ANEXO I

Escuela Técnica Superior de Ingeniería
GENERAL SPECIFICATIONS

COURSE 23/24

Subject Data

Name:
ENERGÍAS ALTERNATIVAS
English name:
ALTERNATIVE ENERGIES

Code:	**Type:**
606810228	Optional

Hours:			
	Total	**In class**	**Out class**
Time distribution	150	60	90

ECTS:				
Standard group	**Small groups**			
	Classroom	**Lab**	**Practices**	**Computer classroom**
4	1,5		0,5	

Departments:	**Knowledge areas:**
Construction industry, Energy, Mechanics and Mining Engineering	Mining exploitation
Year:	**Semester**
3	2nd

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TEACHING STAFF		
Name:	**E-mail:**	**Telephone**
NURIA C. GIL CARVAJAL	**carvajal@uhu.es**	**959217352**

Others Data (Tutoring, schedule...)

- Tutoring, Mondays from 10, 00 h to 14, 20 h y Thursdays from 10, 00 h to 11, 30 h.
- Schedule, Fridays from 10,00 h to 13,00 h
- Office, ETPB39 (Located in the ETSI building of campus "El Carmen")

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SPECIFIC INFORMATION OF THE COURSE

1. Contents description:

1.1 In English:

Energy: definition, classification, units of measure and sources. SOURCES OF ALTERNATIVE OR RENEWABLE ENERGIES:

- The heat pump and its applications (geothermal power).
- Hydraulic power.
- Wind power.
- Biomass.
- The Hydrogen and the fuel cells.
- Oceanic power.
- Solar power (thermal, thermoelectric and photovoltaic).
- Cogeneration.
- Nuclear fusion.

1.2 In Spanish:

Energía: definición, clasificación, unidades de medida y fuentes. FUENTES DE ENERGÍAS ALTERNATIVAS O RENOVABLES:

- La bomba de calor y sus aplicaciones (energía geotérmica).
- La potencia hidráulica.
- La energía eólica.
- La biomasa.
- El Hidrógeno y las pilas de combustible.
- La energía oceánica.
- La energía solar (térmica, termoeléctrica y fotovoltaica).
- La cogeneración.
- La fusión nuclear.

2. Background:

2.1 Situation within the Degree:

This subject is part of the 3rd year of the GRADE ENGINEERING IN EXPLOTATIONS OF MINES AND ENERGY RESOURCES as mandatory in the Energy Resources itinerary.
It is a necessary and fundamental subject in the mining and civil works context, as many private and public companies, are investing in the alternative energy sector and hiring mining professionals to develop their activities.

2.2 Recommendations

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Due to the context within the degree, it is convenient to have passed the subjects of the first and second year.
Use and mastery of a second language, especially English.

3. Objectives (as result of teaching):

- The aim is to develop the contents of the general guidelines set by the Government, on the mandatory subject ALTERNATIVE ENERGIES in the Degree of Engineering Degree in Mining and Energy Resources.
- The aim is to provide for the graduate the appropriate answer to such fundamental questions as the acquisition of knowledge that meets the needs demanded by today's society, on the one hand, and to train them in the precise competencies for the exercise of their profession in a convenient and competitive manner.
- The student is intended to know about **ALTERNATIVE AND/OR RENOVATIVE ENERGY SOURCES:** ***The heat pump and its applications (geothermal energy). Hydraulic power. Wind power. Biomass. Hydrogen and fuel cells. Ocean power. Solar power (thermal, thermoelectric and photovoltaic). Cogeneration. Nuclear fusion power***

4. Skills to be acquired

4.1 Specific Skills:

ER08: Alternative energies and efficient use of energy

4.2 General, Basic or Transversal Skills:

The specific skills for the Degree in Mining and Energetic resources exploitation engineering are set out in Order CIN/306/2009 and essentially involve:

The capacity to understand and apply the fundamentals and knowledge of the following subjects to problem solving in mining engineering:

- Mechanics, thermodynamics,
- fields and waves and electromagnetism;
- Geology and morphology of the land;
- Materials science and technology;
- Fluids and hydraulic mechanics;
- Soil and rocks geotechnics and mechanics;
- Materials resistance and structures theory;
- Topography, photogrammetry and mapping;
- Company concept, organization and management;
- Research and assessment of environmental impact;
- Power electric systems;
- Integral planning and management of projects.

Qualification in Major in Mining Exploitation:

- Mining exploitations.
- Geotechnical studies applied to mining.
- Testing and sampling methods;
- Modelling; mapping development.
- Surface and subterranean works;
- Drilling and support techniques.
- Handling explosives.
- Rock and mineral processing plants.

- Design, operating and maintenance of building materials fabrication plants.

Qualification in Major in Energetic Resources Exploitation:

- Use, transformation and management of energetic resources.
- Water resources management.
- Electric, thermal power and alternative energies.
- Refining, petrochemical and carbochemical processes.
- Nuclear engineering and radiation protection.
- Explosives manufacturing, handling and use.

5. Training Activities and Teaching Methods

5.1 Training Activities:

- Theoretical sessions
- Academically directed teaching activities
- Fieldwork sessions

5.2 Teaching Methods::

- Participatory Master Class.
- Development of Field Practices in small groups.
- Individual or Collective Tutoring. Face to face interaction.
- Planning, Realization, Tutoring and Presentation of Essys
- Conferences and Seminars.
- Assessments and Exams.

5.3 Development and Justification:

The methodological proposal consists of a harmonious combination of several techniques supervised by the lecturer: participatory master class, document analysis, independent essays and reports, and seminars. In addition, field practices (visits to energy facilities) are proposed. The first classes will focus on the explanation of this new way of learning by the lecturer. Subsequently and following the course schedule, each student must present orally in class three topics of the program that will have been previously prepared. The rest will
prepare two questions on the subject and a question time will open in which they must answer each other. The moderator will be the student who exposes the theme of the day. The professor will oversee the development of these activities as discussed in previous paragraphs and will have provided the necessary teaching material and bibliography for their preparation
The presentations will be of approximate 20-30 minutes in which the assimilation of all the basic concepts of each topic and the oral and visual presentation of the slides will be evaluated. This requires the student to attend class regularly and show a participatory attitude in class.

Weekly the student will deliver an essay of each topic of the syllabus (as they are exhibited in class), prepared in mind maps and slideshows (PowerPoint, Prezi, kanva or similar). The essays will be corrected and returned to students to provided information to reduce the gap between current performance and a desired goal.
In addition, the professor may ask students to prepare some articles of interest to be discussed in class or to carry out some voluntary bibliographic work to raise evaluation marks.
For those who are not present at class or who do not overcome the continuous assessment there is an examination of the total content of the Syllabus.

6. Detailed Contents

LESSON 1. GENERALITIES.
1.1. Energy: definition, classification, units of measure and sources. Conversion between energy forms.
1.2. Generalities.
1.3. Gas emission.
1.4. Energy consumption.
1.5. Non-renewable energies.
1.6. Renewable energies.
1.7. Diverse opinions about the climate change.

LESSON 2. SOLAR ENERGY.
2.1 The Sun like source of energy.
2.2 Solar power plants: thermal, thermoelectric and photovoltaic.
2.3 Solar Thermal power generation.
2.4 Solar Photovoltaic or solar cells.
2.5 Perspective of the market of the solar power in Spain.

LESSON 3. WIND ENERGY.
3.1. The origin of the wind and wind power.
3.2. Brief history of the wind utilization.
3.3. Wind turbines.
3.4. Wind farms.
3.5. Environmental impact.
3.6. Possibilities for the applications of the wind power in Spain.

LESSON 4. BIOENERGY AND BIOFUELS.
4.1. Origins and classification of the biomass.
4.2. Transformation of the biomass in energy. Biological conversion and thermal processes.
4.3. Types and applications of the biomass (methane, Biodiesel and Bioethanol).
4.4. Recent developments to increase the performance of the biomasses.
4.5. Plants and transgenic trees for the production of biomass.
4.6. Biogas and cogeneration power plants.
4.7. Synfuels in commercial aviation.

LESSON 5. HYDROGENE.
5.1 Hydrogen in the earth and in the universe.
5.2 The energetic point of view of the hydrogen.
5.3 Fuel Cells. Production and storage of Hydrogen.
5.4 Types of Fuel Cells.
5.5. Hybrid vehicles.
5.6. Electric car and other ecological vehicles.
5.7 Fuel Cells for aviation.
5.8 Hydrogen production from the water.
5.9 What does the future hold?

LESSON 6. GEOTHERMAL ENERGY.

6.1 The geothermal phenomenon.
6.2 Geothermal heat pumps.
6.3 Direct use and applications.
6.4 Geothermal heating systems.
6.5 Geothermal power plants
6.6 Managing geothermal reservoirs
6.7 Hot, Dry Rock

LESSON 7. THE HYDRAULIC ENERGY.

7.1. The power of water.
7.2. Historical evolution of the hydraulic utilization.
7.3. Hydraulic power and hydroelectric power plants.
7.4. Types of hydroelectric power plants
7.5 Hydroelectric power plants in Spain and over the world.
7.6 Advantages and disadvantages of Hydroelectric power plants.

LESSON 8. OCEANIC ENERGY.

8.1. Generalities.
8.2. Tidal power.
8.3 Tidal power plants.
8.4. The project of Kislaya's Bay.
8.5. Waves power.
8.6. Extraction of wave power.
8.7. Thermal ocean power.

LESSON 9. COGENERATION.

9.1. Cogeneration. Trigeneration. Energy efficiency. Cogeneration technologies
9.2. Benefits of cogeneration.
9.3. How does cogeneration improve fuel efficiency?
9.4. Components of a cogeneration system
9.5 Off-site or district systems.
9.6 Business case considerations.

LESSON 10. NUCLEAR FUSION.

10.1. The power of a star.
10.2. Solar fusion.
10.3. Hydrogen in nuclear fusion
10.4. Power liberation in the nuclear fusion
10.5 ITER experimental reactor

LESSON 11. CLIMATE CHANGE AND FOSSIL FUELS.

11.1 Problems created by fossil fuels
11.2. Acid rain.
11.3. The greenhouse effect.
11.4. The ozone layer.
11.5. Climate change.
11.5. Kyoto protocol and other International meetings.

LESSON 12. STORAGE TECHNOLOGIES.

12.1. Types of energy storage.
12.2. Pumped storage hydropower.
12.3. Compressed air energy storage.
12.4. Large-scale batteries.
12.5. Superconducting magnetic storage.
12.6. Flywheels.
12.7. Capacitors. Hydrogen. Environmental considerations.
12.8. Costs.

LESSON 13. ENERGY, ECONOMICS AND ENVIROMENT.

13.1. Energy conservation and cogeneration.
13.2. Energy and the environment
13.3. Economics.
13.4. Life cycle analysis.
13.5. Sustainable development: A compelling scenario.
13.6. Energy and ethics.
13.7. Energy and geopolitics.

7. Bibliography

7.1 Basic Bibliography:

- BREEZE P. et al; "Renewable Energy Focus Handbook" (2009); Elsevier
- FANCHI, J. R. (2004) "Energy. Technology and directions for the future". Elsevier Academic press. London. U.K.
- SABONNADIERE, J. C.; (2009). "Renewable Energy Technologies". ISTE Ltd. & Wiley & Sons
- VIERIRA DA ROSA, A; (2009). "Fundamentals of Renewable Energy processes". Second Ed. Elsevier.
- ZILBERMAN, D. et al. (2010) "Handbook of Bioenergy Economics and Policy". Springer

7.2 Additional Bibliography:

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BRIDGEWATER A. (2009). Energias alternativas handbook. Ediciones paraninfo, S.A.
CREUS SOLÉ, A. (2009); "Energías Renovables" 2ª Ed. Editorial técnica.
DOMÍGUEZ GÓMEZ, J. A. (2008). "Energias alternativas, 3° edición". Equipo Sirius.
JARABO, F. y ELORTEGUI, N.; (2000). Energías renovables. SAPT Publicaciones Técnicas,S.L. Madrid.
MADRID VICENTE, A. (2008); "Energías renovables Fundamentos, Tecnologías y Aplicaciones"; AMV EDICIONES
ROLDÁN VILORIA, J. (2013); "Energias renovables: lo que hay que saber". Ediciones Paraninfo

8. Systems and Assessment Criteria

8.1 System for Assessment:

- Problems / theory exam
- Documents / original works (individual or in group)
- Work presentation and essays
- Individual student monitoring
- Practice presentation

8.2 Assessment Criteria and Marks:

8.2.1 Examinations Convocatory I

Attendance obligatory (85% of the lectures).

THEORETICAL /PROBLEMS EXAM (MIN-MAX 0-65 %)
Three topics of the Syllabus will be presented. The presentations (Power Point presentations or other) will be 20-30 minutes long and will be valued the assimilation of the basic concepts of every topic and the oral and visual presentation of the slides.
Competencies acquired: ER08, CB4, EE11, EE12, CB4, CGO7, CG16, CG17, CT1, CT3

DEFENSE OF WRITTEN WORKS OR ESSAYS (MIN-MAX 0-15%)
Bibliographic work on a topic related to the program of the subject (voluntary), plus the weekly delivery of a report in which the complete contents of each topic, as they are exposed in class, elaborated in mind maps and in slide presentations ((10 slides in PowerPoint, Prezi, kanva or similar).
Competencies acquired: CB1, CB2

PRACTICE EXAM. (MIN-MAX 0-10%).
Skills acquired: ER08

INDIVIDUAL STUDENT MONITORING (MIN-MAX 0-10%)
Participatory and respectful attitude in class will be valued. Likewise, interest, punctuality, tutorials and everything that can help the student to improve their learning process.
Competencies acquired: CG16, CT6A

FOR THOSE WHO ARE NOT PRESENT AT CLASS OR WHO DO NOT OVERCOME THE CONTINUOUS ASSESSMENT
An examination of the total content of the program (100%) is proposed: This test will deal with a series of short development questions and / or multiple-choice test on the syllabus taught.

HONORS:
It is also contemplated that the minimum requirements for obtaining the mention of "Matrícula de Honor" is, obtain an Outstanding grade (10) in every one of the evaluation activities.

8.2.2 Examinations Convocatory II

Students will be evaluated with a single final exam, where the grade (100% grade) will be a single test. This test will deal with a series of short development questions on the syllabus taught.

8.2.3 Examinations Convocatory III

Students will be evaluated with a single final exam, where the grade (100% grade) will be a single test. This test will deal with a series of short development questions on the syllabus taught.

8.2.4 Extraordinary Convocatory

Students will be evaluated with a single final exam, where the grade (100% grade) will be a single test. This test will deal with a series of short development questions on the syllabus taught.

8.3 Single Final Evaluation:

- For each ordinary and extraordinary call, the students who cannot benefit from the continuous evaluation will be qualified only on the basis of a final exam to demonstrate the acquisition of (CB1, CB2,CB3, CB4, CG16, CG20, CG21, CT1, Ct3 and CT5 skills of the subject autonomously, dispensing of the teaching-learning procedures developed in the teaching period.
- Students will be evaluated with a single final exam, where the grade (100% grade) will be a single test. This test will deal with a series of short development questions on the syllabus taught.