Computational analysis and design - BMEEOHSDT85

I. Subject Specification

1. Basic Data

1.1 Title

Computational analysis and design

1.2 Code

BMEEOHSDT85

1.3 Type

Module with associated contact hours

1.4 Contact hours

Type	Hours/week / (days)
Lecture	9
Seminar	4
Consultation	1

1.5 Evaluation

Exam

1.6 Credits

3

1.7 Coordinator

name	Dr. Balázs Kövesdi
academic rank	Associate professor
email	kovesdi.balazs@emk.bme.hu

1.8 Department

Department of Structural Engineering

1.9 Website

https://epito.bme.hu/BMEEOHSDT85
https://fiek2.mywire.org/course/view.php?id=2545

1.10 Language of instruction

english

1.11 Curriculum requirements

Ph.D.

1.12 Prerequisites

There are no subject prerequisites. Students participating in the course must be proficient in the design of steel and reinforced concrete structures, especially in the dimensioning of bridge structures. Students must know the basics of structural design based on Eurocode, the theoretical and practical basics of structural design, and the basics of the finite element method. Required knowledge of the English language: intermediate B2 level.

1.13 Effective date

1 September 2022

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2. Objectives and learning outcomes

2.1 Objectives

The purpose of the PhD course is to describe the application of advanced numerical modeling and experiment-based design of steel structures. In the framework of the course, the most advanced numerical modeling-based design procedures applicable in the current steel structural design, their practical applicability and limitations will be presented. In addition, methods of the correct application of experimental results supplementing numerical modeling-based design is introduced. Various experimental-based model validation techniques and design process development procedures are also presented. The practical applicability of the advanced design procedures is presented through examples of bridge structures. The course includes an explanation of the applicability of advanced numerical methods in the production technology of steel structures and welding simulation. Students who complete the course acquire knowledge in the following topics:

- application of advanced numerical modeling techniques in civil engineering structures;
- finite element model-based design of bridge structures and numerical simulation of modern bridge construction methods;
- components of bridge monitoring systems, design and application of their measurement results;
- application of experimental and/or measurement results in the design of steel structures;
- development of Eurocode-based design procedures based on numerical simulation and experiments;
- manufacturing technology developments based on numerical modeling - welding simulation.

2.2 Learning outcomes

Upon successful completion of this subject, the student:

A. Knowledge

1. knows advanced numerical modeling techniques,
2. knows the options for finite element model-based design of bridge structures and how to use them,
3. knows the components of bridge monitoring systems, the applicability of measurement results in design,
4. knows the possibility of developing Eurocode-based design procedures based on numerical simulation and experiments,
5. knows the possibilities of numerical modeling-based production technology developments (e.g. welding simulation) and their applicability in design.

B. Skills

1. able to apply advanced numerical modeling techniques in practice,
2. capable of advanced, numerical model-based modeling of steel structures, selecting the appropriate model level and creating the numerical model,
3. able to perform steel structural design based on the results of the numerical model, evaluate the results from a design theory point of view,
4. is able to take numerical model-based production technology innovations into account in the design process.

C. Attitudes

1. cooperates with the lecturer and fellow students in expanding knowledge,
2. open to the use of numerical tools,
3. open to the use of advanced sizing methods,
4. strives for accurate and error-free task solutions.

D. Autonomy and Responsibility

1. Independently thinks through the numerical modeling problems and design of steel structures based on the calculation results,
2. accepts and considers new dimensioning procedures with an open mind, their principles and correctness.

2.3 Methods

Lectures, calculation exercises, project assignment, written and oral communication, use of IT tools and techniques.

2.4 Course outline

Week	Topics of lectures and/or exercise classes
1.	Introduction - application of advanced numerical modeling techniques for civil engineering structures
2.	Finite element model-based design - basic assumptions and design methods
3.	Finite element model-based design of bridge structures, accurate calculation methods
4.	Development and numerical simulation of modern bridge construction methods
5.	Advanced numerical model-based fatigue assessment of bridge structures
6.	Development of Eurocode-based design procedures using numerical analysis
7.	Modelling of cyclic behaviour in the design of steel grades
8.	Structural analysis based on monitoring systems and measurement methods, processing and application of measurement results
9.	Production technology developments with numerical simulation - description of the welding simulation process - its theoretical background and application
10.	Project work description - presentation of numerical model-based design examples

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

1. L. Dunai; B. Kövesdi (Lecture notes): Numerical model based design - slideshows.
2. ECCS: Commentary and worked examples to EN 1993-1-5 "Plated Structural Elements".
3. B. Johannson, R. Maquoi, G. Sedlacek, C. Müller, D. Beg: Commentary and worked examples to EN 1993-1-5 "plated structural elements", Joint report, JRC Scientific and Technical Reports, First Edition, 2007.
4. prEN 1993-1-14: Eurocode 3 - Part 1-14: "Design assisted by finite element analysis", CEN.

2.6 Other information

2.7 Consultation

At a pre-arranged time with the course coordinator (Dr. Balázs Kövesdi, kovesdi.balazs@emk.bme.hu) and lecturer (Dr. László Dunai, dunai.laszlo@emk.bme.hu).

This Subject Datasheet is valid for:

Inactive courses

II. Subject requirements

Assessment and evaluation of the learning outcomes

3.1 General rules

The learning outcomes stated in point 2.2 are evaluated on the basis of a project work and the result shown in the exam.

3.2 Assessment methods

Evaluation form	Abbreviation	Assessed learning outcomes
Project work	HF	A.1-A.4; C.1-C.4
Exam	V	A.1-A.5; B.1-B.4; D.1-D.2

The exact time of the evaluations held during the semester, and the deadlines for homework assignments and submissions, are contained in the "Detailed Semester Timetable", which is available on the subject's website. 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
HF	20%
V	80%
Sum	**100%**

The condition for passing the subject is that the student achieves 50% of the available score on the homework. Insufficient performance in the exam will result in an Insufficient grade.

3.4 Requirements and validity of signature

The condition for obtaining the signature is that the student submits the project assignment.
Midterm results previously obtained from the subject, which can be taken into account when determining the exam grade, can be accepted retroactively for up to 6 semesters.

3.5 Grading system

Grade	Points (P)
excellent (5)	80<=P
good (4)	70<=P<80%
satisfactory (3)	60<=P<70%
passed (2)	50<=P<60%
failed (1)	P<50%

3.6 Retake and repeat

3.7 Estimated workload

Activity	Hours/semester
lectures	10×2=20
project work	5×10=50
preparation for exam	1×8=8

independent learning of designated written curriculum	12
Sum	**90**

3.8 Effective date

1 September 2022

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Inactive courses