Fragility assessment - BMEEOHSDT71

I. Subject Specification

1. Basic Data

1.1 Title

Fragility assessment

1.2 Code

BMEEOHSDT71

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	Dr. László Gergely Vigh
academic rank	Associate professor
email	vigh.laszlo.gergely@emk.bme.hu

1.8 Department

Department of Structural Engineering

1.9 Website

http://epito.bme.hu/node/16225?language=en
https://fiek2.mywire.org/course/view.php?id=2475

1.10 Language of instruction

hungarian and english

1.11 Curriculum requirements

Ph.D.

1.12 Prerequisites

1.13 Effective date

1 September 2022

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2. Objectives and learning outcomes

2.1 Objectives

The motivation of the studies is to understand the meaning of „extreme event”, what is the failure probability/risk, what is the reliability of the structure, what is the acceptable risk, how to mitigate risk, development of standards for practicing engineers, assuring acceptable risk level, conventions for reliability analysis. The objective of the course is that the student shall understand and be aware of the principles and basis of fragility and risk assessment methods, fragility and hazard curves and the associated challenges, reliability analysis of complex systems, incorporation of time dependency, finding optimum risk, resilience assessment.

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,
2. knows the principles of fragility and risk assessment,
3. is aware of the uncertainties in engineering problems, the distribution functions that are typical in civil engineering problems, and the model development methods,
4. is aware of the terms of failure probability and reliability index, the principles of basic reliability analysis methods (FORM, SORM and Monte Carlo analysis),
5. knows the principles of resilience assessment

B. Skills

1. identifies failure modes,
2. applies the statistical and analysis methods for assessment of measuring results,
3. solves reliability problems by FORM and Monte Carlo methods using specific softwares,
4. uses reliability analysis for systems,
5. completes fragility assessment,
6. creates fragility curve,
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 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 to understand the complexity, comprehensiveness of the problems and recognize the synergies

2.3 Methods

Theoretical lectures and practical seminars are basically not separated, but are held in hybrid way. Theoretical parts emphasize the principles; rigorous mathematical derivation is not addressed. Practical parts 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.

2.4 Course outline

Week	**Topics of lectures and/or exercise classes**
1.	Introduction
2.	Reliability analysis (background lecture) - 1
3.	Reliability analysis (background lecture) - 2
4.	Problem statement, challenges in fragility assessment
5.	Challenges in fragility assessment
6.	Fragility curve
7.	Hazard curve
8.	Failure mode, systems
9.	Reliability analysis of systems
10.	Computational practice
11.	Time dependancy
12.	Partial factors, optimum risk
13.	Resilience assessment
14.	Resilience assessment

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:

- Faber: Risk and safety in civil, environmental and geomatic engineering
- Sorensen: Structural reliability theory and risk analysis
- Rao, S.R.: Engineering optimization – Theory and practice. Fourth Edition. Wiley, 2009.

b) Online materials:: materials uploaded to the web site of the subject, e.g.:

- Lecture notes, electronic lecture notes,
- slides of lectures and practices,
- solved problems
- background materials on reliability analysis

2.6 Other information

2.7 Consultation

The instructors are available for consultation during their office hours, as advertised on the information system. Special appointments can be requested via e-mail. Consultation during lecture breaks is also available.

This Subject Datasheet is valid for:

Inactive courses

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 of student performance occurs via homeworks, class work (active involvement in lectures) and examination.

3.2 Assessment methods

Evaluation form	Abbreviation	Assessed learning outcomes
Homework	HW	A.1-A.5; B.1-B.7; C.1-C.5; D.1-D.2
active involvement in lectures	A	A.1-A.5; B.1-B.7; C.1-C.5; D.1-D.2
oral exam	E	A.1-A.5; B.1-B.7; C.1-C.5; 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
HW	40%
A	10%
Total in semester	**50%**
E	50%
Sum	**100%**

There is no individual criteria for HW and A. To obtain successful grade, the sum of HW and A shall be equal to or exceed 50% of the achievable points, and E shall be equal to or exceed 50% of the achievable points.

3.4 Requirements and validity of signature

To obtain signature, the sum of HW and A shall be equal to or exceed 50% of the achievable points.
In case of re-application for the subject the results obtained during the new semester overwrite the results obtained during any previous semesters (except for the examination course).
Semester results achieved earlier can be considered retroactively in the evaluation process of further semester in accordance to the rules of the Code of Studies and Exams (BME TVSZ).

3.5 Grading system

Grade	Points (P)
excellent (5)	85<=P
good (4)	75<=P<84,5%
satisfactory (3)	60<=P<74,5%
passed (2)	50<=P<59,5%
failed (1)	P<50%

3.6 Retake and repeat

1. Late submission of homework is possible till 12:00 on the last day of the supplementary week. For the effective schedule of the homework assignments and due dates, consult the detailed course schedule of

the course on the subject website.
2. “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	14×0.5=7
homework	25
home studying of the written materials	5
preparation for the exam	25
Sum	**90**

3.8 Effective date

1 September 2022

This Subject Datasheet is valid for:

Inactive courses