SUBJECT DATASHEET

I. SUBJECT SPECIFICATION

1 BASIC DATA

1.1 Title

METHODS IN ENGINEERING ANALYSIS

1.2 Code

BMEEOHSMK51

1.3 Type

Module with associated contact hours

1.4 Contact hours

type	hours/week
lectures	1
seminars/exercise classes	1

1.5 Evaluation

midterm grade

1.6 Credits

3

1.7 Coordinator

name:	Dr. László Gergely Vigh
academic rank:	associate professor
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1.8 Department

Department of Structural Engineering (www.epito.bme.hu/hidak-es-szerkezetek-tanszek)

1.9 Website

www.epito.bme.hu/BMEEOHSMK51

1.10 Language of instruction

Hungarian and English

1.11 Curriculum requirements

Compulsory in all the MSc programmes of Civil Engineering

1.12 Prerequisites

No prerequisites

1.13 Effective date

February 1, 2019.

2 OBJECTIVES AND LEARNING OUTCOMES

2.1 Objectives

The objective of the course is that the student shall understand and be aware of the principles and basis of practical methods of engineering analysis and assessments, statistics, probability theory,

reliability analysis, numerical methods, risk analysis, optimization and digital signal processing. It also serves as the basis of the subsequent MSc subjects on modelling, design and programming.

2.2 Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge
   1. is aware of the principles and basic terms of statistics and probability theory, knows the basic statistical analysis and assessment methods, is aware of the distribution functions that are typical in civil engineering problems,
   2. is aware of the terms of failure probability and reliability index, the principles of basic reliability analysis methods (FORM, SORM and Monte Carlo analysis),
   3. understands the importance of serial and parallel reliability systems,
   4. is aware of the definition of risk, principles of risk analysis and decision making analysis,
   5. knows the principles of finite difference, finite volume and finite element methods in solution of partial differentiate equations,
   6. knows the basic terminology of digital signal processing and understands the consequences of too rough sampling,
   7. understands the aim of optimization, can distinguish local and global optimum, and is aware of the principles of the most important classic optimization techniques,

B. Skills
   1. applies the statistical methods for assessment of measuring results,
   2. solves simple reliability problems by FORM and Monte Carlo methods using specific softwares,
   3. computes risk on the basis simple logic tree,
   4. is able to formulate numerical solution for simple PDEs
   5. is able to compute and evaluate the Fourier spectra of digital signals,
   6. is able to present his/her results in proper written form,

C. Attitudes
   1. follows the lectures, makes effort to understand the study material,
   2. collaborates with the teacher in gaining knowledge,
   3. is continuously gaining knowledge,
   4. is open to the use of IT tools and equipments,
   5. aims accuracy in his/her calculations/solutions,

D. Autonomy and responsibility
   1. is independent in problem statements and solutions,
   2. aims understanding the complexity, comprehensiveness of the problems and recognizing the synergies.

2.3 Methods

Lectures emphasize the principles; rigorous mathematical derivation is not addressed. Practical lectures illustrate the practical application of the methods, incorporating the use of specific practical tools. Active involvement in and communication during the lectures are expected, helping the understanding of the study material. Homeworks help strenghtening the skills, while control tests support in deepen the knowledge.

2.4 Course outline

week Topics of lectures and/or exercise classes

1. Introduction. Numerical methods.
2. Finite difference method.
3. Finite volume method. Finite element method.

4. Digital signal processing.
5. Computational practice.
6. Summary. HW practice.
7. Basis of statistics and probability theory.
8. Statistical analysis in practice.
9. Principles of risk assessment and reliability analysis, uncertainties in engineering problems.
10. Methods of reliability analysis: practical use of FORM, SORM, Monte Carlo analysis.
11. Acceptable risk. Risk assessment, decision making.
12. Computational practice.
13. Summary. HW practice.
14. Optimization.

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) Textbooks, literature
    1. Wilcox: Numerical methods for PDEs. Unit 2, 16.90 Computational Methods in Aerospace Engineering, MITOpenCourseware.
    2. Hoffman – Frankel: Numerical methods for engineers and scientists. CRC Press, 2001.
    3. Faber: Risk and safety in civil, environmental and geomatic engineering
    4. Sorensen: Structural reliability theory and risk analysis
b) Online materials: materials uploaded to the web site of the subject, e.g.:
    1. Lecture notes, electronic lecture notes,
    2. slides of lectures and practices,
    3. solved problems
    4. midterm test samples with solution

2.6 Other information

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. Consultation during lecture breaks is also available.

II. SUBJECT REQUIREMENTS

3 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, homework assignments and class work.

3.2 Assesement methods

Type of evaluation	**abbrev.**	**assessed learning outcomes**
active involvement in lectures	A	A.1-A.7, B.1-B.6, C.1-C.5, D.1-D.2
Midterm control test #1 (30-minute test)	MT1	A.5-A.7, B.4-B.6, C.5, D.1
Midterm control test #2 (30-minute test)	MT2	A.1-A.4, B.1-B.3, C.5,D.1
Homework #1	HW1	B.4, B.7, C.2-C.5, D.1-D.2
Homework #2	HW2	B.5, B.7, C.2-C.5, D.1-D.2
Homework #3	HW3	B.1-3, B.7, C.2-C.5, D.1-D.2

Note: homeworks are defined as per TCSZ 110.§ (3) b) type.

The homeworks are mandatory. The dates of midterm tests and deadlines of assignments/homework and their type (mandatory or optional) can be found in the detailed course schedule on the subject's website.

3.3 Evaluation system

abbreviation	**score**
MT1	20%
MT2	20%
HW1	10%
HW2	10%
HW3	20%
A	20%
Total in semester	**100%**
Sum	**100%**

3.4 Requirements and validity of signature

No signature can be obtained.

3.5 Grading system

To obtain successful grade, attendance requirement must be fulfilled.

Semester grade is failed, if any of the following applies:

- MT1 is failed if the gained points do not achieve 50% of the achievable points.

- MT2 is failed if the gained points do not achieve 50% of the achievable points.
- A mandatory homework is failed if the gained points do not achieve 40% of the achievable points.
- Homework is failed if the sum of the homework points HW1 + HW2 + HW3 do not reach 50% of the achievable points.

The final grade is computed on the basis of the sum of MT1 + MT2 + HW1 + HW2 + HW3 + A, as follows:

grade	**points (P)**
excellent (5)	85<=P
good (4)	73<=P<85%
satisfactory (3)	61<=P<73%
passed (2)	50<=P<61%
failed (1)	P<50%

3.6 Retake and repeat

1) Late submission of homeworks – with penalty fee applied – is normally possible one week after the normal deadline. In case the normal deadline of a homework falls the last week of the study period, the late submission deadline is the last day of the supplementary week, 12:00. Schedule and details on the homework submissions can be found on the web site of the subject.
2) Each MT can be repeated (2nd attempt) during the supplementary week; the exact date and time of the repetition is announced on the web site of the subject. The new result overwrites the result of the 1st attempt.
3) "Active involvement in lectures" A cannot be repeated, cannot be substituted with other forms of activity.

3.7 Estimated workload

activity	**hours/semester**
contact hours	14×2=28
preparation for the lectures	12x0,5 + 2x8 = 22
preparation for the tests	5
homework	35
home studying of the written material	**90**
in total	14×2=28

3.8 Effective date

February 1, 2019.