Linnæus University

Dnr: 2022/4584-3.1.2.2

Course syllabus

Faculty of Technology

Department of Building Technology

4BY370 Konceptuell konstruktionsteknik, 10 högskolepoäng
4BY370 Conceptual structural design, 10 credits

Main field of study
Civil Engineering

Subject Group
Building Technology

Level of classification
Second Level

Progression
A1N

Date of Ratification
Approved 2019-06-10
Revised 2022-12-19 by Faculty of Technology. Content is revised and Old term (English B) removed from prerequisites.
The course syllabus is valid from autumn semester 2023

Prerequisites
General entry requirements for studies on second level with field specific requirements:

- Bachelor of Science within technology 180 credits, or equivalent qualification
- English 6

Objectives

The course gives a picture of and an understanding of the early phase of a construction project, before the final design concepts are determined, and verification models for structures.
Knowledge and understanding
For a passing grade the student must have

- knowledge and understanding of the role of the structural designer in the early stages of a construction project and
- an understanding of the Eurocode's verification models for the mechanical strength of structures in ultimate limit state and serviceability limit state.

Skills and Abilities
For a passing grade the student shall

- Be able to develop preliminary design solutions and make rough estimates of dimensions and material consumption based on limited information at an early stage in a construction project.
- Be able to choose and evaluate the advantages and disadvantages of different design concepts with regard to span widths, horizontal stabilizing systems, foundation, the length of time to complete constructions and the degree of prefabrication, fire protection and sound insulation.
- Be able to select appropriate static models based on the actual performance of the structural system with respect to, among other things, connections and joints between different structural parts, stiffeners of structural elements to avoid instability problems, and to be able to select appropriate structural solutions for the global stability of various construction works.
- Be able to analyse how different structural concepts affect the robustness of construction works and what may need to be changed or improved to get a sufficiently robust structural system.
- Be able to account for and communicate the advantages and disadvantages of different structural design concepts.
- Be able to apply the models of the Eurocodes for verifying the load-bearing capacity of construction works.

Assessment skills and problem approach
For a passing grade the student shall

- Be able to assess the advantages and disadvantages of different choices of structural design solutions and different choices of structural materials.
- Be able to assess whether sufficient information exists to be able to make a preliminary design of a construction works structural systems.

Content

The course deals with the early stages of a construction project, before the final constructive concept for load-bearing building components has been chosen. It is important at this stage to communicate with the client and the architect so that suitable structural concepts are evaluated and chosen and the intended functions are obtained in the finished construction works.

- An introduction to the early phase of a construction project and the role of the structural designer at this stage.
- Selection of suitable design concepts and stabilisation systems based on different functional requirements regarding the intended use of a building and the contractor's wishes for construction production technology.
- Selection of suitable design calculation models for different design concepts and systems for structural stabilisation.
- Rough estimates regarding calculations of the dimensions of structural elements based on limited information on loads and building design.
- Basic design rules in the Eurocodes, design situations and actions that shall be considered.
- Application of the Eurocode verification models for structural integrity, action effects with regard to different types of actions. Particular focus is placed on load takedown calculations in multi-storey buildings, wind loads, snow loads and accidental actions.
- Analysis of structural failures; what has gone wrong and how could more suitable constructive solutions have been chosen?

- Introduction to sustainability issues associated with the build environment, including assessment tools for sustainability.
- Application of simple assessment tools to quantify the sustainability of structural concepts in the early stage of a construction project.

The course includes three smaller assignments related to the content of the lectures. Also included in the course is a larger project work where selection of structural solutions and materials is made based on limited information. Calculations and selected solutions are documented in a technical report.

Type of Instruction

The teaching consists of lectures, seminars, exercises and project works. Compulsory elements are three smaller assignments and one larger project work. The larger project work shall be presented by each individual group. The smaller assignments are discussed at three seminars.

Examination

The course is assessed with the grades A, B, C, D, E, Fx or F.

The grade A constitutes the highest grade on the scale and the remaining grades follow in descending order where the grade E is the lowest grade on the scale that will result in a pass. The grade F means that the student’s performance is assessed as fail (i.e. received the grade F).

- Project work A-F 7 credits
- 3 smaller assignments A-F 3 credits (1 credit/task)

The final grade is a weighted mean relative the credits for each task, where the project work is given the weight 70% and the assignments together is given the weight 30%.

Repeat examination is offered in accordance with Local regulations for courses and examination at the first and second-cycle level at Linnaeus University.

If the university has decided that a student is entitled to special pedagogical support due to a disability, the examiner has the right to give a customised exam or to have the student conduct the exam in an alternative way.

Course Evaluation

During the implementation of the course or in close conjunction with the course, a course evaluation is to be carried out. Results and analysis of the course evaluation are to be promptly presented as feedback to the students who have completed the course. Students who participate during the next course instance receive feedback at the start of the course. The course evaluation is to be carried out anonymously.

Other

Grade criteria for the A–F scale are communicated to the student through a special document. The student is to be informed about the grade criteria for the course by the start of the course at the latest.

The course material is presented on an Internet website for students. Access to the Internet and computers is available in the university's computer rooms and at the university library.

Required Reading and Additional Study Material

Required reading
Bader, Thomas & Mattsson, Björn, The Eurocode verification format (70 pages).

Reference Literature
Implementation of Eurocodes – Handbook 3 – Action effects for buildings, Aachen 2005. Larsen, O P. (2016) Conceptual Structural Design - Bridging the gap between architects and engineers, ICE Publishing.

SS-EN 1990:2002 Eurocode – Basis of structural design

SS-EN 1990/A1:2005/AC:2010 Eurocode – Basis of structural design

SS-EN 1991-1-1/AC:2009 Eurocode 1: Actions on structures – Part 1-1: General actions – Densities, self-weight, imposed loads for buildings

SS-EN 1991-1-2/AC2:2013 Eurocode 1: Actions on structures - Part 1-2: General actions - Actions on structures exposed to fire

SS-EN 1991-1-3/A1:2015 Eurocode 1 – Actions on structures – Part 1-3: General actions – Snow loads

SS-EN 1991-1-4:2005/A1:2010 Eurocode 1: Actions on structures – Part 1-4: General actions – Wind actions

SS-EN 1991-1-7:2006/A1:2014 Eurocode 1 - Actions on structures - Part 1-7: General actions - Accidental actions

SS-EN 1992-1-1:2005/A1:2014 Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings

SS-EN 1993-1-1:2005/A1:2014 Eurocode 3: Design of steel structures - Part 1-1: General rules and rules for buildings

SS-EN 1995-1-1:2004/A2:2014 Eurocode 5: Design of timber structures - Part 1-1: General - Common rules and rules for buildings