

# COLLEGE OF ENGINEERING MECHANICAL AND ELECTRICAL DEPARTMENT



Course Name: QUALITY AND ELECTRIC ENERGY SAVINGS  
Course ID:  
Faculty Course ID: 5681  
University Course ID: 01108  
Study plan level: IX  
Normal hours per week: 3  
Lab hours per week: 0  
Complementary Practices:  
Extra-class Work Hours / Week: 3  
Course type: IEA/Optional  
Approved credits needed:  
Curricular last revision date: 2013

CACEI ID:  
Credits: 6  
Total hours course: 48

Prerequisite course: Power electronics II (5616)

## COURSE JUSTIFICATION

With the increasing use of electronic devices and nonlinear loads, and phenomena associated with power distribution networks have increased the causes of distortion of the basic parameters of the electrical power with consequent unrest and problems in equipment and systems consumers of electricity, so it is essential that the electrical and Automation Engineer can be able to analyze and solve them.

Also the costs incurred to produce electricity tend to rise steadily as they depend largely on non-renewable resources each day become scarcer . So it is of primordial importance that the Electrical and Automation Engineer has the ability of conduct studies on saving electricity and propose appropriate solutions.

## COURSE OBJECTIVE

Develop and interpret the basic principles of quality and electrical energy saving , and propose alternative solutions to such situations in power systems .

## COURSE TOPICS

### 1. Concepts of power quality

3hrs .

**Objective:** Analyze the basic concepts and terms related to power quality .

- 1.1 - . Energy quality .
- 1.2 - . Voltage fluctuations .
- 1.3 - . Voltage waveform .
- 1.4 - . Effects on electrical equipment.

### 2. Factors affecting the quality of power

7 hours .

**Objective:** To analyze the factors that distort the basic parameters of electric power.

- 2.1 - . Interruptions
- 2.2 - . Overvoltage Transients.
- 2.3 - . Depressions of voltage .
- 2.4 - . Voltage fluctuations .
- 2.5 - . Harmonic distortion .
- 2.6 - . Ferro resonance .

- 2.7 - . Power factor .
- 2.8 - . Frequency variation.

### 3. Sources of interference

6 hours .

**Objective:** Identify the main sources of harmonic distortion affecting electrical systems.

- 3.1 - . Electronic equipment .
- 3.2 - . Electric welding equipment .
- 3.3 - . Load changes
- 3.4 - . Closing and opening switches.
- 3.5 - . Capacitors and controls.
- 3.6 - . Converters .
- 3.7 - . Atmospheric phenomena .

### 4. corrective Actions

4 hours .

**Objective:** To provide the basic tools to propose and implement related quality power solutions.

- 4.1 - . Ground systems

- 4.2 - . Harmonic filters.
- 4.3 - . Controls for capacitors.
- 4.4 - . 12 pulses rectifiers.

- 4.5 - . Overvoltage protection .
- 4.6 - . Automation processes.

### 5. Process management savings

**3 hours .**

**Objective:** To analyze the administrative process to implement a program of electricity saving.

- 5.1 - . Planning .
- 5.2 - . Organization.
- 5.3 - . Direction .
- 5.4 - . Tracking .

### 6. Savings Opportunities

**10 hours .**

**Objective:** To investigate the opportunities for electricity savings associated with industrial processes and equipment.

- 6.1 - . Lighting .
- 6.2 - . Processing equipment ( motors).
- 6.3 - . Other electrical loads.
- 6.4 - . Optimization systems.

### 7. Economic Analysis

**3 hours.**

**Objectives:** To identify and master the basic concepts for economic analysis and feasibility studies of projects related to electricity savings .

- 7.1 - . Recovery time .
- 7.2 - . Internal rate of return.
- 7.3 - . Present value .
- 7.4 - . Evaluation of alternatives.

### 8. energy Diagnostics

**12 hours .**

**Objectives:** Develop and implement a program of saving energy , especially electricity .

- 8.1 - . Required information .
- 8.2 - . Programming activities.
- 8.3 - . Formation workgroup.
- 8.4 - . Implementation of activities .
- 8.5 - . Measurements .
- 8.6 - . Processing information .
- 8.7 - . Presentation .
- 8.8 - . Evaluation .
- 8.9 - . Economic analysis .
- 8.10 - . Indices power consumption .
- 8.11 - . Estimated potential savings.

## METHODOLOGY

Exhibition topics: analysis of the concepts presented in the course program . Using digital tools such as online platforms, discussion or research tasks that encourage collaborative work among students, exams application and development of small projects. The course delivery scheme is proposed by more than one teacher , so that in the end be evaluated by a project that integrates the knowledge and skills developed during this .

## EVALUATION CRITERIA

The rating of course is the average of 2 midterm exams and final exam. Each assessment is weighted with the guidelines and requirements of the professor / professors conducting the course.

## BIBLIOGRAPHY

### **TEXT BOOK:**

The ABCs of power quality . Gilberto Enriquez Harper.  
Limusa

The power quality in electrical systems . Gilberto Enriquez Harper. Limusa

Power quality in power systems and electrical machines  
FUCHS / Massom -A -PRESS

Distribution Reliability and Power Quality Dugan,  
McGranaghan , Santoso Mc Graw hill

Power system Harmonics and Francisco de Rosa Marcel  
Decker

IEEE standards: 141 red, 142 green, emerald 1100 .  
Harmonic Control 519 , 493 gold , 739 bronze

Course Energy Saver FIDE , CONAE

Energy efficiency guidelines HEADQUARTERS  
(lighting , motors, etc. )

IEEE 493 gold, 739 bronze 793

AC Power Systems Hand Book Jerry C Whitaker 3rd Ed  
CRIPRESS

Email addresses of interest.

<http://www.icas.com.mx/>  
<http://www.sfindustry.com/>

<http://www.fide.org.mx/>

<http://www.conae.gob.mx/wb/>

<http://www.conuee.gob.mx/>

<http://www.energia.org.mx/>