

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
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