

Optional course: code UE HAE924E

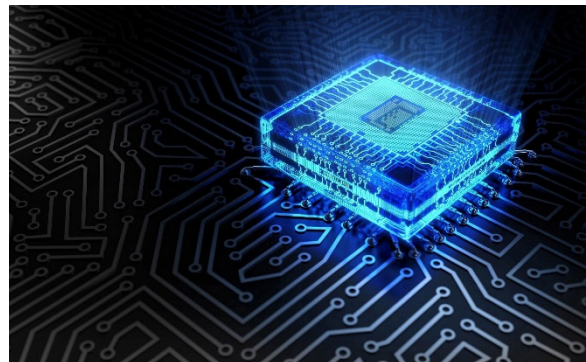
System on Chip and Embedded systems (5 ECTS)

Learning Outcomes:

- Knowledge and implementation of the main functionalities of a micro-controller: GPIO, Clock, Timer, PLL, PWM, DAC, ADC, SPI, I2C. Programming in C and assembler on STM32 (and/or PIC): Features, data representations, interrupt handling. Choice and dimensioning of a solution according to a need: Direct programming Vs embedded OS. Joint hardware and software design in VHDL language, FPGA prototyping of an embedded system based on a 32-bit MIPS processor, performance measurement and optimization by hardware acceleration.

Description :

- Lecture
 - Fundamentals of digital logic: combinatorial and sequential circuits
 - Basic constructs: Finite State Machines, shift registers, datapaths, memories etc
 - Hardware Description Language: VHDL for modeling, simulation and logic synthesis - Reconfigurable logic: FPGA, principles and applications
 - Computer architecture: from the Von Neumann machine to modern computer architectures - Microcontrollers
 - standard instruction set architectures (MIPS32, RISC-V)
 - computer organization: memories, busses, cache memories, instruction pipeline, interfaces
 - Advanced concepts: NUMA, cache coherence, shared / distributed memories, compute acceleration
 - Fundamentals of operating systems
- Labs
 - Hands-on exercises with
 - VHDL basics, simulation
 - Logic synthesis (ASIC)
 - FPGA prototyping
- Projects
 - Projects topic decided upon course start. Possible topics cover microcontrollers, compute accelerator implementation and exploitation for 32-bit processors etc.



Literature

- The VHDL Cookbook (Peter J. Ashenden)