Offered by
ICT Engineering

IT-CAL1

1.1

Computer Architecture Lab

ECTS
10

Prerequisites
Knowledge about basic computer programming.

- SDJ1

Main purpose
The main purpose of the course is to provide students with an introduction to computer architecture and low-level software development, including tools and theory needed to write working software for embedded systems (ASM/C).

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

- Explain numbering representations, including two's complement to represent negative numbers in the binary numbering representation
- Understand the functionality of basic logic gates, half- and full-adders, flip/flops, etc.
- Understand how Boolean expressions can be used to reduce Boolean expressions
- Explain the architecture of simple CPUs and how they function, explain the build and working behavior of basic building blocks of CPUs (registers, ALUs, etc.)
- Explain assembler programming
- Explain Clocks, instruction set layout, memory architectures, addressing modes
- Explain basic C programming artefacts and constructs
- Understand pointers and simple data structures in C
- Understand Test Driven Development (TDD)

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

- Write functioning C programs for embedded systems
- Use automated tests (Unit tests) to verify behaviour of C programs
- Use UML to document C programs
- Write functioning assembler programs for microcontrollers
- Calculate execution time of ASM programs (AVR MCU)
- Debug assembler/C programs
- Analyze and describe simple logical circuits (Boolean expressions)
- Use Boolean algebrato reduce Boolean expressions

Competences
Having completed this course, students should be able to:

- Understand and explain the functionality of the components of basic computer architectures
- Use mathematical theory to understand low-level computer architecture and programming
- Construct small applications using low-level C and assembler programming
- Be able to integrate simple I/O devices in embedded applications

Topics

- Problem solving
- Number systems and number representations
- Digital electronics (gates, flip/flops, etc.)
- Boolean algebra
- CPU Architecture
- Memory
- Stack
- I/O
- Buses
- Instruction set
- Assembler programming
- Subroutines, calling conventions
- Introduction to timers and interrupts (AVR MCU)

- Logical operators
- Functions
- Logical operators
- Structuring source files for C
- Arrays and simple data structures
- Pointers in C
- Abstract data types in C
- UML in embedded Applications
- Atmel AVR
- Test Driven Development (TDD)

Teaching methods and study activities
Activities change between theory, self-study and exercises in the lab. The mandatory course tasks will typically be done in small project groups.

Each group must deposit 600 DKK for loan of necessary equipment.

Resources

- The AVR Microcintroller and Embedded System – using assembly and c; Muhammad Ali Macidi, Sermad Naimi, Sepehr Naimi. Prentice Hall, ISBN 0-13-800331-9 or 978-1292042565
- On-line resources
- Hand-outs

Evaluation
Internal examination.

Three-hour written exam (75%) and hand-in exercises (25%) with marks according to the 7-point grading scale.

Examination

Three-hour written examination.

Grading criteria
According to the 7-point grading scale.

Mark 12:
Awarded to students who have shown excellent comprehension of the above-mentioned competences. A few minor errors and shortfalls are acceptable.

Mark 02
Awarded to students for the just acceptable level of comprehension of the required competences.

Additional information
Required workload for students is estimated to 275 hours where approximately 2/3 is self-study including exercises and examination preparation.

Responsible
Ib Havn

Valid from
1.8.2017

Course type
ICT Engineering;Compulsory Course for all ICT Engineering;Business Information Systems;Cross Media;Embedded Engineering;

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