

Course syllabus

Risk- och informationshantering inom bygg- och anläggningsteknik Risk and Information Management in the Built Environment

VBKN35, 7,5 credits, A (Second Cycle)

Valid for: 2023/24

Faculty: Faculty of Engineering, LTH

Decided by: PLED V

Date of Decision: 2023-02-07

General Information

Elective for: V5-hb, V5-at

Language of instruction: The course will be given in English

Aim

The aim of the course is to provide fundamental expertise, skills, and knowledge for the design of new and the management of existing buildings and infrastructure. The focus is on the management of risks (uncertainties and consequences) with the help of information and integrity management measures.

Learning outcomes

Knowledge and understanding

For a passing grade the student must

- understand and justify decisions optimized for economy and safety while supporting sustainability
- understand and explain the concept 'value of information' and the conditions for realizing this
- understand and explain the fundamentals of utility theory and decision theory in civil engineering
- understand and explain the fundamental concepts of reliability and risk-based approaches for the design of new structure and assessment of existing buildings and infrastructure

Competences and skills

For a passing grade the student must

- be able to identify decisions which optimize economy, safety, as well as support sustainability
- be able to perform decision analyses and value of information analyses
- be able to perform probabilistic design and assessment of new and existing buildings and infrastructure
- be able to select, create, verify, and update probabilistic models in built environment engineering application, e.g., concerning natural hazards, structural health information, structural integrity management, structural reliability, and risk management
- be able to summarize and critically evaluate data with established data analysis methods

Judgement and approach

For a passing grade the student must

- be able to evaluate economic and safety efficiency of engineering decisions before and after implementation of measures
- be able to evaluate the safety level of a structural system for service life extension and increased sustainability

Contents

The course covers:

- Elementary data analysis
- Fundamentals of probability, utility theory and decision analysis
- Random variables, random processes, and probabilistic inference
- Reliability analysis
- Demand, capacity, action, and information modelling
- Risk, decision and value of information analysis and tools
- Risk acceptance criteria
- Application examples
- Guest lectures from industry and research community

The course encompasses the methods of probabilistic modelling and model adaptation in the field of built environment engineering with emphasis on the topics of natural hazards, structural health information, integrity management, structural reliability, and risks. Ultimately, the students acquire abilities to perform decision and value of information analyses to identify economy and safety optimal, as well as sustainability supporting, decisions.

The course is based on lectures, seminars, exercises, a major project assignment, and an oral examination. The student can choose application area in the project assignment according to interest and can be associated with structural engineering, building physics, construction management, building materials or HVAC.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)

Assessment: The examination is based on an oral exam together with evaluation of the report from the project assignment. The dates for the oral exam are decided during the course.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts

Code: 0123. **Name:** Examination.

Credits: 4,5. **Grading scale:** TH. **Assessment:** Examination

Code: 0223. **Name:** Project Assignments.

Credits: 3. **Grading scale:** UG. **Assessment:** Project Assignments. For written assignments, not only the correctness of calculations and results is assessed, but also the quality of the presentation, i.e. structure and descriptive texts of the report.

Admission

Admission requirements:

- FMS032 Mathematical Statistics, Basic Course or FMSF50 Mathematical Statistics, Basic Course
- VBK013 Structural Engineering, Basic Course or VBKF15 Structural Engineering

The number of participants is limited to: No

The course overlaps following course/s: VBKN10

Reading list

- STRUREL, Software for reliability analysis, Munchen.
- Rychlik, I & Ryden, J: Probability and Risk Analysis. An Introduction for Engineers. Springer Verlag, 2006, ISBN: 978-3-540-24223-9. This book is available as e-book without cost for students at Lund University (found through LUBSearch).
- Faber, M. H.: Statistics and Probability Theory in Pursuit of Engineering Decision Support. Springer, 2012, ISBN: 978-94-007-4055-6. This book is available as e-book without cost for students at Lund University (found through LUBSearch).
- Joint Committee on Structural Safety (JCSS): Probabilistic Model Code. ISBN: 978-3-909386-79-6. Found on the following website: <https://www.jcss-lc.org/jcss-probabilistic-model-code/>.
- Faber, M. H., Ed.: Risk Assessment in Engineering - Principles, System Representation & Risk Criteria. JCSS Joint Committee on Structural Safety. Found on the following website: <https://www.jcss-lc.org/risk-assessment-in-engineering/>.
- Raiffa, H. and R. Schlaifer: Applied statistical decision theory. Wiley, 2000, ISBN: 978-0-471-38349-9. Available to the students on demand.
- Benjamin, J. R. and C. A. Cornell: Probability, Statistics and Decision for Civil Engineers. Dover, 2014, ISBN: 978-0486780726. Available to the students on demand.

Contact and other information

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Course homepage: <https://canvas.education.lu.se/>

Further information: Course homepage at Canvas