



A) COURSE

Course Id:	Course
5616	Power Electronics

Class Hours per Week	Lab hours per week	Complementary practices	Credits	Total hour course
3	2	3	8	48

A) COURSE OBJECTIVE

	EE (IEA)	ME (IM)	MME (IMA)	EME (IME)	MTE (IMT)
Level:	VIII				
Course Type (Required/Elective)	Elective				
Prerequisite Course:	Power Electronics I				
CACEI Classification:	IA				

C) General purpose of the Course

At the end of the course, the student will be capable of:

Study processes of power electronics to convert direct current to alternating current, and its industrial application in electrical machines control. The impact of power electronics in electric energy quality is presented, as well as its management and operation in electrical networks.

D) TOPICS (CONTENTS AND METHODOLOGY)

1.- Inverters		16 Hours
Specific Objective:	Analyze conversion process from CD to CA, controlling frequency and amplitude of the generated voltage.	
	1.1.- Monophasic inverters of half bridge and complete bridge. 1.2.- Three-phase inverters. 1.3.- PWM techniques. 1.4.- Dead time. 1.5.- Inverters in fixed voltage and frequency. 1.6.- Inverters in variable voltage and frequency. 1.7.- Application in electric backup systems. 1.8.- Application in AC motors control.	
Readings and other resources	Internet, references according needs of the unit, consulting and research.	
Teaching Methodologies	Topics exhibiton by the teacher and/or students; Use of some didactic techniques, discussion and analysis sessions.	
Learning Activities	Class exercises or homework; Research projects and digital simulation exercises.	



2.- ELECTRIC MACHINES CONTROL		16 Hours
Specific Objective:	Presentation of the concepts of speed control and torque in electric machines, using power convertors and digital controllers.	
2.1.-	Control Structures to CD machines.	
2.2.-	Control Structures to CA machines.	
2.3.-	Steady state behavior.	
2.4.-	Numerical Simulation.	
2.5.-	Speed and torque control.	
2.6.-	Closed loop system.	
Readings and other resources		
Teaching Methodologies		
Learning Activities		

3.- ELECTRIC SYSTEMS AND ELECTRIC ENERGY QUALITY		16 Hours
Specific Objective:	Analyze the impact in the electric energy quality of operation phenomenons asociated with electronic convertors and electric machines, as well as its propagation in power systems. Analysis to identification and mitigation Techniques will be presented.	
3.1.-	Electrical networks	
3.2.-	Quality of electric energy concepts.	
3.3.-	Generation, effects and propagation of harmonic currents.	
3.4.-	IEEE recommendations and European regulations.	
3.5.-	Systems of harmonic currents reduction	
3.6.-	Power factor control	
3.7.-	Ground maps.	
Readings and other resources	Readings to concept research, as well as complement and strength analyzed in class topics.	
Teaching Methodologies		
Learning Activities		

E) TEACHING AND LEARNING METHODOLOGIES

Exhibition of topics, analysis and synthesis of exposed concepts, design and simulation exercises in specialized software, homework discussion, exams application and development of laboratory practices.

F) EVALUATION CRITERIA:

5 partial exams, the average of them represents the final grade.

Evaluation:	Schedule	Suggested Form of Evaluation and weighing	Topics
<i>First partial exam</i>			
<i>Partial exam</i>	70%		
<i>Homework</i>	20%		
<i>Participation</i>	10%		
<i>Second partial exam</i>			
<i>Partial exam</i>	70%		
<i>Homework</i>	20%		



Participation	10%			
<i>Third partial exam</i>				
Partial exam	70%			
Homework	20%			
Participation	10%			
Total				100%
Ordinary exam				
Laboratory				
Extraordinary Exam				
Title Exam				
Regularization Exam				

G) BIBLIOGRAPHY AND ELECTRONIC RESOURCES

Main Books

- Muhammad Harum Rashid, *Electrónica de Potencia*, Pearson Education-Prentice Hall, 2ª Edición. 2004.
- Daniel W. Hart, *Electrónica de Potencia*, Prentice Hall, 1ª Edición. 2001.
- IEEE Red Book .- Std. 141-1993.–(Reaff 1999) *Electric Power Distribution for Industrial Plants*.
- IEEE.- Brown Book .-Std. 399-1997.- *Industrial and Commercial Power Systems Analysis*.
- PSPICE – ORCAD 16.3x, versión estudiantil

Complementary Books

- Ned Mohan, Tore M. Undeland, William P. Robbins, *Electrónica de Potencia: Convertidores, aplicaciones y diseño*, Mc Graw Hill, 3ª Edición. 2009
- John G. Kassakian, Martin F. Schlecht, George C. Verghese, *Principles of Power Electronics*, Prentice Hall, 1991.
- Bimal. K. Bose, *Power Electronics and AC Drives*, Prentice Hall. 1st edition, 2001
- Richard. G. Hoft, *Semiconductor Power Electronics*, Krieger Publishing Company. 1st Edition, 1991.
- P. C. Sen, *Thyristor DC Drives*, Krieger Publishing Company. 1st Edition, 1991.