

Magnetic circuits and transformers

Academic Year: (2022 / 2023)

Review date: 01-09-2022

Department assigned to the subject: Electrical Engineering Department

Coordinating teacher: GARCIA DE BURGOS, MARIA BELEN

Type: Compulsory ECTS Credits : 6.0

Year : 3 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Physics II

Electrical Power Engineering Fundamentals

OBJECTIVES

Skills to design electromagnetic devices. Skills to analyze the performance of a transformer under different circumstances. Skill to carry out tests to obtain transformer parameters. Basic knowledge about national and international standards. Skill to analyze interactions between the transformer and the electrical system. Skill to select a transformer for a given application.

Explain and justify the working principle of single-phase transformers, three-phase transformers and instrument transformers and their function in power systems.

DESCRIPTION OF CONTENTS: PROGRAMME

Topic 1: REVIEWING BASIC CONCEPTS ON ELECTRICITY AND MAGNETISM. Maxwell's equations. Core losses. Dielectric losses. Magnetic circuits. Self and mutual inductances.

Topic 2: CONSTITUTION OF POWER TRANSFORMERS. Magnetic core, windings, insulation system. Transformer refrigeration. Basic concepts on maintenance.

Topic 3: SINGLE-PHASE TRANSFORMERS. No load performance. On-load performance. Overloads. Equivalent circuit. Efficiency. Voltage drop. Parallel operation. Short circuit currents. Inrush current.

Topic 4: THREE-PHASE TRANSFORMERS. Types of transformers. Phasor groups. No-load performance. Transformer performance under balanced and un-balanced loads. Zero-sequence impedance. Tertiary windings. Interconnected star windings. Three winding transformers. Autotransformers. Tap changers. Application of the different transformer types and phasor groups.

LEARNING ACTIVITIES AND METHODOLOGY

The learning methodology includes:

- Lectures covering the main topics described within the course outline.
- Case study and problem solving lectures, where some issues are addressed from a practical point of view.
- Laboratory sessions

ASSESSMENT SYSTEM

At least two partial exams which include problems and theory questions. With a score upper than 5.0 the exercise is passed.

Those students with one or various failed exercises must perform a final exam of those failed exercises.

The laboratory weight is 10% of the final grade. At the end of the course the students will take a test on the lab sessions.

% end-of-term-examination: 60

% of continuous assessment (assignments, laboratory, practicals...): 40

BASIC BIBLIOGRAPHY

- Kulkarni, S.V; Khaparde, S.A. Transformer engineering. Design and Practice, Marcel Dekker, 2012

ADDITIONAL BIBLIOGRAPHY

- S.Kulkarni; S Khaparde Transformer Engineering. Design and Practice, Marcel Dekker, 2012

BASIC ELECTRONIC RESOURCES

- Juan Carlos Burgos . OCW Circuitos Magnéticos y Transformadores: <http://ocw.uc3m.es/ingenieria-electrica/circuitos-magneticos-y-transformadores>