

Course guide

340106 - CEER-E6009 - Power Plants and Renewable Energies

Last modified: 04/06/2024

Unit in charge: Vilanova i la Geltrú School of Engineering
Teaching unit: 709 - DEE - Department of Electrical Engineering.

Degree: BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Optional subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: IGNASI PERAT BENAVIDES

Others: IGNASI PERAT BENAVIDES

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

3. CE27. Ability to design power stations.
4. CE28. Applied knowledge of renewable energies.
5. CE30. Knowledge of storage systems of electricity.

Transversal:

1. SUSTAINABILITY AND SOCIAL COMMITMENT - Level 3. Taking social, economic and environmental factors into account in the application of solutions. Undertaking projects that tie in with human development and sustainability.
2. EFFECTIVE USE OF INFORMATION RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.

TEACHING METHODOLOGY

- In the theory classes, will be exposed and develop the theoretical foundations of programmed materials. They consist of theoretical explanations complemented by activities to encourage participation, discussion and critical analysis by students.

- In the classes of problems will arise and solve exercises related to the matters. Students should meet individually or in groups, indicating problems.

Within hours, students will conduct laboratory practices as required and submit the relevant report of the activity along with appropriate calculations and critical considerations.

-Will work in groups during the course of a specific topic related to the subject.

LEARNING OBJECTIVES OF THE SUBJECT

To know the different types of conventional power plants and with renewable energy, its main constituent elements and components, as well as energy storage systems more appropriate.

-Dimensioning generation systems from various sources of energy.

STUDY LOAD

Type	Hours	Percentage
Hours large group	45,0	30.00
Hours small group	15,0	10.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

1.- Principles of electric power generation.

Description:

- 1.1.- Energy and society. Energy resources. Primary energy.
- 1.2.- The historical development of power generation.
- 1.3.- General Classification of power plants.
- 1.4.- Environmental considerations of power generation (Electricity and Sustainable Development).

Full-or-part-time: 10h

Theory classes: 3h

Laboratory classes: 2h

Self study : 5h

2.- Supply and demand of electric energy.

Description:

- 2.1.- The production of electricity.
- 2.2.- Legislative framework. The market operator and system operator.
- 2.3.- Control of the power system: frequency and voltage.
- 2.4.- Coverage of the load demand. Generation schedule.

Full-or-part-time: 16h

Theory classes: 4h

Laboratory classes: 2h

Self study : 10h

3.- Hydraulic power plants.

Description:

- 3.1.- Historical of hydroelectric power plants.
- 3.2.- Types of hydropower plants. Damms. General components.
- 3.3.- Hydraulic turbines, types and functions. Selection criteria. Cavitation. Automatic control..
- 3.4.- Central or reversible pump: Type and operation.
- 3.5.- Mini microhidràulica. Feasibility and legislation.
- 3.6.- Environmental aspects of hydroelectric generation.

Full-or-part-time: 33h

Theory classes: 10h

Laboratory classes: 3h

Self study : 20h

4.- Conventional thermal and combined cycle power plants.

Description:

- 4.1.- Introduction and historical evolution of conventional power stations. Rankine cycle and performance. Combustion.
- 4.2.- Main components of the powerplant: Preparation of fuel, boilers and emission controls.
- 4.3.- Steam turbines, condensers.
- 4.4.- Gas-fired power. Gas turbines. Brayton cycle and performance.
- 4.5.- Cogeneration.
- 4.6.- Combined Cycle Power Plants. Performance analysis.
- 4.7.- Environmental aspects.

Full-or-part-time: 33h

Theory classes: 10h

Laboratory classes: 3h

Self study : 20h

5.- Nuclear powerplants.

Description:

- 5.1.- Radioactivity. Biological effects. Protection.
- 5.2.- Nuclear reactions. Type reactors. Control and regulation.
- 5.3.- Radioactive Waste. Environmental aspects of nuclear power plants.

Full-or-part-time: 33h

Theory classes: 10h

Laboratory classes: 3h

Self study : 20h

6.- Renewable energy powerplants.

Description:

- 6.1.- Characteristics of renewable energy. Legislative framework.
- 6.2.- Wind farms. Resources Assessment. Technological aspects of wind generation.
- 6.3.- Photovoltaic. Type cells. Stand-alone and grid connected.
- 6.4.- Thermal power stations with biomass. Photosynthesis. Biogas and biofuels.
- 6.5.- Other possibilities of generating electricity with renewable energy: geothermal and marine.
- 6.6.- Environmental aspects.

Full-or-part-time: 25h

Theory classes: 8h

Laboratory classes: 2h

Self study : 15h

GRADING SYSTEM

- Test done during the course (30%)
- Test done at the end (40%)
- Realization of problems, and work practices, group or individual (30%)

Re-evaluation: there will be a re-evaluation test of the part corresponding to the exams, according to the re-evaluation criteria established in the EPSEVG regulations

EXAMINATION RULES.

-The written tests are face and individual.

-In the classes of problems and / or laboratory practices will be assessed, where appropriate, the prior work with the presentation of results of each activity.

BIBLIOGRAPHY

Basic:

- Black & Veatch. Power plant engineering. New Delhi: CBS Publishers, 1998. ISBN 9788123905587.
- El-Wakil, M. M. Powerplant technology. New York [etc.]: Mc-Graw Hill, 1985. ISBN 007019288X.
- Kaltschmitt, Martin; Streicher, Wolfgang; Wiese, Andreas. Renewable energy : technology, economics and environment [on line]. Berlin [etc.]: Springer, 2007 [Consultation: 22/04/2022]. Available on: <https://link.springer.com/book/10.1007/3-540-70949-5>. ISBN 9783540709473.
- Burton, Tony [et al.]. Wind energy handbook [on line]. 2nd ed. Chichester: Wiley, 2011 [Consultation: 15/02/2024]. Available on: <https://onlinelibrary-wiley-com.recursos.biblioteca.upc.edu/doi/book/10.1002/9781119992714>. ISBN 9780470699751.
- Orille Fernández, Ángel Luis. Centrales eléctricas. Barcelona: Edicions UPC, 1993. ISBN 8476533403, 8489636524.

Complementary:

- Raja A.K.; Srivastava, Amit Prakash ; Dwivedi, Manish. Power plant engineering [on line]. New Delhi: New Age International, 2006 [Consultation: 12/02/2024]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pg-origsite=primo&docID=330884>. ISBN 9788122418316.
- Steam : its generation and use. CreateSpace, 2011. ISBN 9781466275829.
- Nuclear engineering handbook. Boca Raton: CRC Press, 2009. ISBN 9781420053906.
- Praetorius, Barbara [et al.]. Innovation for sustainable electricity systems : exploring the dynamics of energy transitions [on line]. 2008. New York: Physica, 2008 [Consultation: 24/03/2022]. Available on: <https://link.springer.com/book/10.1007/978-3-7908-2076-8>. ISBN 9783790820751.