Linnæus University

Dnr: 2021/2631-3.1.2.2

# Course syllabus

Faculty of Technology

Department of Computer Science and Media Technology

2DT901 Datorns uppbyggnad, 7,5 högskolepoäng
2DT901 Computer Organization, 7.5 credits

**Main field of study**
Computer Engineering

**Subject Group**
Computer Science

**Level of classification**
First Level

**Progression**
G2F

**Date of Ratification**
Approved by Faculty of Technology 2021-06-21
The course syllabus is valid from spring semester 2022

**Prerequisites**
Object-oriented programming, Parallel programming, Electromagnetism, and Discrete Mathematics or equivalent.

## Objectives

After completing the course the student shall be able to:
*Knowledge and understanding*

- A.1 Explain the importance of abstraction in the design of digital systems,
- A.2 explain the most important software and hardware abstractions in today's computer systems,
- A.3 explain the operation of moderately complex digital systems, and
- A.4 describe how virtualization and virtual memory work.

*Competence and skills*

- B.1 Analyze the performance of digital systems in terms of latency and capacity,
- B.2 design simple hardware systems based on various digital abstractions such as memories, logic circuits, logical trees, state machines, pipelining and buses,
- B.3 implement low-level programs in C, and
- B.4 translate simple programs written in any high-level language to machine

code.

*Judgement and approach*

- C.1 Assess how different hardware designs, e.g. in terms of cache and hit rate, affects the performance of application programs.

## Content

The course starts with various system components such as microcontrollers, I / O devices and sensors. To achieve an understanding of the interaction between hardware and software, the programming takes place in assembler.
In the latter part of the course, the system components are put together into a complete system, and the focus is shifted to e.g. virtualization and virtual memory. Programming under this part takes place in C.
The following topics are covered:

- Digital circuits and CMOS.
- Read, interpret and understand data sheets.
- Combinatorial and sequential logic.
- Permit machines.
- Hardware architectures, e.g. von Neumann.
- Machine code and assembler code.
- Low-level programming in C.
- The borderland between software and hardware.
- The memory hierarchy.
- Pipelines.
- Virtual memory.
- Devices and interrupts.

## Type of Instruction

Teaching takes place in the form of lectures and teacher-led laboratory work. The laboratory tasks are performed in groups.

## Examination

The examination of the course is divided as follows:

| Code | Designation | Grade | Credits |
|---|---|---|---|
| 2201 | Written exam | AF | 3,50 |
| 2202 | Programming tasks | AF | 4,00 |

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

The grade A constitutes the highest grade level, the remaining grades follow in descending order where the grade E constitutes the lowest grade level for passing. The grade F means that the student's performance has been assessed as failed.

Assessment of student performance is made through programming assignments and a written exam. Renewed examination is given in accordance with Local rules for course and examination at undergraduate and advanced level at Linnaeus University.

To pass the course, grade E or higher is required for all parts. The final grade is decided

from: written exam (40%) and programming assignments (60%).

If the university decides that a student is entitled to special educational support due to a disability, the examiner has the right to give an adapted test or that the student completes the test in an alternative way.

**Objectives achievement**

The examination elements are linked to the course objectives in the following ways:

| **Goal** | 2201 | 2202 |
|---|---|---|
| A.1 | ☑ | |
| A.2 | ☑ | |
| A.3 | ☑ | ☑ |
| A.4 | ☑ | |
| B.1 | ☑ | ☑ |
| B.2 | | ☑ |
| B.3 | ☑ | ☑ |
| B.4 | | ☑ |
| C.1 | ☑ | |

## 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 is conducted in such a way that the course participants' experiences and knowledge are made visible and developed. This means, for example, that we have an inclusive approach and strive for no one to feel excluded. This can be expressed in different ways in a course, for example by using the gender-neutral example.

## Required Reading and Additional Study Material

Required reading:

- Patterson, David A. och Hennessy, John L., *Computer Organization and Design - The Hardware/Software Interface*, latest edition, Morgan Kaufmann. Pages: 600 of 800.