

**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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<b>Learning Objectives (Competences)</b>	<b>Students...</b>		<b>Competencies</b>	<b>Taxonomies</b>																
	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																
<b>Performance Assessment</b>	<table border="1"> <thead> <tr> <th>End-of-module exam</th> <th>Assessment</th> <th>Length (min.)</th> <th>Weighting</th> <th>Form</th> </tr> </thead> <tbody> <tr> <td>written exam</td> <td>Grade</td> <td>90</td> <td>70</td> <td>acc. to module agreement</td> </tr> </tbody> </table>					End-of-module exam	Assessment	Length (min.)	Weighting	Form	written exam	Grade	90	70	acc. to module agreement					
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None																				
<b>Classroom Attendance Requirement</b>																				
<b>Learning material</b>																				
<b>Comments</b>																				