tasks including formulae, substitutions as well as numerical results equal to those uploaded electronically (see details in homework) and dimensions.
4. Submission of tests is conditional on showing an identity document including photo and signature at the beginning of the test.

2.7 Consultation

1. Joint consultations before each test to help preparing for the tests are organized outside the official schedule. Attendance on these consultations are optional.
2. The instructors are available for consultation during their office hours, as advertised on the department website. Special appointments can be requested via e-mail: kovacs.tamas@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

The assessment of the learning outcomes specified in clause 2.2. above and the evaluation of student performance occurs via three tests (T) and three homework (HW) during the semester.

3.2 Assessment methods

Evaluation form	Abbreviation	Assessed learning outcomes
Test#1 (midterm evaluation)	T1	A.1-A.4; B.1-B.4, B.6-B.7; D.1-D.4
Test#2 (midterm evaluation)	T2	A.5-A.7; B.5-B.7; D.1-D.4
Test#3 (midterm evaluation)	T3	A.1-A.8; B.1-B.7; D.1-D.4
Homework#1 (midterm evaluation)	HW1	A.1-A.4; B.1-B.4, B.6-B.7; C.1-C.2
Homework#2 (midterm evaluation)	HW2	A.5-A.7; B.5-B.7; C.1-C.2
Homework#3 (midterm evaluation)	HW3	A.1-A.8; B.1-B.7; C.1-C.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
T1-T3	82%
HW1	6%
HW2	6%
HW3	6%
Sum	**100%**
Extra points (for those, who have already fulfilled 50% out of T1&T2 and complete T3 above 50%) equal to 10% of the lowest test result (out of Test#1, #2 and #3) and limited to a maximum of 8.	**8%**

3.4 Requirements and validity of signature

Attendance on at least 70% of lectures.

3.5 Grading system

Conditions to receive grade:

- Average of the best two total results out of those obtained from Tests#1, #2 and #3 (three results) shall be at least 50%.
- Average of the best two results of theoretical test parts out of those obtained from Tests#1, #2 and #3 (three results) shall be at least 40%.
- Obtaining at least a total of 45 points according to clause 3.3 above.

The final grade is determined as follows:

Grade	Points (P)
excellent (5)	90<=P

good (4)	75<=P<90%
satisfactory (3)	60<=P<75%
passed (2)	45<=P<60%
failed (1)	P<45%

3.6 Retake and repeat

There is no minimum requirement for individual midterm tests, therefore no possibility for individual retake of tests is available

3.7 Estimated workload

Total: 3 credits × 30 hours/credits = 90 hours/semester.

Activity	**Hours/semester**
contact hours	14×2=28
homework	11+11+10=32
preparation for tests	3×10=30
Sum	**90**

3.8 Effective date

1 September 2022

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2023/2024 semester I