WELCOME TO STUDY POWER ELECTRONICS!

Learning aids

Goals:

The goal of this course is to introduce students to the basics of power electronic converters, motivate them to study and understand professional concepts, and effectively develop the complex reasoning skills, being engaged with the material they are studying, articulate and test students ideas through experimentations and discussions. A student shall acquire experience in:

- Single-phase half-wave rectifiers;
- Single-phase full-wave rectifiers;
- Three-phase rectifiers;
- Single-phase inverters CSI and VSI;
- Three-phase inverters CSI and VSI;
- AC converters;
- DC converters.

Course contents:

Part 1. Rectifiers: Common Features of Rectifiers; Single-Phase Half-Wave Rectifiers; Single-Phase Full-Wave Rectifiers; Single-Phase Bridge Rectifiers; Three-Phase Full-Wave Rectifiers; Three-Phase Bridge Rectifiers

Part 2. Inverters: Common Features of Inverters; Voltage Source Inverters; Current Source Inverters; Resonant Inverters;

Part 3. AC/AC Converters: AC Voltage Regulators; Direct Frequency Converters; DC Link Converters

Part 4. DC/DC Converters: DC Voltage Regulators; Step-Down Choppers; Step-Up Choppers; Universal Choppers

Part 5. Utility Circuits: Snubbers and Clamps; Introduction to Gate and Base Drivers; Basics of Electromagnetic Compatibility

Course volume (ECP): 5

Teaching semester: Autumn

Study form: stationary study

Combined e-learning course includes lectures in auditorium (32 hours), exercises in computer class (16 hours), labs in laboratory (16 hours), and individual work with e-learning materials (70 hours). Course duration - 4 mounts.

Study level: Bachelor study

Target audience: students on electrical engineering and power electronics, mechatronics and informatics

Access conditions: knowledge base on Electrical Engineering, Electronics and Semiconductors

Learning activities:
Course Power Electronics for bachelor students includes lectures, exercises and laboratory works. Assessment methods: exam or self-assessment using active learning possibilities.
Weekly hours - 4 (lectures - 2, exercises - 1, laboratory works - 1).

E-Activities
Self-study of optional parts of the theoretical course using the Internet resources given by teachers. Self-training in optional part of exercises given in the frame of e-course. Self-preparing of optional part of laboratory works given in e-manual on labs. Serf-testing by quizzes published on the site. Self-assessment using the assessment rules of the course.

Lecture quizzing (optional)

After each module, students are quizzed on the material using the developed test questions. Principles of testing:
quiz type- multiple choice quiz
number of quizzes – 7
quiz duration – 5...8 min
average number of questions in a quiz – 10
possible number of correct answers in a question – 0...4
scoring principle – +1 for each correct answer and -1 for each incorrect answer

Exercises (mandatory + optional)

Principles of exercise arrangement:
number of lessons – 7:
mandatory – 5, optional – 2
average number of problems per lesson – 5
number of mandatory problems in a lesson – 1, number of optional problems – 4
number of variants = number of students
scoring – +1 for each solved problem

Laboratory works (mandatory + optional)

Every laboratory work involves both the mandatory and the optional items. Each team member may obtain additional scores if the team implements the optional items. The number of variants is equal to the number of students. Students obtain additional scores for answering the questions given at the end of the laboratory blocks. The average number of problems to solve in a block amounts to 10. Again, solution of only one problem in a lesson is mandatory, whereas the other ones are optional. The number of variants is equal to the number of students. Basic activities:

- Off-site preparation
- In-class pre-work talk
- Laboratory work implementation
- In-class summing-up discussion
- Off-site report generation and defence

Summary of the labs scoring:
+1 score for each circuit designed and assembled without an instructor help
+1 score for each formula calculated before, during and after the lesson
+1 score for each diagram predicted before and plotted on the lesson
+1 score for each question answered

Self-assessment: We use an active learning method in assessment.
Learning process assumes solution of the mandatory tasks and optional tasks which give additional points. During the semester students follow online their current rating and the expected exams scores using self-assessment module. By solving the additional tasks the student can raise his credit rating and the final exams score.

Assessment rules:
All kind of studies in Power Electronics are finalized by the quizzes and reports resulting in assessment.
The course consists of mandatory and optional parts. The mandatory part is required for all students, whereas optional - for the students, who want to increase their credits and to get best grades automatically, without exams. Assessment rules are presented by a diagram “Assessment System on Power Electronics” in menu “About the Discipline”.

Learner support:
Communication with learners takes place in e-learning environment (Moodle) and Facebook, during teaching seminars and consultation times.

Textbooks:
1. "Power Electronic Converters" by V. Vodovozov and R. Jansikene (in English and in Estonian)
2. "Introduction to Power Electronics", available at http://bookboon.com/int/student/electro/introduction-to-power-electronics

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