PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE
COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRICAL ENGINEERING
ABET COURSE SYLLABI

IEE2273 ELECTRICAL MACHINES LABORATORY

Credits and contact hours: 5 UC credits / 5 hours (4 h. Laboratory experiences and 1 h. independent learning)

Instructor's name: Mario Sáez, Luis Vergara

Course coordinator's name Javier Pereda

Textbook: Electric Machinery by A. E. Fitzgerald, Jr.,Charles Kingsley, Stephen Umans, and A. E. Fitzgerald (Hardcover - Jul 25, 2002).

Course Catalog Description: This course allows students to check the theory learned in the course IEE2213 Electric Machines, practice safety precautions, operate power transformers and electrical machines, connect and control soome processes such as starting and synchronization of different types of motors and generators (synchronous, induction, DC, reluctance , etc.).

Prerequisite Courses: IEE2213 Electric Machines; IEE2183 Electrical Measurements Laboratory

Co-requisite Courses: To be defined

Status in the Curriculum: Elective

Course Learning Outcomes:

1. Understand and implement safety precautions to make connections of equipment and rotating machinery to the electric network.
2. Interpret the notation for high and low terminal voltage of transformers.
3. Recognize the importance of grounding the neutral for Y connection.
4. Connect and operate a single or three-phase transformer for different types of loads.
5. Determine the angular offsets of any connection of three-phase transformers.
6. Connect single-phase or three-phase transformers in parallel.
7. Determine the voltage regulation for different types of load.
8. Connect and control the starting operation of various types of AC and DC motors.
9. Determine the characteristics or typical operation curves of motors and generators (AC and DC).
10. Operation of synchronous machine in the four quadrants: as motor and generator.
11. Perform the operation of the induction machine as a generator.

12. Perform speed control of DC and AC machines by static converters.

Relation of Course to ABET Criteria:

a. Knowledge of mathematics, science and engineering
b. Design and conduct experiments: analyze and interpret data
e. Identify, formulate, and solve engineering problems
f. Professional and ethical responsibility
j. Knowledge of contemporary issues
k. Techniques, skills, and modern tools for engineering practice.

Topics covered:

1. **Single-phase transformer:** Identification of design features and equipment or components for testing; Identification of terminals and polarity marks; testing for short circuit and open circuit parameter determination; measurement of excitation current transformer in open circuit and full load; voltage regulation with inductive and capacitive loads; Parallel operation of single phase; and connection as autotransformer.
2. **Three-phase transformer:** Identification of design features and equipment or components for testing; operation in open circuit and using a three-phase load (star-star with neutral grounded and floating); operation in open circuit and with full load (delta and zig-zag); calculation of angular offset of typical phase connections; recording and analysis of harmonics in voltage and current for different connections; operation with unbalanced phase loads and single-phase loads; and operation of transformers with tertiary compensation.
3. **DC machines:** Identification of design features, additional testing equipment and terminals of the machine; Getting typical operating characteristics of motors and generators; Speed control of motors; Load characteristics of generators; Determination of load excitation curves for various types of machines (Shunt, compound, etc.).
4. **Synchronous machines:** Identification of design features, additional testing equipment and terminals of the machine; Features short and open circuit network synchronization; Operation in quadrants defined by P and Q; V curves for motors.
5. **Induction Machines:** Identification of design features, additional testing equipment and terminals of the machine; operational tests in open circuit and locked rotor for parameters determination; Generator operation; Torque-speed characteristics with rotor resistance as a variable parameter; and single-phase motors.
6. **AC and DC Motor Drives:** Introduction to static converters; and control of DC and AC motors.