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

IEE2244 INDUSTRIAL ELECTRONICS

Credits and contact hours:	10 UC credits/10 hours (3 Lecture hours per week; 2 h. homework hours per week and 5.5 hours of Independent learning experience per week)
Instructor's name:	Juan Dixon
Course coordinator's name	To be defined
Textbook:	Power Electronics Handbook, Academic Press, 2007.
Course Catalog Description:	The course is structured to give the students the fundamentals of power electronics, including dc-dc, dc-ac, ac-ac and ac-dc converters, using all existing technologies for these purposes.
Prerequisite Courses:	IEE2123 Electric Circuits
Co-requisite Courses:	None
Status in the Curriculum:	Required for students in the power system area.
Course Learning Outcomes:	At the end of the course, students will be able to propose solutions and solve a variety of problems for low, medium and high power industrial applications. They also will be able to design and implement any kind of power converters.
Relation of Course to ABET Criteria:	a. Knowledge of mathematics, science and engineering b. Design and conduct experiments: analyze and interpret data c. Design a system, component, or process e. Identify, formulate, and solve engineering problems f. Professional and ethical responsibility i. Techniques, skills, and modern tools for engineering practice.
Topics covered:	1. Introduction: Objectives and application fields, power semiconductors, energy conversion methods, solid state converters classification. 2. Generalized Conversion: Commutation, switching functions, transfer functions in ideal converters, displacement factor, active power, reactive and harmonic power. Definitions, line-commutation and self-commutation. Resonant converters. Multilevel converters.

3. AC-DC Conversion or rectification: Rectification using natural commutation, single-phase, three-phase and poli-phase rectifiers, double star bridge rectifiers. Design of thyristor rectifiers, ignition, overlap and extinction angle. Rectification using self-commutation, the Boost and the Buck principles, PWM modulation, voltage source and current source rectifiers, duality of the transfer functions, feedback, harmonic control and control of the power factor, design aspects.
4. AC-AC Conversion: Phase displacement with fixed frequency conversion. Variable frequency conversion, dual converters, single-phase and three-phase conversion: cycloconverters.
5. DC-DC conversion: Application of Buck and Boost principles, Cûk converter, Flyback converters, isolated switching power supplies, high and low voltage conversion. Two and four quadrants operation of dc-dc converters.
6. DC-AC Conversion or inversion: Single-phase and three-phase inverters, natural commutation inversion, forced commutation inversion, current and voltage sources inverters, indirect and direct current control. Multilevel converters in DC-AC conversion.
7. Protection circuits, overvoltage and overcurrent protections, dv/dt and di/dt transient protections, snubbers, gate protections, thermal protections.
8. FACTS (Flexible Alternating Current Transmission Systems), HVDC (High Voltage Direct Current) transmission systems, Active power filters, operation and implementation principles. Series, shunt, and hybrid power filters.