MJ1015 Electrical and Control Engineering for Industrial Systems 4.5 credits

El och styrteknik i industriella system

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

The official course syllabus is valid from the autumn semester 2025 in accordance with the decision by the Faculty Board: M-2024-0018. Date of decision: 2024-10-14.

Grading scale

A, B, C, D, E, FX, F

Education cycle

First cycle

Main field of study

Technology

Specific prerequisites

MG1202 Engineering mathematics, 6 credits

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After passing the course, the student should be able to:

1. Explain basic electrical principles and their application in industrial systems. Application also includes basic component knowledge about the function of switches, fuses, generators, motors and other electrical components.
2. Analyse and design simple electrical circuits and simple control systems for industrial processes.
3. Solve practical problems with respect to electrical circuits and control strategy in industrial systems considering function and sustainability.
4. Identify, explain and prevent risks in electrical and electrically powered systems, with a focus on personal safety and fire risks.
5. Carry out simple troubleshooting of electrical systems in industry environments and explain how to carry out maintenance of electrical systems and control systems in industry environments.
6. Explain why different generations of control systems exist in industrial processes and give examples of how older and newer systems interact in the processes.

Course contents

The course is based on practical examples of technical systems that exist around us in everyday life and that the course participants can relate to. Examples on such is a wind turbine that feeds electricity to a nearby industry, an electric vehicle that is loaded from the grid, or an escalator.

The course contains the following subareas:

1. Basics, such as direct current, alternating current, Ohm's law and Kirchhoff's current and voltage laws, induction.
2. Rms values in relation to momentary voltage and current.
3. Power calculations, active, reactive and apparent power.
4. Basic knowledge about electrical components and their function (e.g. switches, fuses, generators and motors, as well as wiring, cables and different types of electrical loads).
5. The basics of transfer of electricity and single phase and three-phase systems.
6. Use of electric power and principles of storage in batteries.
7. Energy flow from source to load, identification and quantification of losses.
8. Control systems: Principles of control and regulation.
9. Control systems: Hardware including sensors and actuator, software and programming techniques. Traditional and new control methods.

10. Control systems: Applications of industrial control. Overview of traditional and new computer networks, such as LAN, Modbus, 5G etc.
11. Electrical safety with a focus on personal safety and fire risks. Insulation of electrical circuits and devices is an important element in this subarea.
12. Troubleshooting and maintenance of electrical systems and control systems in industry environments.

Examination

- TEN1 - Written exam, 2.0 credits, grading scale: A, B, C, D, E, FX, F
- KON1 - Partial exam, 0 credits, grading scale: P, F
- KON2 - Partial exam, 0 credits, grading scale: P, F
- LAB1 - Laboration, 1.5 credits, grading scale: P, F
- LAB2 - Laboration, 1.0 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

The course has continuous assessment. During the course, two quizzes are offered (KON1, KON2). A Pass grade on a quiz can be credited for the corresponding exam question.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.