# Surveying I. - BMEEOAFBsFC001-00

## I. Subject Specification

### 1. Basic Data

*1.1 Title*

**SURVEYING I.**

*1.2 Code*

**BMEEOAFAT45**

*1.3 Type*

Module with associated contact hours

*1.4 Contact hours*

| Type | Hours/week / (days) |
|---|---|
| Lecture | 1 |
| Lab | 2 |

*1.5 Evaluation*

Exam

*1.6 Credits*

3

*1.7 Coordinator*

| | |
|---|---|
| name | Dr. Szabolcs Rózsa |
| academic rank | Associate professor |
| email | rozsa.szabolcs@emk.bme.hu |

*1.8 Department*

Department of Geodesy and Surveying

*1.9 Website*

https://epito.bme.hu/BMEEOAFAT45
https://edu.epito.bme.hu/course/view.php?id=4720

*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 2023

## 2. Objectives and learning outcomes

*2.1 Objectives*

The aim of this course is to learn the basic concepts of Surveying, the structure of surveying instruments and the basic surveying observations and their processing, such as the optical levelling (line levelling, detail point levelling), the application of the theodolites and total stations and horizontal and vertical angular observations. Students will learn and practise the units used in surveying as well as the math solutions of coordinate and elevation computations.

*2.2 Learning outcomes*

Upon successful completion of this subject, the student:

A. Knowledge

1. Knows the basic concepts and functions of surveying and geodesy
2. Understands the structure and the variants of surveyors' levels.
3. Knows the possible solutions of height determination.
4. Knows the implementation of line levelling and detail point levelling as well as the processing of measurements.
5. Knows the systematic errors of levelling and the procedure and rules of levelling
6. Knows the way of implementation of trigonometric heighting and the systematic errors and their considerations
7. Knows the structure of the theodolite as well as the basics of its examination
8. Knows the systematic errors of angular observations and how to handle them
9. Knows the basics units used in surveying
10. Has a general knowledge of the projections and control networks used in practise and also knowhow to access surveying data
11. Knows the fundamental tasks of surveying calculations and the orientation of mean direction

B. Skills

1. Able to use the units used in surveying and to convert between them
2. Able to perform height determination with levelling
3. Able to set up theodolites/total stations and to carry out measurements of directions and zenith angles
4. Able to process measurements of directions and zenith angles as well as to correct the systematic errors
5. Able to reduce distance observations to the reference level (mean sea level)
6. Able to orient the observed mean directions, and to calculate the horizontal coordinates of unknown points using the 1. and 2. fundamental tasks of surveying

C. Attitudes

1. Collaborate with the professor and other students
2. Attempts to acquire the knowledge to use the necessary instruments to perform surveying tasks
3. Attempts to effectively use builtin programs and memory functions of calculators
4. Attempts for accurate and errorfree calculations, take advantage of control alternatives

D. Autonomy and Responsibility

1. Independently practise the usage of theodolite and prepare for the practical test
2. Openly receives the wellfounded critical comments

*2.3 Methods*

Lectures, computation and measurement exercises, communication in writing and oral, use of IT tools and techniques, tasks independently and teamwork, logistic techniques.

*2.4 Course outline*

*Principle of levelling, the usage of surveyors' level.*

| Week | Topics of lectures and/or exercise classes |
|---|---|
| 1. | The principle of positioning.. |

| | | |
|---|---|---|
| | | Height, altitude measurement. The structure of surveyors' level.<br>*Surveying: science and profession. Basic Calculation techniques: units. Calculations with angles. Trigonometric functions and their determination with a calculator. Trigonometric theorems* |
| | 2. | |
| | 3. | The rules and the systematic errors of levelling. Line levelling, detail point levelling.*Determination of vertical control points with levelling.* |
| | 4. | Detail point levelling |
| | 5. | Horizontal measurements. Angular observations, the theodolite.*Summary: height determination with levelling. The theodolite and its role in angular observations.* |
| | 6. | *Usage, setup and direction observation with the theodolite.* |
| | 7. | Systematic errors of angular observations. Examination of the theodolite. Mean direction, direction observations, zenith angle. Computation of excentric angular observations. *Usage of theodolite: horizontal and vertical angular observations, calculation of mean direction and zenith angle.* |
| | 8. | *Usage of the theodolite: measurement and processing of angular observations.* |
| | 9. | Geodetic projections. National control networks. Record of surveying data.<br>Summary the usage of theodolite |
| | 10. | *Calculations on the projection plane: fundamental tasks of surveying.* |
| | 11. | Trigonometric heighting. Definition of distances: corrections, reductions<br>*Orientation of mean directions on a known point* |
| | 12. | Calculation of trigonometric heighting. Summary of the |

| | |
|---|---|
| | calculations on the projection plane. |
| 13. | Fundamentals of mapping. Computer aided mapping, production techniques. *Intersections.* |
| 14. | *Optional practise: Total stations and their applications.* |

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) Printed lecture notes:

- Bannister-Raymond-Baker: Surveying (Prentice Hall)

b) Online materials:

- https://edu.epito.bme.hu/course/view.php?id=4720

*2.6 Other information*

*2.7 Consultation*

Appointments: As specified on the department's website, or in consultation with the course instructorsvia email

*This Subject Datasheet is valid for:*

2025/2026 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 ofstudent performance occurs via two midterm tests, a practical report and a written exam in the examination period.

*3.2 Assessment methods*

| Evaluation form | Abbreviation | Assessed learning outcomes |
|---|---|---|
| 1. Midterm test | MT1 | A.2, A.3, A.4, A.5; B.1, B.2; C.3 |
| 1. Practical report | PR1 | A.7, A.8; B.3, B.4; C.1 C.3; D.1, D.2 |
| 2. Midterm test | MT2 | A.9, A.10, A.11; B.1, B.6; C.3, C.4 |
| 2.Exam | E | A.1-A.12; B.1-B.6; C.3-C.4 |

The dates of deadlines of assignments/homework can be found in the detailed course schedule on the subject's website.

*3.3 Evaluation system*

To successfully gain the signature of the subject it is compulsory to acquire at least 50% of the points of the midterm tests. To complete the subject, the practical report must also be completed. To successfully complete the practical report, the given measurement and data processing task has to be completed correctly, within a specified time limit.

Students must sit an exam after successfully obtaining the signature from the course.

The weights of the assessments are as follows:

| Abbreviation | Score |
|---|---|
| MT1 | 20% |
| PR1 | 0% (must be fulfilled) |
| MT2 | 20% |
| **midterm in total** | **40%** |
| **Exam** | **60%** |
| **in total** | **100%** |

*3.4 Requirements and validity of signature*

To successfully gain the signature of the subject it is compulsory to acquire at least 50% of the points of the midterm tests. To complete the subject, the practical report must also be completed. To successfully complete the practical report, the given measurement and data processing task has to be completed correctly, within a specified time limit.

Minimum requirements:
- MT1 and MT2 a minimum requirement is 50% of the maximum points;
- PR1 must be passed
- a minimum attendance of 70% on both the lectures and the practicals are required

The validity of the signature is two years after its achievement.

*3.5 Grading system*

The final grade is defined as the lump sum of the MT1, MT2 and the Exam points.

To achieve a final grade the students must hold the signature from the course and earn the minimum of 50% on the exam.

The grade points are calculated as follows:

P = MT1 + MT2 + E,

where

- MT1 is the midterm test 1 with a maximum of 20 pts;

- MT2 is the midterm test 2 with a maximum of 20 pts;

- E is the written exam test with the maximum of 60 pts.

| **Grade** | **Points (P)** |
|---|---|
| excellent (5) | 88-P |
| good (4) | 76-87 |
| satisfactory (3) | 63-75 |
| pass (2) | 50-62 |
| fail (1) | -49 |

*3.6 Retake and repeat*

1. Minimum requirements are specified for both mid-term tests and the practical tests. Thus, all of them can be retaken once.
2. In case of retaking anassessment the second result will be taken into account from the new and previous results.
3. In case of failing the retake, there is a possibility for a second retake for 2 of the aforementioned assessments - after the payment of the predetermined fee in the completion week from

*3.7 Estimated workload*

| **Activity** | **Hours/semester** |
|---|---|
| contact hours | 14×3=42 |
| preparation for the practise | 14×1=14 |
| preparation for the assessments | 6+8+6=20 |
| preparation for the exam | 14 |
| **Sum** | **90** |

*3.8 Effective date*

1 September 2023

*This Subject Datasheet is valid for:*

2025/2026 semester I