



Faculty of Health, Science and Technology
Electrical Engineering

Syllabus

Electrical Principles

Course Code:	ELGA17
Course Title:	Electrical Principles <i>Ellära</i>
Credits:	7.5
Degree Level:	Undergraduate level
Progressive Specialisation:	First cycle, has less than 60 credits in first-cycle course/s as entry requirements (G1F)

Major Field of Study:
ETA (Electrical Engineering)
FYA (Physics)

Course Approval

The syllabus was approved by the Faculty of Health, Science and Technology 2022-08-30, and is valid from the Spring semester 2023 at Karlstad University.

Prerequisites

Registered for Foundation course in Mathematics, 7.5 ECTS credits, and Calculus and geometry, 7.5 ECTS credits, or equivalent.

Learning Outcomes

Upon completion of the course, students should be able to

1. explain the basic theory of electric and magnetic fields and relate it to electrotechnical applications,
2. use basic methods in circuit theory and circuit technology to describe and analyse simple electric circuits,
3. give an account of the concepts of phasor and impedance and use them in calculations with the $j\omega$ -method for simple electric networks consisting of resistors, capacitors, and inductors, as well as sinusoidal voltages and currents,

4. describe introductory theory of electric power technology and relate it to the transmission of electrical energy, and
5. perform connections and measurements on simple electric circuits.

Content

Electric fields: Charge, Coulomb's law, electric field strength, voltage, potential, current, resistance, power, Joule's law, Ohm's law, capacitance, special cases of Gauss's law, and capacitor.

Magnetic fields: Magnetism and magnetic fields, current-carrying conductors and magnetic fields, magnetic flux density, special cases of Ampère's law, special cases of Biot-Savart's law, magnetic force, torque on a current loop in a magnetic field and the principle for an electric motor, magnetic flux, induction, Faraday's law, Lenz's law, inductance, inductor, and oscillation in a circuit consisting of a capacitor and an inductor.

Circuit theory and circuit technology: Kirchhoff's current law and voltage law, reference direction of current and reference polarity for calculations, consumed and emitted power. Serial, parallel, delta, and star connected resistors. Voltage division and current division, voltage, current, and resistance measurements, two-terminals, ideal resistor, ideal voltage generator and ideal current generator, voltage two-terminals and current two-terminals, successive replacements of two-terminals, Thévenin equivalent circuits, Norton equivalent circuits, power adaptation, net solving with Kirchhoff's method, node-voltage analysis and mesh-current analysis, the principle of superposition, and the Wheatstone bridge.

Alternating current and alternating voltage: Root mean square value, sinusoidal current and voltage, average power, phasor representation. Connection between sinusoidal current and voltage for ideal resistor, ideal capacitor, and ideal inductor. Ideal transformer, impedance, the $j\omega$ -method (the complex method), power adjustment, and resonance.

Electric power technology: Power of sinusoidal current and voltage; average, reactive, and apparent power. Phase compensation, three-phase system, and introduction to power distribution.

Reading List

See separate document.

Examination

Assessment is based on a written exam and written lab reports.

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 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.