Strength of Materials - BMEEOTMAS41

I. Subject Specification

1. Basic Data

1.1 Title

Strength of Materials

1.2 Code

BMEEOTMAS41

1.3 Type

Module with associated contact hours

1.4 Contact hours

Type	Hours/week / (days)
Lecture	2

1.5 Evaluation

Exam

1.6 Credits

3

1.7 Coordinator

name	Bojtárné Dr. Bagi Katalin
academic rank	Professor
email	bagi.katalin@emk.bme.hu

1.8 Department

Department of Structural Mechanics

1.9 Website

https://epito.bme.hu/BMEEOTMAS41
https://edu.epito.bme.hu/course/view.php?id=374

1.10 Language of instruction

hungarian and english

1.11 Curriculum requirements

Compulsory in the Civil Engineering (BSc) programme

1.12 Prerequisites

Weak prerequisites:

- Structural Analysis I. (BMEEOTMAT43)

Recommended prerequisites:

- Structural Analysis I. (BMEEOTMAT43)
- Matematics A2a (BMETE90AX02)

1.13 Effective date

5 February 2020

2. Objectives and learning outcomes

2.1 Objectives

The subject first introduces the two most important energy theorems of strength of materials, the theorem of potential energy and the theorem of complementary potential energy. Using these theorems the equilibrium and compatibility states of elastic beams can be determined. Second, based on the concept of potential energy, the main methods of stability analysis (energy method; static method) and the fundamentals of buckling analysis of compressed columns are introduced.

2.2 Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge

1. knows the stationarity theorem of potential energy and the conditions of application
2. knows the minimum theorem of complementary potential energy and the conditions of application
3. knows the differential equation of the elastic curve
4. knows the energy method of stability analysis and the conditions of application
5. knows the static method of stability analysis and the conditions of application
6. knows the concept of slenderness limit
7. knows the method to determine the critical buckling stress for slender columns
8. knows the method to determine the critical buckling stress for short columns

B. Skills

1. formulates the potential energy of elastic beams based on the characteristic displacement functions,
2. formulates the complementary potential energy of elastic beams based on the characteristic internal force functions,
3. determines the deformed shape of bar structures with broken axis line approximately,
4. is able to perform stability analysis on structural models consisting of rigid bodies and springs, and to determine the critical load,
5. determines the critical buckling stress in slender and short bars under centric compression,
6. is able to express his/her thoughts in an organized way in oral and written communication,
7. is able to solve numerical problems reliably and accurately,

C. Attitudes

1. aims at learning and routinely using tools required for solving strength of materials problems,
2. aims at accurate and flawless problem solving

D. Autonomy and Responsibility

1. is able to individually think over strength of materials problems and to solve them using the given resources,
2. is open to valid criticism.

2.3 Methods

Lectures, numerical practices for large groups, oral and written communication, use of IT devices and techniques, optional practice problems solved individually and in teams (home practice), work management techniques.

2.4 Course outline

Week	**Topics of lectures**
1.	Work theorems (repetition)
2.	Stationarity theorem of potential energy
3.	Minimum theorem of complementary potential energy
4.	Application of energy theorems, problem solving
5.	Partial summary
6.	Differential equation of the elastic curve
7.	Application of energy theorems for static loads
8.	Application of energy theorems for kinematic loads
9.	Partial summary
10.	Fundamental concepts of stability analysis
11.	Basic problems of stability analysis
12.	Fundamentals of buckling analysis of compressed bars
13.	Buckling analysis of compressed bars, problem solving
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

Books:

- Kaliszky S. – Kurutzné Kovács M. – Szilágyi Gy.: Szilárdságtan, 2000;
- Hibbeler: Mechanics of Materials. Pearson, 2011;
- Gere – Goodno: Mechanics of Materials. Cengage Learning, 2015,
- Beer – Johnston: Mechanics of materials. McGraw-Hill, 2009

2.6 Other information

- Attendance at lectures is compulsory.
- 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: bagi.katalin@epito.bme.hu.

This Subject Datasheet is valid for:

2023/2024 semester II

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 six quiz checks, and an oral exam in the examination period.
- The duration of each quiz test is 22 minutes.
- The best two out of the first three quiz checks are to be considered with equal weights. The best two out of the second three quiz checks are to be considered with equal weights.
- No requirements are made on the successfulness of the tests.
- 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 quiz test (summarizing check)	ZH1	A3, B1, B2, B8-9, C1-2
2nd quiz test (summarizing check)	ZH2	A3, B5, B8-9, C1-2
3rd quiz test (summarizing check)	ZH3	A1, B8-9, C1-2
4th quiz test (summarizing check)	ZH4	A2, B8-9, C1-2
5th quiz test (summarizing check)	ZH5	B1-2, B8-9, C1-2
6th quiz test (summarizing check)	ZH6	A4-8, B6-7, B8-9, C1-2
Oral exam (summarizing check)	V	A.1-A.8; B.1-B.7; C.1-C.2; 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**
CT1	12,5%
CT2	12,5%
CT3	12,5%
CT4	12,5%
CT5	12,5%
CT6	12,5%
V	50%
Sum	**100%**

3.4 Requirements and validity of signature

- Signature and eligibility for the exam is granted if an average of 50% or more is reached in the four eligible essays (the two best of the first three and the two best of the second three).
- 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.
- The semester performance is determined by the results of the best two out of the first three quiz tests and the best two out of the last three quiz tests.
- Exam below 50% is regarded unsuccessful, the exam mark is "Failed" (regardless of the score attained in the semester).
- 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 exam 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

- The quiz tests cannot be retaken in this subject.

3.7 Estimated workload

Activity	**Hours/semester**
contact lessons	14×2=28
preparation for lessons during the semester	6×3=18
preparation for the checks	6×4=24
preparation for the exam	20
Sum	**90**

3.8 Effective date

5 September 2024

This Subject Datasheet is valid for:

2023/2024 semester II