

Module Name	Analogue and Digital Circuit Design Advanced
Module Number	Eul-ET-C-ADSTV, Eul-IST-C-ADSTV
Responsible Lecturer	Prof. Dr. sc. techn. habil. Frank Ellinger frank.ellinger@tu-dresden.de
Qualification Objectives	After completing the module, students have advanced knowledge of the functionality and design principles of analogue and digital circuits. They possess knowledge of semiconductor devices – particularly transistors – and master the analysis and design of analogue, mixed-signal, and digital circuits. They are familiar with the architecture and system concepts of complex digital systems. Students are acquainted with current concepts and issues in the field of circuit design, including specific challenges in nanoscale CMOS technologies, methods for reducing power dissipation, measures to increase processing speed, and the consideration of statistical influences from manufacturing technologies. Students can apply their theoretical knowledge in practice, measure circuit parameters, and evaluate these in comparison to theoretical designs.
Contents	The module covers the analysis, dimensioning, and optimization of analogue and digital circuits. It also includes examples of chip implementations based on current semiconductor technologies such as CMOS and BiCMOS. Topics related to analogue circuits include amplifier concepts (e.g., bandwidth enhancement considering the Miller effect), multistage amplifiers (e.g., cascode), power amplifiers, current sources, current mirrors, and circuits for DC power supply. Topics related to digital circuits include the design of complex logic functions in the form of arithmetic-logic circuits (e.g., ALUs, shifters, and multipliers), state machines such as finite state machines, and flip-flop and oscillator circuits. Additional topics include digital architecture and system concepts such as register-transfer logic, memory architectures (e.g., DRAM, SRAM, and EPROM), mixed-signal circuits (e.g., ADC, DAC, and interfaces), and the methodology for designing complex digital and mixed-signal systems. The module also includes hardware-based setups and measurements of electronic circuits, such as basic amplifier circuits, feedback circuits, power amplifiers, operational amplifiers, voltage supply circuits, basic digital circuits, flip-flop circuits, and state machines.
Teaching and Learning Forms	3 hours per week of lectures, 2 hours per week of exercises, 2 hours per week of practical lab courses, and self-study.
Prerequisites for Participation	The competencies to be acquired in the module "Circuit Design" are required.
Usability	The module is a compulsory module of the main study program in the fields of Information Technology as well as Microelectronics in the diploma program Electrical Engineering and Information Systems Engineering. It creates the prerequisites for the modules that list this module in the field "Prerequisites for Participation."
Prerequisites for the Award of Credit Points	Credit points are awarded when the module examination is passed. The module examination consists of a written exam lasting 150 minutes and a complex assignment with a workload of 63 hours. Both examination components are mandatory for passing.
Credit Points and Grades	8 credit points can be earned through the module. The module grade is determined by the weighted average of the grades of the examination components. The written exam is weighted sevenfold, and the complex assignment is weighted threefold.
Frequency of the Module	The module is offered every winter semester.
Workload	The total workload is 240 hours.
Duration of the Module	The module lasts one semester.