

**Module description: Computer Engineering 1**

<b>Module Code</b>	t.BA.XX.CT1.10HS
<b>ECTS Credits</b>	4
<b>Language of Instruction/Examination</b>	German
<b>Organizational Unit</b>	InES
<b>Module Coordinator</b>	Juan-Mario Gruber
<b>Legal Framework</b>	The module description is part of the legal basis in addition to the general academic regulations. It is binding. During the first week of the semester a written and communicated supplement can specify the module description in more detail.
<b>Module Characteristic</b>	Type 3a  2 lecture lessons per semester week and class+ 2 lab bi-weekly lessons per semester and half-class
<b>Module Description</b>	The module deals with the interaction of hardware and software for realising a computer system. It conveys the structure and functionality of a processor from the programmer's point of view and shows how programs are converted into executable machine code.

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<b>Module Content</b>	<p><b>Organization of a computer system</b></p> <ul style="list-style-type: none"><li>• Information presentation and translation of programs</li><li>• Hardware architecture: CPU, memory, I/O, bus</li><li>• Components and Functionality of a CPU</li><li>• Instruction set: Coding of instructions and operands</li><li>• Command processing</li><li>• Performance features of processors</li></ul> <p><b>Data transfer and memory organization</b></p> <ul style="list-style-type: none"><li>• Addressing modes</li><li>• Memory access</li><li>• Integer data types, arrays, pointers</li><li>• Memory map</li><li>• Endianess</li></ul> <p><b>Arithmetic Logic Unit (ALU)</b></p> <ul style="list-style-type: none"><li>• Arithmetic and logical operations</li><li>• Processor Status Registers and Flags</li><li>• Calculating with the ALU</li><li>• Integer casting</li></ul> <p><b>Program sequence control, functions and subprograms</b></p> <ul style="list-style-type: none"><li>• Compare and jump commands</li><li>• Structured coding</li><li>• Mapping of control structures parameter transfer and stack frame</li></ul> <p><b>Exceptional Control Flow</b></p> <ul style="list-style-type: none"><li>• Hardware Interrupts</li><li>• Interrupt Service Routine</li><li>• Vector table</li><li>• Exceptions (Traps)</li></ul> <p><b>Linking</b></p> <ul style="list-style-type: none"><li>• Tasks and functionality of a linker</li><li>• Address resolution and relocation</li><li>• Left Map and Symbol Table</li></ul> <p><b>Practical exercises</b></p> <ul style="list-style-type: none"><li>• Hardware-related programming internships on a concrete target system</li><li>• Working with Cross-Compiler, Assembler, Linker, Loader and Debugger</li></ul>
<b>Prerequisite Knowledge</b>	<ul style="list-style-type: none"><li>• Programming knowledge in C</li><li>• Basics of digital technology</li><li>• Number systems: Decimal, Binary, Hexadecimal, Two's Complement</li></ul>

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Learning Objectives (Competences)	Students...			Competencies	Taxonomies
	You can explain how function calls and interrupts occur on a processor and apply the knowledge in your own programs.			M, F	K2, K3
	You can describe the structure and function of a processor. You can explain how instructions are processed in a processor.			F	K1, K2
	You can create system-oriented programs and transfer the knowledge into different programming languages. You know the possibilities of a toolchain and can set up and use a development environment.			M	K3
	You understand how structures and data types of high-level languages are converted into executable machine code by the compiler. You will use this knowledge to optimize performance.			F, M	K2, K3
	You can independently familiarize yourself with new microprocessor architectures.			SE, M	K2
Performance Assessment	End-of-module exam	Assessment	Length (min.)	Weighting	Form
	written exam	Grade	90	70	acc. to module agreement
	Performance assessment during the semester	Assessment	Length (min.)	Weighting	Form
	written exam	Grade	45	15	acc. to module agreement
	Presentation Graded assignments during teaching semester			15	acc. to module agreement
Classroom Attendance Requirement	None  The labs have to be submitted on site during the lab lessons.				
Learning material					
Comments	<b>Mandatory mid-term exam:</b> Date according to course schedule. Missed exams: Dispensation in advance possible for justified cases. Afterwards only with medical certificate. Resit can be an oral exam. Missed exams without dispensation will receive a 1.0 grade. <b>Labs:</b> grading based on the presence and number of solved labs. Lab solutions (programs) have to be presented and explained to the lecturer. <b>Semester end exam:</b> Written exam or Moodle; documents and tools as according to specification. Covers the topics from lectures and labs.				