2.4.2 Advanced Electronics

Advanced Electronics

Module Summary
Module code: EEIB420
Module coordinator: Prof. Dr. Frieder Keller
Credits (ECTS): 7 Points
Semester: 4. Semester
Pre-requisites with regard to content: Competencies acquired in modules Mathematics 1 + 2 +3, Circuit Analysis 1 + 2, Instrumentation and Measurement, Signals and Systems
Pre-requisites according to the examination regulations: Regarding to the examination regulations no pre-requisites are required
Participants will be able to describe and analyze electronic circuits and to design basic circuits for a given purpose of application by • knowing about properties of semiconductor materials as well as the characteristics of diodes, bipolar- and field effect-transistors • knowing about the behavior of semiconductor devices a part of electronic circuits • representing diodes and transistors by equivalent circuit diagrams • apply small-signal parameters to describe amplifier circuits • partitioning complex circuits in acquainted basic circuits, • designing circuits for a given application by combination of basic circuits to develop an advanced understanding of electronic semiconductor circuits.
Assessment: Exam, 120 minutes for the theoretical aspects. Practical skills are evaluated by colloquia during the lab experiments and a written report for each experiment.
Usability: This module provides the basics of semiconductor based electronic circuits. Aspects of Instrumentation and Measurement are treated in the same-named module.

Course: Advanced Electronics
Module code: EEIB421
Lecturer: Prof. Dr. Michael Bantel, Prof. Dr. Frieder Keller, Prof. Dr. Alfons Klönne, Prof. Dr. Hermann Ng
Scope of weekly semester hours (SWS): 4
Semester of delivery: Summer semester
Type/mode: Lecture, Compulsory subject

Language of instruction: English
Content: • Properties of semiconductor materials • Semiconductor diodes • Bipolar transistors (npn and pnp) • Characteristics of bipolar transistors • Ebers-Moll und Gummel-Poon model • Spice-Parameter of bipolar transistors • Transistor used as switches, active and reverse area, saturation • Transistor used as small-signal amplifier, small-signal parameters and calculation of the operating point • Calculation of the frequency response • Miller-theorem • Evaluation of harmonics and distortion • Current sources and current mirrors • JFETs • n-MOS und p-MOS FETs • calculation of the operating points of FETs • FET as small signal amplifier • Basics of integration • CMOS inverters • Parasitic effects in integrated circuits
Recommended reading: • Tietze, Ulrich; Schenk, Christoph: Electronic Circuits, Springer Verlag • Horowitz, Paul; Winfried, Hill: The Art of Electronics. Cambridge University Press • Sedra, Adel, S., Kenneth C. Smith: Microelectronic Circuits, Saunders College Publishing • Gray, Paul R., Robert G. Meyer: Analysis and Design of Analog Integrated Circuits, John Wiley & Sons, Inc. • Soclof, Sidney: Design and Applications of Analog integrated Circuits, Prentice Hall, Eglewood Cliffs • Böhmer, Erwin: Bauelemente der angewandten Elektronik, Vieweg Verlag

Course: Advanced Electronics Lab
Module code: EEIB422
Lecturer: Prof. Dr. Michael Bantel, Prof. Dr. Frieder Keller
Scope of weekly semester hours (SWS): 2
Semester of delivery: Summer semester
Type/mode: Laboratory, Compulsory subject
Language of instruction: English

Experiments: • SPICE simulation of basic circuits treated in the lecture • Measurement of characteristics of a transistor circuit, examination of the operation areas: active and reverse area, saturation • Differential amplifier used in OPAMPs • Amplifier based on bipolar technology • Push-Pull-Amplifier (Class A, Class B, Class A-B modes)
Recommended reading: • Tietze, Ulrich; Schenk, Christoph: Electronic Circuits, Springer Verlag • Horowitz, Paul; Winfried, Hill: The Art of Electronics. Cambridge University Press • Sedra, Adel, S., Kenneth C. Smith: Microelectronic Circuits, Saunders College Publishing • Böhmer, Erwin: Bauelemente der angewandten Elektronik, Vieweg Verlag