Other renewable energies

Academic Year: (2019 / 2020) **Review date: 30-04-2019**

Department assigned to the subject: Electrical Engineering Department

Coordinating teacher: ALONSO-MARTINEZ DE LAS MORENAS, JAIME

Type: Compulsory ECTS Credits : 6.0

Year : 1 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Previous knowledge in Electric Circuit Theory, Electric Machines, Fluid Mechanics, Thermodynamics, and Power Plants is recommended.

OBJECTIVES

Students, after completing this course, will be able to:
- Acquire adequate knowledge of Renewable Energies: resources and technology. They must know in more detail those energies more frequent in our environment: wind energy, solar thermal energy and solar photovoltaic.
- Design, calculate and design products, processes, facilities and renewable energy plants.
- Conduct research, development and innovation in products, processes and methods related to renewable energies.
- Follow the technological evolution of renewable energies and have a prospective knowledge of this evolution.

Further:
- They will know the operating principles of the following electricity generation technologies: Thermoelectric solar, minihydraulic, biomass, cogeneration, geothermal and wave power.
- They will know the current state of technical and economic development of these technologies.
- They will understand the function of the main elements of each technology, their relative importance and the limits of each one of them.
- Know the existing alternatives for each technology, as well as the advantages and disadvantages of each one.
- They will be able to evaluate the potential of the resource and carry out a basic sizing for thermoelectric, minihydraulic and biomass solar power plants.

DESCRIPTION OF CONTENTS: PROGRAMME

1. SOLAR RESOURCE
1.1 Basics of solar radiation
1.2 Measurement and estimation of solar radiation

2. SOLAR THERMAL
2.1 Working principle. Types of installations. Resource. Present situation and perspective.
2.2 Concentrating parabolic trough plants. Solar field. Absorbing tube. Solar tracking. Solar field sizing. HFT system. Thermal storage systems.
2.3 Steam cycles. Turbine. Generator. High voltage systems. BOP.
2.4 Limitations. R&D priorities.
2.5 Central tower plants. Solar field and tower design. Comparison with parabolic trough technology.
2.6 Fresnel and Parabolic-stirling plants. Hybrid plants.
2.7 Solar thermal power plant simulation.
2.8 Road to profitability. Costs. Improvement margin. Key ponts.

3. GEOTHERMAL
3.1 Types of installations.
3.2 Resource.
3.3 Present situation and perspective.
3.4 Costs

4. MARINE ENERGIES
4.1 Types of installations.
4.2 Resource.

4.3 Present situation and perspective.
4.4 Costs

5. HYDRO GENERATION
5.1 Working principle. Types of installations. Resource. Present situation and perspective.
5.2 Hydro resource. Energy estimation.
5.3 Dams, weirs and spillways.
5.4 Intakes. Sediment traps. Gates and valves. Open channels. Penstocks. Tailraces.
5.5 Turbines
5.6 Generators. Elerctyic installation.
5.7 Automatization. R&D topics.

6 BIOMASS
6.1 Working principle. Types of installations.
6.2 Resource: Environmental and socio-economic impact. Supply logistics. Transport, pre-treatment and storage.
6.3 Biomass transformation. Biomass characterization. Gasification. Direct burning.
6.4 Present situation and perspective. R&D topics.

LEARNING ACTIVITIES AND METHODOLOGY

The course will consist in master classes, lectures and practical simulation lessons by top-level industry experts.

ASSESSMENT SYSTEM

Ordinary Call
The students will be continuously evaluated during the course by their teachers by means of short tests and assignments (70%) and will take a final exam (30%).

Extraordinary Call:
Evaluation will consist exclusively in a final exam

% end-of-term-examination:	30
% of continuous assessment (assigments, laboratory, practicals…):	70

BASIC BIBLIOGRAPHY

- Carlos Mataix Turbomáquinas hidráulicas, Universidad Pontificia de Comillas, 2009
- S.A. Kalogirou Solar energy engineering : processes and systems, Academic Press, 2009
- Santiago García Garrido Centrales Termoeléctricas de Biomasa, Renovetec.
- Santiago García Garrido Centrales Termosolares CCP, Renovetec.
- Vega Remesal, A.; Ramos Millán, A.; Reina Peral, P.; Conde Lázaro, E. Guia Tecnica de Generacion Electrica de Origen Geotermico, FENERCOM (http://www.fenercom.com/), 2010

BASIC ELECTRONIC RESOURCES

- Celso Penche . LAYMAN'S HANDBOOK ON HOW TO DEVELOP A SMALL HYDRO SITE: http://www.microhydropower.net/download/layman2.pdf
- ESHA . Guide on How to Develop a Small Hydropower Plant : https://energiatalgud.ee/img_auth.php/a/ab/Guide_on_How_to_Develop_a_Small_Hydropower_Plant.pdf
- Varios: IDAE - IGME . Manual de Geotermia: http://dl.idae.es/Publicaciones/10952_Manual_Geotermia_A2008.pdf