**ECTS**  
5  
  
**Prerequisites**  
None. The course must be passed before graduation. 

**Main purpose**

The main purpose of the course is to gain a basic understanding of the organization and design of computers with a focus on the central processing unit (CPU) and the necessary logic involved in building a CPU.

**Knowledge**

Having completed this course, the student has gained knowledge in the below areas. Specifically, the student is able to:

* Describe and apply numbering representations, including two’s complement to represent negative numbers in the binary numbering representation
* Identify the functionality of basic logic gates and be able to combine them into half- and full-adders, flip/flops, etc.
* Describe Boolean algebra and it’s relation to digital circuits
* Describe the architecture of simple CPUs and how they function, explain the build and working behavior of basic building blocks of CPUs (registers, ALUs, etc.)
* Describe instruction set layout and identify memory architectures and addressing modes.

**Skills**

Having completed this course, the student should be able to:

* Create functioning assembler programs for microcontrollers
* Analyse ASM programs (AVR MCU) and calculate execution time
* Execute and debug assembler programs
* Analyze and describe simple logical circuits (Boolean expressions)
* Apply Boolean algebra to reduce digital circuits.

**Competences**

Having completed this course, students should be able to:

* Describe the functionality of the components of basic computer architectures
* Apply mathematical theory to understand low-level computer architecture and programming
* Create simple logic circuits used in CPUs
* Create applications using assembler programming
* Integrate simple I/O devices in embedded applications.

**Topics**

**Teaching methods and study activities**

The required workload for students is estimated at 137 hours where approximately 41 hours (55 lessons of 45 minutes) are in category 1 and 2 of the Student Activity Model.

**CATEGORY 1**  
Participation of lecturer and students  
 Initiated by the lecturer

36 hours - 26%

* Lessons, scheduled
* Excursions
* Project guidance
* Laboratory work
* Exams and tests

**CATEGORY 2**  
Participation of students

Initiated by the lecturer

8 hours - 6%

* Assignments, self-study
* Project and group work
* Homework and preparation for exams
* Evaluation of the teaching

**CATEGORY 3**  
Participation of students

Initiated by students

93 hours - 68 %

* Homework and preparation for exams
* Self-study
* Project work
* Study groups
* Literature search

**CATEGORY 4**  
Participation of lecturer and students

initiated by students

0 hours - 0 %

* Debate meetings
* Study guidance

**Resources**

Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi - The AVR Microcontroller and Embedded Systems using Assembly and C.  
Other resources made available on Studynet.

**Evaluation**

​Permit criteria for attending examination:

2 assignments must be approved before attending the examination.

**Examination**

​Written examination.

Duration: 2 hours.

Allowed tools:

* Course literature according to the course description
* Personal notes

Internal examiner.

The course must be passed before graduation.

**Grading criteria**

Examinations account for  100% of final grade.

**Additional information**

Examination is digital, and the student are required to bring a laptop that are tested and ready for use with Wiseflow and FlowLock.

**Responsible**  
Laurits Ivar Anesen  
  
**Valid from**  
1.8.2019  
  
**Course type**  
ICT Engineering;Compulsory Course for all ICT Engineering;3. semester;Compulsory for the specialization Business Information Systems;Compulsory for the specialization Cross Media;Compulsory for the specialization Embedded Engineering;