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

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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

September 1, 2017.

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 methods of engineering analysis and assessments, statistics, probability theory, reliability analysis, numerical methods, risk analysis, optimization and digital sign 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), understands the time-dependent reliability problem,
   3. understands the importance of serial and parallel reliability systems and the simple methods for assessment of their reliability index,
   4. is aware of the fixed point iteration method and its stability criteria
   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 sign 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 most important classic optimization techniques,
   8. is aware of the definition of risk, principles of risk analysis and decision making analysis,
   9. knows the most important ways of hazard identification and characterization,

B. Skills
   1. applies the statistical methods for assessment of measuring results,
   2. solves simple reliability problems by FORM and Monte Carlo methods,
   3. creates reliability models of complex (serial, parallel or combined) systems,
   4. is able to formulate numerical solution for simple PDEs
   5. is able to provide iterative solution for implicit nonlinear equation,
   6. computes risk on the basis simple logic tree,
   7. 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 and the student fellows 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. in situations of group works, collaborates with his/her student fellows,
   3. 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 application of the methods. 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.
2. Basis of statistics and probability theory.
3. Classic reliability theory, principles of reliability analysis, uncertainties in engineering problems.
4. Methods of reliability analysis: FORM, SORM, Monte Carlo analysis.
5. Reliability models and analysis of serial and parallel systems.
6. Time-dependent reliability. Computational practice. Summary.
7. Fixed point iteration.
8. Finite difference method.
9. Finite volume method.
10. Finite element method.
11. Digital sign processing.
12. Optimization.
13. Risk. Acceptable risk. Principles of risk analysis. Identification and characterization of hazards, their models, logic trees.
14. Risk analysis, decision making. Bayes analysis. 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

a) Textbooks, literature
    1. Wilcox: Numerical methods for PDEs. Unit 2, 16.90 Computational Methods in Aerospace Engineering, MITOpenCourseware.
    2. Faber: Risk and safety in civil, environmental and geomatic engineering
    3. 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

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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

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 Assessment methods

Type of evaluation	**abbrev.**	**assessed learning outcomes**
active involvement in lectures	A	A.1-A.9, B.1-B.7, C.1-C.5, D.1-D.3
Midterm control test #1 (30-minute test)	ED1	A.1-A.3, B.1-B.3, C.5, D.1
Midterm control test #2 (30-minute test)	ED2	A.4-A.9, B.6, C.5,D.1
Homework #1	HF1	B.1-B.3, B.7, C.2-C.5, D.1
Homework #2	HF2	B.4, B.7, C.2-C.5, D.1-D.2
Homework #3	HF3	B.5, B.7, C.2-C.5, D.1-D.2
Homework #4	HF4	B.6-B.7, C.2-C.5, D.1-D.2

Note: homeworks are defined as per TCSZ 110.§ (3) b) type.
Three homeworks are mandatory, the fourth one is optional. 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**
ED1	25%
ED2	25%
HF1	10%
HF2	10%
HF3	10%
HF4	10%
A	10%
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:

- ED1 is failed if the gained points do not achieve 50% of the achievable points.
- ED2 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 HF1 + HF2 + HF3 + HF4 do not reach 50% of the achievable points.

The final grade is computed on the basis of the sum of ED1 + ED2 + HF1 + HF2 + HF3 + HF4 + 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 first day of the exam period 12:00. Schedule and details on the homework submissions can be found on the web site of the subject.
2) Each ED 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

September 1, 2017.