Course Description   Computer Architecture

Keywords: **Microprocessor, Microcontroller, Instruction Set Architecture, Assembler programming**

Audience: 4th term SWB, TIB   **Modul Number:**   **IT 105 4003**

Workload:	**5 ECTS**	**150 h**
divided into	Contact time	75 h
	Self-study	45 h
	Exam preparation	30 h
Course language:	**English or German**	
Modul director:	**Prof. Dr.-Ing. Rainer Keller**	

Valid as of: **09.03.2023**

Recommended requirements:

Programming, Digital processing 1 – 2, software technology, Operating Systems

Desired learning outcomes of the moule:

The students understand the concept and setup of microprocessors including peripheral units and are able to program them. They have a basic understanding of the Instruction Set Architecture of computers and understand how to map programming constructs of higher programming languages onto "the hardware". They understand the interaction of programming languages, the Operating System and the Hardware in order to develop efficient Software.

Knowledge – professional competences
Students know:
- The architecture of computers with microprocessors and microcontrollers,
- The Instruction Set Architecture of microprocessors.

Skills – methodical competences
Students are able to:
- Map programming constructs of higher programming languages onto „the Hardware",
- Create programs in Assembler,
- Program peripheral units to process physical events.

Comprehensive Competencies
Students are able to
- Understand the interaction between programming languages, Operating System and the Hardware.

Contents:

- Setup of computer systems, arithmetic-logic operations,
- Programming model (register set, addressing modes, memory map, instruction set) of an exemplary microprocessor,
- Introduction into machine language, mapping of important high-level language constructs onto the machine language, approximation of memory consumption and execution speed,
- Hardware/Software interfaces for typical peripheral units, digital and analog In-/Output, Timer, simple network interfaces,
- Modular programming, Interfaces for the interaction of different programming languages,
- Support from the Microprocessor for mechanisms required by Operating Systems, e.g. memory protection, virtual memory,
- Overview over current architectures of Micro- and Signal processors: Technology and economical value.

Literature:

- Patterson, D.; Hennessy, J.: Computer Architecture and Design, Morgan Kaufmann, Verlag, 2008.
- Tanenbaum, A.: Structured Computer Organization, Prentice Hall Verlag, 2012.
- Huang, H.W.: The HCS12/9S12. An Introduction to the hardware and software interface. Thomson Learning Verlag, 2009.

Offered:

Every semester

Submodules and Assessment:

Type of instruction:	Lecture with exercises and exam preparation
Type of assessment:	Exam (90 minutes)
Hours per week:	4 SWS
Estimated student workload:	120 hours

Submodules and Assessment:

Type of instruction:	Labor exercises
Type of assessment:	Test
Hours per week:	1 SWS
Estimated student workload:	30 hours

Generation:

Students are able to develop close to the hardware with C/C++ and Assembler in the exercises.

Generation of the module grade:

Exam, ungraded Test