

### **Necessity of the course:**

The course aims to introduce basic electrical engineering concepts to students of non-electrical technical disciplines. It provides the necessary background to understand fundamental electrical quantities.

### **Course topics:**

1. Overview of the semester, including discussion of the course structure and relevance. Overview of basic electrical quantities: prefixes, electric charge, current, voltage, potential, resistance, and conductance.
2. Simple electrical circuits. Ohm's law and Kirchhoff's laws. Series, parallel, and mixed circuit connections.
3. Voltage and current division. Voltage and current measurements in electrical circuits. Internal resistance of measuring instruments, measurement ranges. Resistivity and its temperature dependence.
4. Methods for analyzing complex electrical networks: superposition principle, node-voltage (nodal potential) method.
5. Methods for analyzing complex electrical networks.
6. Equivalent generator theorems: Norton and Thévenin equivalents. Power matching (maximum power transfer).
7. Alternating current (AC) networks: interpretation of basic quantities, sinusoidal networks, characteristics of sinusoidal signals. Resistors, capacitors, and inductors in AC circuits.
8. Switching phenomena: time constant, transient and steady-state conditions. AC power concepts. Polyphase systems.
9. Magnetic fields: permanent magnets, current-carrying conductors. Magnetic flux density, flux, magnetomotive force, magnetic field strength.
10. Interaction between magnetic fields and materials: permeability, magnetic hysteresis. Magnetic cores and windings.
11. Types of induction: stationary induction, motional induction, self-induction and mutual induction.
12. Electric field, capacitance, and practical applications.
13. Semiconductor fundamentals: semiconductor materials, doping, PN junction, diode.
14. Practical aspects of semiconductors and simulation tools (LTSpice).

### **Recommended Literature:**

- Schaum's Outline of Basic Electricity, Second Edition, McGraw-Hill Education – Europe, 2009.
- Electrical Engineering for Technical Secondary Schools, Form Three, Tanzania Institute of Education, 2022
- Electrical Engineering for Technical Secondary Schools, Form Four, Tanzania Institute of Education, 2022
- Grob's Basic Electronics, Mitchel E. Schultz, 11th edition, McGraw Hill, 2010

**Assessment:**

During the semester, two written midterm tests are administered, primarily consisting of calculation-based problems. Only a non-programmable calculator may be used during the tests. To obtain the course signature, a minimum of 40% must be achieved in both midterms. Students achieving 65% or higher may receive a recommended final grade.

## **Grading Scale**

- From **50%**: Satisfactory (2)
- From **65%**: Fair (3)
- From **75%**: Good (4)
- From **85%**: Excellent (5)