



Faculty of Technology and Science  
Electrical Engineering

### Syllabus

#### Course Approval

The syllabus was approved by the Faculty Board of Technology and Science on 2 March 2011, and is valid from the Autumn semester of 2010 at Karlstad University.

**Course Code:** ELGB31

**Introduction to Three-Phase Systems, Electrical Machines and Transformers, 10 ECTS Credits  
(Grundläggande trefasssystem, elmaskiner och transformatorer, 10 Swedish credit points)**

**Degree Level:** Bachelor

**Progressive Specialisation:** G1F (First cycle, has less than 60 credits in first-cycle course/s as entry requirements)

#### Language of Instruction

Swedish

#### Prerequisites

The course ELGA01 (Circuit Analysis), 7.5 ECTS cr or equivalent

#### Major Field of Study

ETA (Electrical Engineering)

#### Learning Outcomes

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

- perform calculations on symmetrical and asymmetrical three-phase current.
- give an account of the design and operation characteristics of single-phase and three-phase transformers,
- give an account of the design and operation characteristics of current measuring transformers,
- perform calculations on measuring transformers,
- give an account of the function performed in rotary, protection, isolation and auto-connected transformers,
- give an account of the design and operation characteristics of direct current and asynchronous and synchronous machines,
- perform calculations on direct current and asynchronous and synchronous machines.

#### Content and Form of Instruction

Instruction is in the form of lectures, exercises and mandatory laboratory sessions.

#### Three-phase current:

system voltage, principal voltage, phase voltage, circuit current, phase current, Y/D connection, active, reactive and apparent three-phase power connection, power factor, phase compensation, efficiency measuring, symmetrically and asymmetrically charged three-phase system

#### Transformers

step down and step up transforming, induction law, transformer formula, no load, load, voltage drop, equivalent scheme, loss, efficiency, construction, materials, windings, cooling, three-phase connections, electrical

characteristics in reconnection, transformer testing, short circuit impedance, winding connector, three-phase transformer parallel connector

#### DC machines

construction, theory, separate and series excitation, armature reaction and commutation, loss, efficiency, start, braking, speed control

#### Asynchronous machines

construction, theory, short-circuit and slip-ring motor, loss, efficiency, start braking, speed control, one-phase operation generator operation

#### Synchronous machines

construction, theory, generator operation, spin up and down magnetisation, start, synchronisation, loss, efficiency, synchronous machine as motor

#### Reading List

See separate document.

#### Examination

Assessment is based on a written exam, mandatory laboratory sessions and reports.

#### Grades

One of the grades U (Fail), 3 (Pass), 4 (Some Distinction), or 5 (Distinction) 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.