Linnæus University

Jnr: 2021/4318-3.1.2.2

Course syllabus

Faculty of Technology
Department of Building Technology

4BY371 Byggnadsfysik med numeriska tillämpningar, 5 högskolepoäng

Building physics with numerical applications, 5 credits

Main field of study
Civil Engineering

Subject Group
Building Technology

Level of classification
Second Level

Progression
A1F

Date of Ratification
Approved 2019-06-10
Revised 2021-11-17 by Faculty of Technology. Assessment methods and Examination are revised.
The course syllabus is valid from autumn semester 2022

Prerequisites
Multivariable Calculus and Vector Calculus, 7.5 credits, The finite element method 7,5 credits or equivalent

Objectives

Knowledge and understanding
To pass, the student is expected to:

- Formulate definitions of the capabilities of different models in building physics.
- Motivate the choice of specific models
- Analyse the validity of different approximations and its numerical results.
- Validate and argue for suitable solution methods for different types of building physical applications.
- Present numerical theories and results orally and in writing.

Competence and skills
To pass, the student is expected to

- Be able formulate the theory behind finite element approaches for transient one- and two dimensional problems.
- Be able to write your own finite element computer program for transient one- and two dimensional problems.
- Be able to perform simulations on heat and moisture transport using the finite element approach

Judgement and approach
To pass, the student is expected to

- Be able to use numerical simulations to judge the performance of a building construction in terms of heat and moisture transport.
- Be able to judge which types of numerical approaches which are suitable for different building constructions.

Content
The course includes the following:

- A general orientation within the field of the building physic subject.
- Balance equations and constitutive equations.
- Strong and weak formulations of transient problems.
- One and two-dimensional finite element formulations.
- Time-stepping schemes and their stability.
- Non-linear transient problems and their numerical solution.
- Solution methods for moisture transport in building envelopes.
- Solution methods for heat transport in building envelopes.

The course includes one or two assignments. The assignments includes establishment of transient finite element models and their simulation results applied to building physical problems.

Type of Instruction
The teaching consist of classroom lesson where the main theory is presented. Each classroom lesson is accomplished by exercises under supervision of the teacher.

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).

The course is assessed through:

- Assignments, 3 credits (A-F)
- Exam, 2 credits (A-F)

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 a web study site that the students reach via the internet. 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

Björn Johannesson and Winston Mmari: Course compendium in Numerical Methods in Building Physics, 2020, approximately 150 pages. The material is provided by the Department of Building Technology, Linnaeus University.

Slides and other types of lecture notes will also be provided during the course.