

Module Description, available in: EN

Lifecycle Management of Infrastructures

General Information

Number of ECTS Credits

3

Module code

FTP_Life

Valid for academic year

2023-24

Last modification

2022-10-11

Coordinator of the module

Thomas Herrmann (ZHAW, hemm@zhaw.ch)

Explanations regarding the language definitions for each location:

- Instruction is given in the language defined below for each location/each time the module is held.
- Documentation is available in the languages defined below. Where documents are in several languages, the percentage distribution is shown (100% = all the documentation).
- The examination is available 100% in the languages shown for each location/each time it is held.

	Lausanne			Lugano	Zurich		
Instruction					X E 100%		
Documentation					X E 100%		
Examination					X E 100%		

Module Category

FTP Fundamental theoretical principles

Lessons

2 lecture periods and 1 tutorial period per week

Entry level competences

Prerequisites, previous knowledge

Basic knowledge in mathematics (introductory lecture in analysis and linear algebra)

MS Excel (implementation of formulae, graphs)

Brief course description of module objectives and content

In this module, students are introduced into basic concepts of lifecycle management of infrastructures with respect to costs vs benefit. Established cost and benefit models of infrastructures are discussed. Based on lifecycle costs analysis, we introduce different methods for the assessment of maintenance strategies, and for decision making with respect to construction, preservation, and replacement. The cost-based approaches are complemented with methods for the analysis of reliability, availability, and risk.

Aims, content, methods

Learning objectives and acquired competencies

- the students understand the function and the benefit of infrastructures, and their effect on society, economy, and environment
- the students are familiar with the challenges for sustainable development of infrastructures
- the students are familiar with concepts for deriving requirements for infrastructures, their verification and validation.
- the students are familiar with the most important methods for decision making in infrastructure management, and are able to apply those methods in concrete cases; for example the calculation of life cycle costs or socio-economic impact, or the simultaneous minimization of costs and risks.
- the students are familiar with the different maintenance strategies (reactive, preventive, condition-based)
- the students know different models of failure and wear behavior, and can apply them
- students know the concepts of reliability theory
- the students are familiar with the method of risk-based maintenance, and can apply this method for maintenance management

Contents of module with emphasis on teaching content

- basic concepts
 - introduction into the infrastructure networks of electricity, water, road, and rail
 - concepts of cost and benefit assessment
 - standards for life cycle management
- infrastructure costs
 - life cycle costing
 - maintenance and replacement strategies for cost minimization
- assessment methods
 - cost-benefit analyses
 - monetary models of benefit and their limits
 - utility analysis
- Basic concepts of maintenance
 - Reliability and availability
 - failure and degradation behavior of systems and components, and modeling
 - Basic maintenance strategies and associated processes
- Maintenance management
 - decision making in maintenance
 - condition based maintenance
 - Reliability Centered Maintenance (RCM)
 - Risk based maintenance
 - Maintenance management in large asset portfolios

Teaching and learning methods

Lecture: Introduction in the relevant concepts with examples

Exercises: applications and use cases

Literature

Supplementary publications.

Note: Since part of the module content is based on Swiss standards, some literature is provided in German/French only.

Assessment

Certification requirements

Module does not use certification requirements

Basic principle for exams

As a rule, all the standard final exams for modules and also all resit exams are to be in written form

Standard final exam for a module and written resit exam

Kind of exam

written

Duration of exam

120 minutes

Permissible aids

Aids permitted as specified below:

Permissible electronic aids

- Laptop (incl. charging cable, mouse), calculator; Moodle access
- Any communication programs (e.g. email, chats, ...) have to be disabled and switched off. Make sure that no communication program is running which might create pop-up windows on your screen.
- Additional devices, like tablets (iPad, etc.), mobile phones, second screens, printers, ... are **not** allowed

Other permissible aids

- Open Book - you have basically access to any resource, including online resources (e.g. for translation). However, communication programs are forbidden (see above)
- Course slides and exercises
- Personal notes
- Any other document that has been created before the beginning of the exam, including Excel files or similar.

Special case: Resit exam as oral exam

Kind of exam

oral

Duration of exam

30 minutes

Permissible aids

No aids permitted