Course guide
330094 - RE - Energy Resources

Last modified: 04/05/2023

Unit in charge: Manresa School of Engineering
Teaching unit: 750 - EMIT - Department of Mining, Industrial and ICT Engineering.
709 - DEE - Department of Electrical Engineering.

Degree: BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Optional 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).
BACHELOR'S DEGREE IN ICT SYSTEMS ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN MINING ENGINEERING (Syllabus 2016). (Optional subject).
BACHELOR'S DEGREE IN MINERAL RESOURCE ENGINEERING AND MINERAL RECYCLING (Syllabus 2021). (Optional subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Cunill Solà, Jordi

Others: Felipe Blanch, Jose Juan De

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. (ENG) Comprensió de la problemàtica de l¿energia i la seva transformació. Comprensió i domini de les diferents tecnologies adaptades als diferents recursos energètics d¿origen renovable.

Transversal:
2. 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.
3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.
4. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.

TEACHING METHODOLOGY

The subject consists of two hours of theory a week in face-to-face classes in the classroom (large groups), with master classes with audiovisual support, and two hours a week in small groups, dedicated to laboratory practices and application problems. Continuous assessment and written tests of theory and problems.

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course the student must be able to:
- Know and understand the problem of energy and energy resources.
- Know and understand the technologies related to renewable energies (geothermal, wind, solar thermal and photovoltaic, hydraulic and biomass).
- Have theoretical and applied knowledge of some electricity generation systems with renewable energies.
- Prepare technical reports and solve technical application problems.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours large group	30,0	20.00
Hours small group	30,0	20.00

Total learning time: 150 h

CONTENTS

Title of content 1 (part of the DEE): GENERAL CONCEPTS OF RENEWABLE SOURCES AND THE ELECTRICAL POWER SYSTEM

Description:
1. Introduction. Historical overview of the evolution of electricity.
2. Electric power system. The electrical grid. Voltage levels.
3. Renewable and non-renewable resources.
4. Introduction to the types of electric power plants.
5. Environmental impact of the production and transport of electrical energy.
6. Electricity demand curves. Generation management and programing.

Related activities:
Continuous assessment test (Activity 1).

Full-or-part-time: 12h
Theory classes: 3h
Practical classes: 3h
Self study : 6h

Title of content 2 (part of the DEE): SOURCES OF RENEWABLE ENERGY. GENERAL AND PHOTOVOLTAIC SOLAR.

Description:
1. Introduction. Energy and environmental impact.
2. Renewable sources and sustainable development.
3. General information on solar energy: The Sun, radiation, peak sun hours, classification of solar thermal and photovoltaic (PV) systems.
4. Photovoltaic systems: PV cell. Current - voltage curves. Equations and equivalent circuit. Cell technologies and performance. PV panels. Elements and electrical characteristics. Solar panel connection.
5. Photovoltaic Installations. Isolated facilities. Basic schemes. Hybrid systems. Installations connected to the grid.
6. Photovoltaic plants with solar tracking. Advantages and disadvantages of the PV systems.

Related activities:
Continuous assessment test (Activity 1).

Full-or-part-time: 24h
Theory classes: 6h
Practical classes: 6h
Self study : 12h

Title of content 3 (part of the DEE): HYDROELECTRIC POWER

Description:
1. Introduction. Definitions and basic operation.
2. Classification of hydraulic power plants.
3. Elements of a hydraulic power station. Typical configurations. Types of dams.
4. Hydraulic turbines: Francis, Pelton, Kaplan and others.
5. Pumping stations. Tidal power plants.
6. Examples of existing hydroelectric power plants
7. Advantages and disadvantages.

Related activities:
Continuous assessment test (Activity 1)

Full-or-part-time: 12h
Theory classes: 3h
Practical classes: 3h
Self study : 6h

Title of content 4 (part of DEMIT): THERMAL SOLAR ENERGY

Description:
Direct solar energy: thermal.

Specific objectives:
Understanding, analysis of direct solar thermal energy.

Related activities:
Continuous assessment test (Activity 2).

Full-or-part-time: 12h
Theory classes: 3h
Practical classes: 3h
Self study : 6h

Title of content 5 (part of DEMIT): BIOMASS ENERGIES

Description:
Biomass energy.

Specific objectives:
Understanding, analysis of biomass energy.

Related activities:
Continuous assessment test (Activity 2).

Full-or-part-time: 12h
Theory classes: 3h
Practical classes: 3h
Self study : 6h

Title of content 6 (part of DEMIT): WIND ENERGY

Description:
1. WIND SITUATION
- Current situation.
- The Limitations in the Market Operation.
- Future evolution, PREPA reports.
- Regulatory Framework.

2. TECHNOLOGY

3. ENVIRONMENT, ENVIRONMENTAL IMPACT

4. ECONOMY

Specific objectives:
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Related activities:
Continuous assessment test (Activity 3).

Full-or-part-time: 24h
Theory classes: 6h
Practical classes: 6h
Self study : 12h

Content title 7 (part of DEMIT): GEOTHERMAL ENERGY

Description:
1. INTRODUCTION
2. NATURE OF GEOTHERMAL RESOURCES
3. DEFINITION AND CLASSIFICATION
4. DEVELOPMENT PHASES OF A GEOTHERMAL PROJECT
5. USE OF GEOTHERMAL RESOURCES
6. ENVIRONMENTAL IMPACT
7. PRESENT AND FUTURE

Related activities:
Continuous assessment test (Activity 3).

Full-or-part-time: 24h
Theory classes: 6h
Practical classes: 6h
Self study : 12h

ACTIVITIES

TITLE OF ACTIVITY 1: CONTINUOUS ASSESSMENT TEST (PART DEE)

Description:
Carrying out a written test with a multiple choice part and with the possibility of including application problems of the corresponding topics. Carrying out some theoretical or practical work directly related to the previously studied content.

Specific objectives:
Development of reasoning techniques and strategies for the analysis and resolution of problems.
Written communication.
Autonomous Learning.

Material:
None for the theoretical part, form (an A4 sheet) for the problems part (if it is the case).

Delivery:
100% of the final grade for the DEE part.

Full-or-part-time: 7h
Practical classes: 2h
Self study: 5h

TITLE OF ACTIVITY 2: CONTINUING ASSESSMENT TEST (DEMIT PART)

Description:
Carrying out a test on the theory of the corresponding topic.

Specific objectives:
Development of reasoning techniques and strategies for the analysis and resolution of problems.
Written communication.
Autonomous Learning.

Material:
Test on the digital Campus.

Delivery:
100% of the final mark for the DEMIT part.

Full-or-part-time: 5h 30m
Practical classes: 2h
Self study: 3h 30m

TITLE OF ACTIVITY 3: CONTINUOUS ASSESSMENT TEST (DEMIT PART)

Description:
Directed work and oral defense together with a part of exams.

Specific objectives:
Development of reasoning techniques and strategies for the analysis and resolution of problems.
Written communication.
Autonomous Learning.

Material:
Internet and bibliography.

Delivery:
50% of the practical work (report and exposure in equal parts) and 50% with the part of exams. All this will be 100% of the final grade for the DEMIT part.

Full-or-part-time: 7h
Practical classes: 2h
Self study: 5h

GRADING SYSTEM

The course will consist of two parts corresponding to the departments indicated below, with the percentage of teaching time established:

Part of the DEE 50% and part of the DEMIT 50%.

The evaluation of each part will be separately and may be through continuous evaluation or partial tests of theory, test or problems.

Final mark of the course: NF = 0.5 x Nee + 0.5 x Nemit

Re-evaluation:

Students who have obtained a 'failed' grade in the regular evaluation period can access the re-evaluation process.

The mark obtained in the test on the day of the reevaluation will replace the mark of the final exam for the subject.

The result of the re-evaluation is a grade that replaces the grade obtained in the ordinary evaluation process, which, in any case, will be a maximum 'pass' 5.

EXAMINATION RULES.

Students must follow the directions and deadlines indicated on the digital campus.
Activities not submitted will be considered a "0".

BIBLIOGRAPHY

Basic:
- Llopis Trillo, G.; Rodrigo Angulo, V. Guía de la energía geotérmica [on line]. Madrid: Fundación de la Energía de la Comunidad de Madrid, 2008 [Consultation: 11/11/2020]. Available on: https://www.fenercom.com/publicacion/guia-de-la-energia-geotermica-2008/.
- Instituto para la Diversificación y Ahorro de la Energía. Manual de geotermia [on line]. Madrid: IDAE, 2008 [Consultation: 23/06/2021]. Available on: https://www.idae.es/publicaciones/manual-de-geotermia-reimpresion. ISBN 9788496680357.
- Quaschning, V. Understanding renewable energy systems [on line]. London: Earthscan, 2005 [Consultation: 13/06/2022]. Available on: https://www-taylorfrancis-com.recursos.biblioteca.upc.edu/books/mono/10.4324/9781315769431/understanding-renewable-energy-systems-volker-quaschning. ISBN 1844071286.
- García Garrido, S. Ingeniería de centrales termosolares CCP: estado del arte en tecnología termosolar. Madrid: Renovetec, 2010. ISBN 9788461441839.
- Fernández Salgado, J. M. Guía completa de la energía solar térmica y termoeléctrica: (adaptada al Código Técnico de la Edificación y al nuevo RITE). Madrid: AMV Ediciones, 2010. ISBN 9788496709577.
- Felipe Blanch, J. J.; López Martínez, J. A. Sistemas solares térmicos de baja temperatura [on line]. Barcelona: Edicions UPC, 1999 [Consultation: 12/11/2020]. Available on: http://hdl.handle.net/2099.3/36409. ISBN 8483013428.
- Talayero Navales, A. P.; Telmo Martínez, E., coords. Energías renovables: energía eólica. Zaragoza: Prensas Universitarias de Zaragoza, 2008. ISBN 9788492521210.

Complementary:
- Hernández Gonzálvez, C., i altres. Manual de minicentrales hidroeléctricas. Madrid: Instituto para la Diversificación y Ahorro de la Energía, 1996. ISBN 8480364122.
- El-Sharkawi, M. A. Electric energy: an introduction. 2nd ed. Boca Raton: CRC Press, 2009. ISBN 9781420062199.
- Pareja Aparicio, M. Energía solar fotovoltaica: cálculo de una instalación aislada. 2ª ed. Barcelona: Marcombo, 2010.
- Villarrubia López, M. Energía eólica. Barcelona: CEAC, 2004. ISBN 9788432910623.
- Fernández Salgado, J. M. Guía completa de la energía eólica. Madrid: A. Madrid Vicente, 2011. ISBN 9788496709669.
- Perales Benito, Tomás. Instalaciones geotérmicas. Las Rozas: Creaciones Copyright, 2012. ISBN 9788415270270.

RESOURCES

Audiovisual material:
- Presentacions al campus digital

Other resources:
Notes on the digital campus.