Plasticity - BMEEOTMMN61

I. Subject Specification

1. Basic Data

1.1 Title

Plasticity

1.2 Code

BMEEOTMMN61

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. Lógó János
academic rank	Professor
email	logo.janos@emk.bme.hu

1.8 Department

Department of Structural Mechanics

1.9 Website

https://epito.bme.hu/BMEEOTMMN61
https://fiek2.mywire.org/course/view.php?id=2000

1.10 Language of instruction

hungarian and english

1.11 Curriculum requirements

Recommended elective in the Specialization in Geotechnics and Geology, Strcutural Engineering (MSc) programme

Recommended elective in the Specialization in Numerical modelling, Strcutural Engineering (MSc) programme

Recommended elective in the Specialization of Structures, Strcutural Engineering (MSc) programme

1.12 Prerequisites

1.13 Effective date

5 February 2020

2. Objectives and learning outcomes

2.1 Objectives

The purpose of the subject is, that the students acquire the basic concepts and methods of plasticity. In the frame of this they will get to know the material models, yield and hardening conditions of plasticity. The torsion problem of prismatic bars, and planar problems of solids will be learnt through examples and applications. There will be an emphasis given to the plastic load bearing capacity of elasto-plastic frame structure, and their limit states.

2.2 Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge

1. is familiar with the basic concepts of plasticity, the general formulas of the material models of elasto-plastic materials,
2. knows the Huber-Mises-Hencky yield condition,
3. knows the Tresca yield condition,
4. knows the basic equations of elasto-plastic materials,
5. is familiar with the pinciple of virtual displacements and the principle of virtual forces,
6. is familiar with the extremum priciples of elasticity,
7. knows the principle of constant stresses in plasticity, and its consequences,
8. is familiar with the static and kinematic principle of the plastic limit state analysis, and applies it for frame structures,
9. is familiar with the concept of shakedown
10. knows the basics of mathmatical programming for the solution of plasticity problems,
11. is familiar with the theory of the torsion analysis of elaso-plastic prismatic bars,
12. is familiar with the problems of plasticity in the case of planar problems,

B. Skills

1. is able to write the general formulas describing the material laws of elasto-plastic materials,
2. is able to write the Huber-Mises-Hencky yield condition,
3. is able to write the Tresca yield condition,
4. analyses and compares the results of the Huber-Mises-Hencky and the Tresca yield conditions,
5. derives the static theorem of the constant stress of plasticity, and uses it accordingly,
6. speaks out the static theorem of plastic limit state analysis, and applies it to beam structures,
7. speaks out the kinematic theorem of plastic limit state analysis, and applies it to beam structures,,
8. derives the theorem of torsion of elasto-plastic prismatic bars, and applies its results correctly,
9. shows the shakedown anlysis with its static theorem and applies it for the shakedown analysis of a beam structure,
10. is able to solve planar problems of plasticity,

C. Attitudes

1. endeavors to discover and routinely use the tools necessary to the problem solving of plasticity problems,
2. endeavors to the precise and error-free problem solving,
3. aspires to prepare a well-organized documentation in writings, and pursues the precise self-expression in oral communication

D. Autonomy and Responsibility

1. independently carries out the conceptual and numerical analysis of structural engineering problems, based on the literature,
2. is open to accept well-founded critical comments.

2.3 Methods

Lectures, exercises, oral and written communication, application of IT tools and technologies, optional individual assignment.

2.4 Course outline

Week	**Topics of lectures and/or exercise classes**
1.	Introduction. Basic concepts. Material models of plasticity
2.	Yield and hardening conditions
3.	Deformation- and incremental theorems of plasticity
4.	Basic equations of elasto-plastic bodies
5.	Work and extremum theorems. Extremum theorems of plasticity
6.	Torsion of prismatic bars.
7.	Planar strain and stress state
8.	Planar strain and stress state
9.	Plastic load carriyng capacity of elasto-plastic bar structures
10.	Plastic shakedown analysis. Static and kinematic theorems, application for bar structures.
11.	Application of mathematical programming in limit state analysis and shakedown analysis.
12.	Analysis of the state change of elasto-plastic frame structures
13.	Analysis of the state change of elasto-plastic frame structures
14.	Analysis of the state change of elasto-plastic frame structures

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) Books:

- Kaliszky Sándor: Plasticity Theory and Engineering Applications. Akadémiai Kiadó, 1989.
- Kaliszky Sándor: Képlékenységtan elmélet és alkalmazások. Akadémiai Kiadó, 1975.

2.6 Other information

Students attending tests/exams must not communicate with others without explicit permission during the test/exam, and must not have an electronic or non-electronic device capable of communication switched on.

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: logo.janos@epito.bme.hu.

This Subject Datasheet is valid for:

Inactive courses

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 two mid-term written checks.
- The duration of each mid-term test is 90 minutes.
- The dates of checks and the deadlines of homeworks 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.6; B.1-B.5; C.1-C.3; D.1-D.2
2nd mid-term test (summarizing check)	ZH2	A.7-A.12; B.6-B.10; 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	50%
ZH2	50%
Sum	**100%**

3.4 Requirements and validity of signature

There is no signature from the subject.

3.5 Grading system

- A minimum presence of 70% is required to gain a signature
- In the case of complying with the requirements on attendance the results are determined as follows.
- Mid-term test result below 50% considered as unsuccessful.
- Both mid-term test must have a successful result to gain a semester mark.
- The semester result is computed by the weighted average A of the mid-term tests, as in section 3.3.:

Grade	Points (A)
excellent (5)	80%≤A
good (4)	70%≤A<80%
satisfactory (3)	60%≤A<70%
passed (2)	50%≤A<60%

failed (1)	A<50%

3.6 Retake and repeat

- In this subject each mid-term test can be retaken once. From the results of the original test and the retake the best counts.
- There is no second retake in this subject.

3.7 Estimated workload

Activity	**Hours/semester**
contact lesson	14×2=28
preparation for lessons during the semester	14×2=28
preparation for the checks	18+16=34
Sum	**90**

3.8 Effective date

5 February 2020

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Inactive courses