Syrian Arab Republic

Higher Institute for Applied Sciences and Technology

Course Specification Document

Title	Fundamentals of Electrotechnics

Credits	3.5 ECTS

Aims	This course aims to put the student on the track of studying electrical engineering by providing him with the necessary knowledge about generating, transmitting, and distributing electrical energy, and connecting various electric loads to the electrical network. It also provides the student with the concepts of both electrical energy and electrical power, and introduces him to the types of AC mains supply (single-phase, three-phase) and their technical details. It teaches the student the structure of electrical transformers and the scientific basics of their design from a magnetic and electrical point of view.

Intended learning outcomes

On successful completion of this course, the student will be able to:

- Understand the important basic concepts in the field of electrotechnics.
- Identify types of AC loads and their effects on the electrical network.
- Analyze apparent, active and reactive power.
- Correct load power factor and realize the positive impact of this correction on AC network.
- Understand electrical transformer model and magnetic circuits.
- Understand three-phase network, balanced and unbalanced loads, and the flow of electrical energy from generation to distribution.
- Apply theoretical concepts in the field of electricity to practical practices.
- Measure apparent, real and passive power and analyze the electrical network.
- Approach the problems of some electrical loads and solve them.
- Design an electrical coil/transformer with specific specifications.

Syllabus

- **Electrical energy concepts:** General definitions, AC generator, electrical load types, load current analysis, apparent, real, and passive power, electrical source/load concept, non-resistive load harms mitigation, power factor correction, electrical power transmission losses and methods of mitigating them.
- **Transformers:** The benefit of transformers, transformer input impedance, ideal/real transformer, magnetizing inductance, leakage inductance, transformer power losses in both wires and core, transformer modelling using measurements (DC, open load, short load), autotransformers.
- **Three-phase network:** Introduction to the multiphase network, three-phase generator,

balanced/unbalanced network, direct/indirect sequencing, Fresnel representation of the three-phase network, three-phase load, star/delta load connection, the concept of neutral point, neutral line current, balanced/unbalanced load, power measurement, phase sequence detector, three-phase transformer, electrical power generation station, electrical energy transmission and distribution from generators to users.

- **Magnetic circuits:** Magnetomotive force MMF, Ampere's law, magnetic field intensity h, magnetic flux density b, magnetic materials permeability, magnetic reluctance, magnetic flux, magnetic saturation, magnetic hysteresis, eddy currents, magnetic circuit (magnetic length and cross-sectional area), magnetic circuit modeling with/without an air gap, design study of a coil/transformer to achieve certain required specifications, selection and placement of winding wires.