Faculty of Health, Science and Technology
Physics

Syllabus

Course Approval
The syllabus was approved by the Faculty Board of Health, Science and Technology on 4 June 2014 , and is valid from the Autumn semester of 2014 at Karlstad University. It replaces the former syllabus approved on 7 March 2013, Reg No 2013/94:3.

Course Code: FYGC07
Physical electronics, 7.5 ECTS Credits
(Fysikalisk elektronik, 7.5 Swedish credit points)
Degree Level: Bachelor
Progressive Specialisation: G2F (First cycle, has at least 60 credits in first-cycle course/s as entry requirements)

Language of Instruction
Swedish or English

Prerequisites
Completed courses in Mathematics, 30 ECTS Credits, and courses in Physics, 35 ECTS Credits, plus attended courses: Solid State Physics, Electromagnetic Field Theory, and Quantum Physics I, or equivalent.

Major Field of Study
FYA (Physics), TKA (Engineering Physics)

Learning Outcomes

The aim of the course is that students acquire knowledge of basic semiconductor and semiconductor component physics and learn to use relevant theoretical models for calculating properties and performance of semiconductor materials and components. Students are also expected to become familiar with handling modern electronic instruments for data collection and characterisation of semiconductor components and circuits.

Upon completion of the course, students should be able to:
- describe the crystal structure and electronic band structure of the most common semiconductor materials,
- give an account of the theoretical foundation of semiconductor physics and use the theory for calculating the properties of semiconductor materials and charge transport,
- give an account of the physical foundation for the p-n junction, the function and transport characteristics of the p-n diode, the bipolar transistor and the MOSFET transistor,
- describe metal-semiconductor junctions and semiconductor hetereojunctions and their application in electronic components,
-outline other types of field effect transistors and semiconductor-based solar cells,
- demonstrate ability to perform electronic characterisations of semiconductor components and use modern electronic measuring instruments.

Content and Form of Instruction

Theory:
Survey of common semiconductor's crystal structure and electronic band structure
The properties of semiconductors: distribution of electrons and holes, Fermi level, intrinsic and extrinsic semiconductor, doping
Charge transport, conductivity, generation and recombination of electron-hole pair
The p-n junction, the p-n diode
Metal-semiconductor junctions, Schottky diode, ohmic contacts, semiconductor hetereojunctions
The bipolar transistor
the MOSFET transistor, CMOS technology
Other types of field effect transistors
Photovoltaic applications, solar cells

Laboratory work
Electrical characterization of diodes and transistors, e.g. current-voltage and capacitance measurements.

Reading List

See separate document.

Examination

Assessment is based on mandatory laboratory tasks, reports and hand-in assignments and on a written exam.

Grades

One of the grades 5 (Distinction), 4 (Some Distinction), 3 (Pass) , or U (Fail), is awarded in the examination of the course.

Quality Assurance

Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course assessment is based on student views and experiences as reported in written course evaluations and/or group discussions. Students will be informed of the result of the evaluation and of the measures to be taken.

Course Certificate

A course certificate will be provided upon request.

Additional Information

Students who enrolled before 1 July 2007 will complete their studies in accordance with the requirements of the earlier admission. Upon completion students may request degree and course certificates to be issued under the current ordinance if they meet its requirements.

The local regulations for studies at the Bachelor’s and Master’s levels at Karlstad University stipulate the obligations and rights of students and staff.

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