COLLEGE OF ENGINEERING
MECHANICAL AND ELECTRICAL DEPARTMENT

Course Name: RENEWABLE ENERGIES
Course ID:
Faculty Curse ID: 5680
University Course ID: 01108 **CACEI ID:** IA
Study plan level: VIII **Credits:** 6
Normal hours per week: 3 **Total hours course:** 48
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
Prerequisite course : non

COURSE JUSTIFICATION

The production and consumption of electricity in the century beginning, has become one of the major technological challenges to overcome. Modern society is based virtually on the use of electricity, thats why it is needed minimal ecologic impact in the process of converting primary energy to electricity. Renewable energies represent an alternative and its environmental impact should be minimal compared to traditional sources. But renewable energy in its conversion to electricity requires support from other disciplines such as: electrical engineering, power electronics, control, instrumentation, electrochemistry and others. This justifies the inclusion of this optional course in the curriculum of Electrical and Automation Engineer.

COURSE OBJECTIVE

Develop the main characteristics of primary energies which are considered renewable ,for the production of electricity. Trends, developments and possible interconnection with existing electrical systems.

COURSE TOPICS

1. Introduction

5 hours .

Objective: Identify the global and national perspective of different types of renewable energy

1.1 - . Renewable Energy Types
1.2 - . Why renewable are necessary
1.3 - . Prospects of renewable energy in the global context
1.4 - . Prospects of renewable energy in the national context
1.5 - . Modularity, growth and economic benefits

2 . Solar energy

11 hrs.

Objective: Analyze the ways of harnessing solar energy, photo thermal type, such as photovoltaic's.

. 2.1 - Types of solar energy : photovoltaic and photo thermal
2.2 - . Irradiation or solar resource
2.3 - . Solar Path
2.4 - solar power systems . Central tower , parabolic channel
2.5 - . Photovoltaic cell
2.6 - . Application of PV cell
2.7 - . Items that constitute a photovoltaic system
2.8 - . Calculation and efficiency of solar systems
2.9 - . Development of a solar energy project

3. Wind Energy

10 hours .

Objective: Analyze the main features that enhance the wind as primary energy to produce electricity. The elements and types that make up a wind turbine

3.1 - . Principle of wind energy
3.2 - . Relationship between power and wind speed
3.3 - . Density of air
3.4 - . Probabilistic Wind Determination
3.5 - . Items that constitute a wind turbine
3.6 - . Types of wind turbines
3.7 - . Environmental Aspects
3.8 - . Trends and patterns of wind systems
3.9 - . Modeling a wind system interconnected to an electrical system

4. Small hydropower

6 hours .

Objective: Analyze the main features that enhance small wáter streams as primary energy to produce electricity.

4.1 - . Principle of small hydropower
4.2 - . Items constituting a hydraulic microturbine
4.3 - . Types of microturbines
4.4 - . Probabilistic determination of watercourses
4.5 - . Trends and designs of a Mini-Hydroelectric System
4.6 - . Modeling a Mini-Hydroelectric system interconnected to an electrical system

5 . Batteries and fuel cells

8 hours .

Objective: To identify the different types of batteries and their use in the renewable systems as well as the fuel cell as an alternative to produce electricity with low environmental impact.

5.1 - . Principles of electrochemical
5.2 - . Types of batteries
5.3 - . Equivalent circuit
5.4 - . Batteries Efficiency
5.5 - . Apps batteries in renewable energy systems
5.5 - . Types of fuel cells
5.6 - . Cells efficiency
5.7 - . Type fuel cells

6. Isolated systems, hybrid systems and interconnected systems

8 hours .

Objective : To integrate the knowledge gained in previous units to identify the various configurations of renewable energies interconnected with the electrical system .

6.1 - . Photovoltaic , wind systems , isolated mini-hydro .
6.2 - . Hybrid systems
6.3 - . Integration to the system .
6.4 - . Requirements for integration
6.5 - . Principles of distributed generation
6.6 - . Case Studies .
6.7 - . Simulation project .

METHODOLOGY

Exhibition topics, analysis and synthesis of the concepts exposed, design and simulation exercises in digital programs, discussion of homework assignments in groups of students, application of exams and development of a project.

EVALUATION CRITERIA

The rating in the course is the average of 2 regular exams and a final exam. Each assessment is weighted with the guidelines and requirements of the professor who teaches the course. To pass the course you need to develop a project to integrate the knowledge and experiences of other assignments.

BIBLIOGRAPHY

TEXT BOOK:

Patel Mukund R., “Wind and Solar Power Systems Design, Analysis and Operation, 2a Ed. CRC Taylor and Francis

Borbely Anne M., Kreider Jan F. “Distributed Generation The Power Paradigm for the New Millennium”, 1a Ed. CRC PRESS

Kiehne, H.A. “Battery technology handbook” 2ª Ed. New York Marcel Dekker

Quari N. P. “Energía Fotovoltaica”, 1ª Ed Librería y Editorial Alsina

Larmine J. Dicks A. “Fuel Cells Systems Explain ” Editorial Wiley

ELECTRONIC LINKS:

http://inelecsa.com.mx
http://www.conae.gob.mx
http://www.conuee.gob.mx
http://www.anes.org
http://www.aerovironment.com
http://www.kyocerasolar.com
http://www.grid-tie.com
http://www.sunnergy.com
http://www.ciat.com.mx/