Power electronic circuits - course description

General information

Course name	Power electronic circuits
Course ID	06.2-WE-ELEKTP-PES-Er
Faculty	Faculty of Computer Science, Electrical Engineering and Automatics
Field of study	Electrical Engineering
Education profile	academic
Level of studies	First-cycle Erasmus programme
Beginning semester	winter term 2019/2020

Course information

Semester	5
ECTS credits to win	5
Course type	optional
Teaching language	english
Author of syllabus	• dr hab. inż. Marcin Jarnut, prof. UZ

Classes forms

The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Lecture	30	2	-	-	Credit with grade
Laboratory	30	2	-	-	Credit with grade
Project	15	1	-	-	Credit with grade

Aim of the course

1. To familiarize students with the clamping properties and limit parameters of basic power electronic connectors as well as the topologies and properties of basic power electronic converters AC / DC, DC / DC, AC / AC and DC / AC.

2. Developing students' understanding of the basic issues regarding the quality of electricity conversion.

3. Developing skills in the selection of the type of power electronic converter in the field of power engineering.

Prerequisites

electrical engineering, physics

Scope

Basic power electronics systems (general characteristics). Historical outline of power electronics. Application area. Types of power electronic converters (PE), their classification and basic functions. Liaison work of semiconductor devices and their thermal models. Basic parameters and assessment of the quality of PE transformation. Coefficients: efficiency, higher harmonics, power, deformation, displacement, asymmetry in the conditions of distorted current.

Non-controlled and controlled rectifiers (AC / DC converters). Topologies and properties of one- two- and six-pulse non-controllable rectifiers. Single and three phase thyristor rectifiers with phase control. Impact of rectifiers on the power source. Examples of applications. DC voltage and DC stabilizers (DC / DC converters). Topologies and properties of buck, boost, buck-boost and bridge type impulse stabilizers with PWM control. Examples of applications.

Single-phase AC controllers (AC / AC converters, f1 = f2). Semiconductor relays and thyristor controllers. Phase and integration control. Thyristor controller operation with R and RL load. Static characteristics, power factor. Transistor Drivers. Examples of applications.

Inverters (DC / AC converters). Single phase voltage and current inverters. Operation and properties of transistor inverters at various loads. PWM control technique in inverters. Voltage and frequency regulation methods. General characteristics of the operation of a three-phase voltage inverter with rectangular modulation and PWM sine type. Examples of applications.

Problems and development trends of power electronics systems. Intelligent power modules, multi-level systems, resonance systems. Development prospects.

Teaching methods

Lecture: conventional lecture, discussion, consultation.

Laboratory: discussion, consultation, group work, laboratory exercises.

Project: individual project, group project

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form

Outcome description	Outcomesymbols	Methods of verification	The class form
Has elementary knowledge about the clamping properties of basic power electronic connectors and about the basic functions of power electronic converters		• an exam - oral, descriptive, test and other • an ongoing monitoring during classes	• Lecture • Laboratory
Has elementary knowledge of topologies and properties of AC / DC, DC / DC, AC / AC and DC / AC power converters		• a project • an exam - oral, descriptive, test and other • an ongoing monitoring during classes	• Lecture • Laboratory • Project
Has elementary knowledge of the areas of application of power electronic converters		• a project • an ongoing monitoring during classes • carrying out laboratory reports	• Laboratory • Project

Assignment conditions

Lecture - the condition of passing is obtaining a positive grade from the summary test.

Laboratory - the pass condition is to obtain positive grades from all laboratory exercises carried out under the program.

Project - the condition for getting credit is obtaining positive grades from all project tasks

Components of the final grade = lecture: 40% + laboratory: 30% + project: 30%

Recommended reading

1. Mohan N., Undeland T. M., Robbins W. P.: Power electronics, John Wiley & Sons, Inc., 1995.

2. Rashid M.: Power electronics handbook. Academic Press, New York / London 2001.

3. Trzynadlowski A.: Introduction to modern power electronics. John Wiley & Sons, 1998

4. Tunia H., Smirnow A., Nowak M., Barlik R.: Układy energoelektroniczne. WNT 1990.

5. Tunia H., Barlik R.: Teoria przekształtników. Wydawnictwa Politechniki Warszawskiej, Warszawa 1992.

6. Piróg S.: Energoelektronika. AGH, Uczelniane Wyd. Nauk.-Dydakt., Kraków 1998.

7. Mikołajuk K.: Podstawy analizy obwodów energoelektronicznych. Warszawa, PWN 1998.

8. Frąckowiak L. Energoelektronika. Wyd. Politechniki Poznańskiej. Poznań 2000.

Further reading

Notes

Modified by dr hab. inż. Radosław Kłosiński, prof. UZ (last modification: 01-11-2019 01:29)

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