Index

Electrical Engineering

Electrical Engineering 1
# Electrical Engineering

**Modules referring to Electrical Engineering**

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<thead>
<tr>
<th>Code</th>
<th>8833271399</th>
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</thead>
<tbody>
<tr>
<td>ECTS credits</td>
<td>5</td>
</tr>
<tr>
<td>Attendance time</td>
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</tr>
<tr>
<td>Language of instruction</td>
<td>English</td>
</tr>
<tr>
<td>Duration</td>
<td>1 Semester Semester</td>
</tr>
<tr>
<td>Cycle</td>
<td>each Winter Semester</td>
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</tbody>
</table>

**Coordinator**

Prof. Dr. F. Scholz, Faculty of Engineering and Computer Science

**Instructor(s)**

Prof. Dr. F. Scholz, Faculty of Engineering and Computer Science

**Allocation of study programmes**

First semester MSc *Energy Science and Technology*
First semester MSc *Advanced Materials*, focus Nanomaterials

**Recommended prerequisites**

Fundamentals of mathematics and physics
Course *Introductory Electrical Engineering*

**Learning objectives**

- Students should be able to
  - perform circuit analysis of linear DC and AC (RLC) circuits.
  - explain the basics of semiconductor physics.
  - explain how basic semiconductor devices work.
  - handle and evaluate measured data on a basic level.
  - convert analogue data into digital data.
  - handle digital data.
  - specify advantages and problems of digital data processing.

**Syllabus**

- Circuit analysis: Network analysis, Thevenin and Norton equivalent circuits, superposition principle, linearity, capacitors & inductors, transformers
- Analysis of transients: Frequency analysis, filters etc.: Frequency response, logarithmic scale, Bode diagram, low pass, high pass, 2nd order low pass etc.
- Fourier and Laplace transformation: Transfer function, step, pulse response, convolution
- Semiconductors: Band structure, density of states, Fermi statistics, impurity conduction, mobility, diffusion, Hall effect
- Diodes: p-n-junction, load line analysis, pn as capacitance, Schottky diode
- Transistors: Bipolar transistor (band structure, common base, common emitter, amplification), Field Effect Transistor (Structure, operation, enhancement and depletion); load line analysis
- Devices for measurement: Operational amplifier, basics, adder, subtractor, integrator, differentiator, logarithmiser
- Probability distribution functions: Binomial, Poisson, Gauss
- Signal filtering, noise: Thermal, shot, 1/f, distribution, generation-recombination,
- Digital Signal Processing: basic logic operations, adders, flip-flop, Digitization: Basics, sampling theorem, DA and AD converters, Digital filters, z-transformation

**Literature**


**Teaching and learning methods**

- 5 credit points
- Lecture 3 h/week
- Solving problems 1 h/week

**Workload**

- Total: 150 h
  - Lecture: 48 h presence
  - 44 h preparation and revision
  - Solving problems: 16 h presence
  - 28 h revision
  - Exam preparation: 14 h exam

**Assessment**

- The credit points will be awarded once the written or the oral exam has been passed (depending on the number of participants). No prerequisites are necessary for exam registration.

**Grading procedure**

- The grade of the module will be the grade of the exam.

**Basis for**

- Modules *Materials Science II*, *Nanomaterials II*
- Elective courses