



Faculty of Health, Science and Technology
Electrical Engineering

Syllabus

Applications of Power Electronics

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| Course Code: | ELGC06 |
| Course Title: | Applications of Power Electronics <i>Tillämpningar av kraftelektronik</i> |
| Credits: | 7.5 |
| Degree Level: | Undergraduate level |
| Progressive Specialisation: | First cycle, has at least 60 credits in first-cycle course/s as entry requirements (G2F) |

Major Field of Study:
ETA (Electrical Engineering)

Course Approval

The syllabus was approved by the Faculty of Health, Science and Technology 2024-02-23, and is valid from the Autumn semester 2024 at Karlstad University.

Prerequisites

Power Electronics, 7.5 ECTS credits, or registered on the Electrical Engineering Bachelor programme, or equivalent

Learning Outcomes

Upon completion of the course, students should be able to:

1. give an account of different designs and applications of power supply units,
2. perform basic calculations for different types of pulse width modulations (pwm) and their applications in the industry,
3. give an account of the motor drives with power electronics,
4. perform basic calculations for filtering and harmonic mitigation,
5. give an account of simulations in different applications of power electronics,
6. describe the application of power electronics in electric vehicles, and
7. describe the application of power electronics in energy management for sustainable cities

and communities.

Content

- Applications of full-wave rectifiers, controlled rectifiers for driving a DC motor, controlled three-phase rectifiers, twelve-pulse rectifiers, three-phase bridge as an inverter, power electronics applications in high-voltage DC systems.
- AC voltage regulators, three-phase voltage regulators, speed control of induction motors, devices for flexible AC transmission systems.
- Various designs and applications for power supplies, flyback converters, forward converters, full-bridge and half-bridge DC converters, current-fed converters, multiple outputs, converter selection.
- Multilevel converters with independent DC sources, average power balancing with pattern switching, different methods for motor drives using power electronics, various types of pulse width modulation (PWM) and their applications in industry, speed control of induction motors, Sinusoidal PWM (SPWM), Hysteresis PWM, Space Vector PWM (SVPWM), field-oriented control of AC machines using SVPWM, smart inverters enabling high penetration of renewable energy sources.
- Power electronics applications in renewable energy systems, electric vehicles, electronic ignition systems, active filters and harmonics, application of power electronics in energy management for sustainable cities and communities.

Reading List

See separate document.

Examination

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

If students have a decision from Karlstad University entitling them to Targeted Study Support due to a documented disability, the examiner has the right to give such students an adapted examination or to examine them in a different manner.

Grades

One of the grades Distinction (VG), Pass (G), or Fail (U) is awarded in the examination of the course. For students in Engineering, one of the grades 5 (Pass with Distinction), 4 (Pass with 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 evaluation is partly based on student views and experiences obtained in accordance with current regulations and partly on other data and documentation. Students will be informed of the result of the evaluation and of any measures to be taken.

Course Certificate

A course certificate will be provided upon request.

Additional information

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