Structures 1 - BMEEOHSMS51

I. Subject Specification

1. Basic Data

1.1 Title

Structures 1

1.2 Code

BMEEOHSMS51

1.3 Type

Module with associated contact hours

1.4 Contact hours

Type	Hours/week / (days)
Lecture	3
Seminar	1

1.5 Evaluation

Exam

1.6 Credits

5

1.7 Coordinator

name	Dr. Kollár László
academic rank	Professor
email	kollar.laszlo@emk.bme.hu

1.8 Department

Department of Structural Engineering

1.9 Website

https://epito.bme.hu/BMEEOHSMS51
https://edu.epito.bme.hu/course/view.php?id=2449

1.10 Language of instruction

hungarian and english

1.11 Curriculum requirements

Compulsory 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 modelling of beams, membrans, plates and the simplest circular shell structures. The most important analytical solutions, the basics and assumptions of numerical solutions are introduced. It’s presented that the different structural considerations can be implemented in the design codes and regulations. The fundamental membrane solutions, shear lag effect, effective width, shear deformation, second-order effects and large deformations, anisotropy and the vibration of floors are also analysed. The main focus of the subject is the analysis of plates and slabs.

2.2 Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge

1. will learn the methods of structural design and calculation
2. will learn the behaviour and design of membrane-type structures,
3. will learn the boundaries of numerical calculations,
4. will learn the typical behaviour of rods
5. will learn the calculation methods of the internal forces and displacements of plate structures,
6. will learn the behaviour and design steps of plates,

B. Skills

1. will be able to calculate discs, beams and plates,
2. will be able to determine the shear deformation and take into consideration the second order effects,
3. will be able to design plates, take into account the second order effects,
4. will be able to calculate the vibration of floors, also in case of slabs supported by beams,

C. Attitudes

1. cooperates with the lecturer and with fellow students,
2. is ready to apply numerical computational tools,
3. is intent on understanding the behaviour of structures,
4. is intent on precise and error-free problem solving,
5. is attending to the classes as a responsible member of the community.

D. Autonomy and Responsibility

1. is open to the new information,
2. is able to think in system.

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.	Modelling, stresses and strains in 2D, material laws, anisotropy, basic equations of elasticity, discs, holes in discs, stress in the knee of frames, Boussinesq solution, brazil-test, shear lag and its application, theory of effective width.
2.	Modelling, stresses and strains in 2D, material laws, anisotropy, basic equations of elasticity, discs, holes in discs, stress in the knee of frames, Boussinesq solution, brazil-test, shear lag and its application, theory of effective width.
3.	Modelling, stresses and strains in 2D, material laws, anisotropy, basic equations of elasticity, discs, holes in discs, stress in the knee of frames, Boussinesq solution, brazil-test, shear lag and its application, theory of effective width.
4.	Basic equations of beams, bending, twisting, shearing, Timoshenko-beam, significance of shear/torque in beams with solid and thin-walled cross section, second order effects and their application in design codes, large deflection of beams.
5.	Basic equations of beams, bending, twisting, shearing, Timoshenko-beam, significance of shear/torque in beams with solid and thin-walled cross section, second order effects and their application in design codes, large deflection of beams.
6.	Basic equations of beams, bending, twisting, shearing, Timoshenko-beam, significance of shear/torque in beams with solid and thin-walled cross section, second order effects and their application in design codes, large deflection of beams.
7.	Basics of vibration, summation theorems, sources and modelling of damping.
8.	Basic equations of plates, boundary conditions (Kirchhoff plate), behaviour of plates, reinforced concrete plates, anisotropy plates, large deflection of plates, vibration of floors, explanation of the limits applied in design codes, vibration of floors supported by beams and its approximation with the help of the displacements, summation theory of Föppl, Southwell and Dunkerly, vibration of ribbed floors, effect of the shear on the vibration (ex. timber-concrete slab), effect

	of normal force on the vibration, modal analysis of slabs and its comparison with the modal analysis of earthquake design, ponding, slabs with continuous elastic support, plastic design.
9.	Basic equations of plates, boundary conditions (Kirchhoff plate), behaviour of plates, reinforced concrete plates, anisotropy plates, large deflection of plates, vibration of floors, explanation of the limits applied in design codes, vibration of floors supported by beams and its approximation with the help of the displacements, summation theory of Föppl, Southwell and Dunkerly, vibration of ribbed floors, effect of the shear on the vibration (ex. timber-concrete slab), effect of normal force on the vibration, modal analysis of slabs and its comparison with the modal analysis of earthquake design, ponding, slabs with continuous elastic support, plastic design.
10.	Basic equations of plates, boundary conditions (Kirchhoff plate), behaviour of plates, reinforced concrete plates, anisotropy plates, large deflection of plates, vibration of floors, explanation of the limits applied in design codes, vibration of floors supported by beams and its approximation with the help of the displacements, summation theory of Föppl, Southwell and Dunkerly, vibration of ribbed floors, effect of the shear on the vibration (ex. timber-concrete slab), effect of normal force on the vibration, modal analysis of slabs and its comparison with the modal analysis of earthquake design, ponding, slabs with continuous elastic support, plastic design.
11.	Basic equations of plates, boundary conditions (Kirchhoff plate), behaviour of plates, reinforced concrete plates, anisotropy plates, large deflection of plates, vibration of floors, explanation of the limits applied in design codes, vibration of floors supported by beams and its approximation with the help of the displacements, summation theory of Föppl, Southwell and Dunkerly, vibration of ribbed floors, effect of the shear on the vibration (ex. timber-concrete slab), effect of normal force on the vibration, modal analysis of slabs and its comparison with the modal analysis of earthquake design, ponding, slabs with continuous elastic support, plastic design.
12.	Basic equations of plates, boundary conditions (Kirchhoff plate), behaviour of plates, reinforced concrete plates, anisotropy plates, large deflection of plates, vibration of floors, explanation of the limits applied in design codes, vibration of floors supported by beams and its approximation with the help of the displacements, summation theory of Föppl, Southwell and Dunkerly, vibration of ribbed floors, effect of the shear on the vibration (ex. timber-concrete slab), effect of normal force on the vibration, modal analysis of slabs and its comparison with the modal analysis of

	earthquake design, ponding, slabs with continuous elastic support, plastic design.
13.	Basic equations of plates, boundary conditions (Kirchhoff plate), behaviour of plates, reinforced concrete plates, anisotropy plates, large deflection of plates, vibration of floors, explanation of the limits applied in design codes, vibration of floors supported by beams and its approximation with the help of the displacements, summation theory of Föppl, Southwell and Dunkerly, vibration of ribbed floors, effect of the shear on the vibration (ex. timber-concrete slab), effect of normal force on the vibration, modal analysis of slabs and its comparison with the modal analysis of earthquake design, ponding, slabs with continuous elastic support, plastic design.
14.	Basic equations of plates, boundary conditions (Kirchhoff plate), behaviour of plates, reinforced concrete plates, anisotropy plates, large deflection of plates, vibration of floors, explanation of the limits applied in design codes, vibration of floors supported by beams and its approximation with the help of the displacements, summation theory of Föppl, Southwell and Dunkerly, vibration of ribbed floors, effect of the shear on the vibration (ex. timber-concrete slab), effect of normal force on the vibration, modal analysis of slabs and its comparison with the modal analysis of earthquake design, ponding, slabs with continuous elastic support, plastic design.

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

Kollár L. P., Tarján G.: Tartószerkezetek elmélete és számítása, 2015

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:

2024/2025 semester II

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 tests and the examination.

3.2 Assessment methods

Evaluation form	**Abbreviation**	**Assessed learning outcomes**
1. midterm test	ZH1	B.1-B.2
2. midterm test	ZH2	B.3
3. midterm test	ZH3	B.4
1.-3. Homework	HW1-HW3	B.1-B.4; C.1-C.4
written examination	V	A.1-A.76 B.1-B.4; C.1-C.5; 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**
MT1	15%
MT2	15%
MT3	15%
HW1	3%
HW2	3%
HW3	3%
Total achievable during the semester	39%
Exam	61%
Sum	**100%**

3.4 Requirements and validity of signature

In order to obtain a signature, the student must have passed the midterm tests according to point 3.3 and have achieved at least 50% (19.5 points) of the total number of points in the semester.

15 points can be reached in each midterm test. The two best tests are taken as a basis for the semester performance. The midterms are unsuccessful if the sum of the two best tests does not reach 15 points. If the sum of the first and second (according to date!) tests is above 15 points and the third test is above 7,5 points, 50% of the points obtained in the weakest(!) test will be added as a bonus to the sum of the two best tests. There are no retakes of the tests.

Homework assignments are worth 3 points each, for a total of 9 points. No points will be awarded for homeworks submitted after the deadline.

Any student who takes a regular (non-examination) course with a signature received in a previous semester will have his/her previous result overwritten by his/her result for the current semester. Mid-semester results obtained previously in the subject and taken into account for the determination of the examination grade may be accepted retroactively back to 6 semesters.

3.5 Grading system

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%

Final grade is determined on the basis of the sum of the points obtained during the semester and the exam. An exam point lower than 40% (24.4 points) of the total, or an overall performance lower than 50% will result in an Unsatisfactory mark.

3.6 Retake and repeat

There is no repetition of the midterm tests.

3.7 Estimated workload

Activity	Hours/semester
contact hours	14×4=56
preparation for the courses	14×1=14
preparation for the tests	3×6=18
preparing the homework	3×10=30
preparation for the examination	32
Sum	**150**

3.8 Effective date

5 February 2020

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2024/2025 semester II