# Basics of Statics and Dynamics - BMEEOTMAT41

## I. Subject Specification

1. Basic Data

1.1 Title

Basics of Statics and Dynamics

1.2 Code

BMEEOTMAT41

1.3 Type

Module with associated contact hours

1.4 Contact hours

| Type | Hours/week / (days) |
|---|---|
| Seminar | 5 |

1.5 Evaluation

Exam

1.6 Credits

6

1.7 Coordinator

| | |
|---|---|
| name | Dr. Hincz Krisztián |
| academic rank | Associate professor |
| email | hincz.krisztian@emk.bme.hu |

1.8 Department

Department of Structural Mechanics

1.9 Website

https://epito.bme.hu/BMEEOTMAT41
https://fiek2.mywire.org/course/view.php?id=451

1.10 Language of instruction

hungarian and english

1.11 Curriculum requirements

Compulsory in the Civil Engineering (BSc) 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 introduce the fundamental problems of rigid body mechanics, kinematic and kinetic analysis of planar motions of material points and rigid bodies, the procedure of statical analysis, the method for the calculation of reactions and internal forces, the procedure to determine internal force diagrams in the case of statically determinate simple and compound structures, the classification of structures and problems with respect to statical determinacy.

2.2 Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge

1. knows the concepts of velocity, acceleration, angular velocity, angular acceleration, and the relationships between them,
2. knows Newton's laws of motion and the major theorems based upon them,
3. clearly understands the concepts of linear momentum, angular momentum, kinetic energy in the cases of material points and rigid bodies,
4. knows the methods to determine the resultant of force systems,
5. knows the constraints used in statical models and the associated reaction types,
6. knows the concepts of statical determinacy, indeterminacy, and overdeterminacy,
7. knows the internal forces in bars and beams, their physical meaning and calculation methods,

B. Skills

1. is able to characterize the motion of material points and rigid bodies, to formulate the relationships between the variables,
2. marks the active and passive forces acting on the bodies of structures consisting of a single or multiple rigid bodies,
3. solves the elementary equilibrium problems,
4. formulates the equilibrium equation system for engineering structures,
5. formulates and solves the equilibrium equations for the calculation of each reaction force of simple structures,
6. characterizes each section of internal force diagrams of planar and spatial strucures in equilibrium, and calculates all characteristic values,
7. routinely draws the internal force diagrams of planar structures with straight axis lines,
8. performs the calculation of reactions and internal forces of spatial structures,

C. Attitudes

1. aims at accurate and flawless problem solving,

2. elaborates the solution such that it is clear to understand or possibly to continue,
3. aims at precise and clear use of language,

D. Autonomy and Responsibility

1. is open to criticism,
2. is prepared to recognize and correct errors,

2.3 Methods

Lectures and calculation practices based on the electronically distributed workbook, solving home works and practice problems in individual or team work.

2.4 Course outline

| Week | Topics of lectures and/or exercise classes |
|---|---|
| 1. | Basic concepts of mechanics, kinematics of material points |
| 2. | Kinetics of material points, Newton's laws |
| 3. | Kinematics and kinetics of rigid bodies |
| 4. | Distributed forces, mid-term summary |
| 5. | Reactions of simple structures |
| 6. | Reactions of compound structures |
| 7. | Trusses |
| 8. | Statical determinacy, mid-term summary |
| 9. | Internal forces of simple and compound structures |
| 10. | Internal force diagrams of simple structures |
| 11. | Internal force diagrams of compound structures |
| 12. | Internal force diagrams of structures with branching axis lines |
| 13. | Spatial internal forces, mid-term summary |
| 14. | Summary, repetition |

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: Gáspár-Tarnai: Statika (Műegyetemi Kiadó, 2002)
Online materials: Németh-Hincz-Kovács: Workbook (https://edu.epito.bme.hu/course/view.php?id=595)

2.6 Other information

- 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: hincz.krisztian@emk.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

- Evaluation of learning outcomes described in Section 2.2. is based on three mid-term tests, and an exam in the examination period.
- There are 90 minutes for the preparation and the submission of each mid-term test.
- The duration of the preparation part of the exam is 105 minutes.
- A mid-term test is valid (counted in the final grading) if its score reaches 50%.
- 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 mid-term test (summarizing assessment) | ZH2 | A.1-A.4; B.1-B.3; C.1-C.3 |
| 2nd mid-term test (summarizing assessment) | ZH2 | A.4-A.6; B.4-B.5; C.1-C.3 |
| 3rd mid-term test (summarizing assessment) | ZH3 | A.7; B.8; C.1-C.3 |
| Oral exam (summarizing check) | V | A.1-A.7; B.1-B.8; 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 | 15% |
| ZH2 | 15% |
| ZH3 | 15% |
| V | 55% |
| **Sum** | **100%** |

3.4 Requirements and validity of signature

A student is to obtain a signature and has eligibility for the exam
-if all three mid-term tests are valid, and
-the average of the three best mid-term tests reaches or exceeds 50%.

3.5 Grading system

- The exam with a result below 50% is regarded unsuccessful, the exam mark is "Failed".
- In the case of a successful written exam, the final result is computed by the weighted average A of the

exam, and the mid-term tests, as in section 3.3.

- The final mark depends on the A value as follows:

| **Grade** | **Points (A)** |
|---|---|
| excellent (5) | 85%≤A |
| good (4) | 75%≤A<85% |
| satisfactory (3) | 65%≤A<75% |
| passed (2) | 50%≤A<65% |
| failed (1) | A<50% |

3.6 Retake and repeat

- There is one retake of each mid-term test.
- There is no second retake in the subject.

3.7 Estimated workload

| **Activity** | **Hours/semester** |
|---|---|
| contact lessons | 35×2=70 |
| preparation for lessons during the semester | 35×1=35 |
| preparation for the checks | 6×5=30 |
| study of the assigned written sources | 9 |
| preparation for the exam | 36 |
| **Sum** | **180** |

3.8 Effective date

1 September 2022

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