Bachelor in Mining Exploitation and Energy Resources Engineering

Course information

Year 2021-22

GENERAL SPECIFICATIONS			
English name			
ALTERNATIVE ENERGIES			
Spanish name			
ENERGÍAS ALTERNATIVAS			
Code	**Type**		
606810228	Optional		
Time distribution			
	Total	**In class**	**Out class**
Working hours	150	60	90

ECTS:

Standard group	Small groups			
	Classroom	**Lab**	**Practices**	**Computer classroom**

Departments	**Knowledge areas**
Construtión industry, Energy, Mechanics and Mining Engineering	Mining exploitation
Year	**Semester**
3	2ND

TEACHING STAFF			
Name	**E-Mail**	**Telephone**	**Office**
NURIA C. GIL CARVAJAL	carvajal@uhu.es	959702054	959217352

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). The hydraulic power. The wind power. The biomass. The Hydrogen and the fuel cells. The oceanic energy. The solar power (thermal, thermoelectric and fotovoltaic). The 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. fusión nuclear.

2. Background

2.1.Situation within the Degree:

2.2. Recommendations:

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.

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 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.
Major in Mining Exploitation: Qualification in:
Mining exploitations. Geotechnical studies applied to mining. Testing and sampling methods; modelling; mapping development. Surface and subterranean works; perforation and support techniques. Handling explosives. Rock and mineral processing plants. Design, operating and maintenance of building materials fabrication plants.
Major in Energetic Resources Exploitation: Qualification in:
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. 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 summaries and conceptual maps. 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.

References:
BREEZE P. et al; "Renewable Energy Focus Handbook" (2009); Elsevier (Chapter 1, 3)
http://www.elsevierdirect.com/ 9780123747051
FANCHI, J. R. (2004) "Energy. Technology and directions for the future". Elsevier Academic press. London. U.K. (Chapter 1)
SORENSEN, B. (2007). "Renewable Energy Conversion, Transmission and Storage" Elsevier.
JORDAN, A. et al; (2010). "Climate Change Policy in the E. U. "; Cambridge University Press. (Introduction)

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.

References:
BREEZE P. et al; (2009) "Renewable Energy Focus Handbook"; Elsevier
http://www.elsevierdirect.com/ 9780123747051 (Section 6)
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. (Chapters 1, 2, 3, 4)
VIERIRA DA ROSA, A; (2009) "Fundamentals of Renewable Energy processes" 2nd Ed. Elsevier. (Appendix A: "The measurement of time")

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.

References:
BREEZE P. et al; "Renewable Energy Focus Handbook" (2009); Elsevier
http://www.elsevierdirect.com/ 978012374705 (Section 9)
FANCHI, J. R. (2004) "Energy. Technology and directions for the future". Elsevier Academic press. London. U.K. (Chapter 12)
SABONNADIERE, J. C.; (2009). "Renewable Energy Technologies". ISTE Ltd & Wiley & Sons. (Chapters 5, 6)

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.

References:
BREEZE P. et al; "Renewable Energy Focus Handbook" (2009); Elsevier
http://www.elsevierdirect.com/ 9780123747051 (Sections 11, 12)
FANCHI, J. R. (2004). "Energy, Technology and directions for the future". Elsevier Academic press. London. U.K. (Chapter13)
MUTHA, V. K. (2010). "Handbook of Bioenergy and Biofuel" SBS PUBLISHERS & DISTRIBUTORS PVT. LTD. (Introduction)
SABONNADIERE, J. C.; (2009). "Renewable Energy Technologies". ISTE Ltd & Wiley & Sons. (Chapters 10, 11, 12)
ZILBERMAN, D. et al. (2010) "Handbook of Bioenergy Economics and Policy". Springer

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?

References:
BREEZE P. et al; "Renewable Energy Focus Handbook" (2009); Elsevier
http://www.elsevierdirect.com/ 9780123747051 (Section 5)
VIEIRA DA ROSA, A; (2009). "Fundamentals of Renewable Energy processes". Second Ed. Elsevier. (Chapters 9, 10, 11)

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

References:
BREEZE P. et al; "Renewable Energy Focus Handbook" (2009); Elsevier

http://www.elsevierdirect.com/ 9780123747051 (Section 8)
FANCHI, J. R. (2004) "Energy. Technology and directions for the future". Elsevier Academic press. London. U.K. (Chapter 4)
SABONNADIERE, J. C.; (2009). "Renewable Energy Technologies". ISTE Ltd & Wiley & Sons (Chapter 9)

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.

References:
BREEZE P. et al; "Renewable Energy Focus Handbook" (2009); Elsevier
http://www.elsevierdirect.com/ 9780123747051. (Section 10)
SABONNADIERE, J. C.; (2009). "Renewable Energy Technologies". ISTE Ltd & Wiley & Sons. (Chapter 8)

LESSON 8. OCEANIC ENERGY.

8.1. Generalities
8.2. Tidal power (Maremotriz).
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.

References:
BREEZE P. et al; "Renewable Energy Focus Handbook" (2009); Elsevier
http://www.elsevierdirect.com/ 9780123747051 (Section 7)
SABONNADIERE, J. C.; (2009). "Renewable Energy Technologies". ISTE Ltd & Wiley & Sons. (Chapter 7)

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.

References:
Cogeneration feasibility guide. Office of Environment and Heritage NSW.
http://www.em-ea.org/guide%20books/book-2/2.7%20cogeneration%20.pdf
www.environment.nsw.gov.au.
http://www.code-project.eu/wp-content/uploads/2011/04/CODE_CS_Handbook_Final.pdf
http://www.albadronline.com/oldsite/books/POWER%20GENERATION%20HANDBOOK/Power%20Generation%20Handbook-Part3.pdf (chapter 22 & 23).

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

References:
FANCHI, J. R. (2004) "Energy. Technology and directions for the future". Elsevier Academic press. London. U.K. (Chapter 11)

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.

References:
MADRID VICENTE, A. (2008); "Energías renovables Fundamentos, Tecnologías y Aplicaciones"; AMV EDICIONES (Chapter 4).
QUASCHNING V. (2010): "Renewable energies and climate change". IEEE. Press. Wiley. (Chapter 2).
http://www.mitosyfraudes.org/Calen7/CO2nocausa.html
http://www.biocab.org/Global_Warming_sp.html
http://www.tiempo.com/ram/2424/la-historia-del-clima/
http://www.dsri.dk/~hsv/Noter/solsys99.html
http://www.iac.es/gabinete/iacnoticias/2-2000/16.pdf
http://www.wisphysics.es/2007/12/analisis-de-fcf-6-2
http://www.monografias.com/trabajos80/calentamiento-global-antropogenico/calentamiento-global-antropogenico.shtml
http://ciencia.nasa.gov/science-at-nasa/2007/14dec_excitement/
www.globalwarmingout.com
http://books.google.es/books?id=hxIjOfHB11oC&printsec=frontcover&hl=es&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

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.

References:

BREEZE P. et al; “Renewable Energy Focus Handbook” (2009); Elsevier (Chapter 13)

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.

References:
FANCHI, J. R. (2004) “Energy. Technology and directions for the future”. Elsevier Academic press. London. U.K. (Chapter 14)

FIELD PRACTICES (Depending on the availability)
Visit to industrial plants of the sector.

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:

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, 3º edición". Equipo Sirius.

FANCHI, J. R. (2004); “Energy, Technology and directions for the future” Elsevier academic press. London U.K.

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:

CONTINUOUS ASSESSMENT FOR COURSE BASED IN:

Continuous evaluation presents a number of benefits in the educational context. First, it allows the student an easier overcoming of the subjects, because both content and competencies are assimilated and learned in a more gradual and deep way, receiving constant support from teachers. In addition, having continuous feedback, the students will be able to know their own learning pace, having the opportunity to rectify and reorient the educational process, improving studying habits and methods. It therefore promotes learning increasing the organizational capacity itself. According to Glasser (1999), we learn 95% of what we teach others (classifying, summarizing, structuring, defining, generalizing, developing, testing and 80% of what we do autonomously, 70% of what we discuss with others, versus values low than we see, we hear and read. The evaluation will be carried out on the basis of the following criteria:

THEORETICAL /PROBLEMS EXAM (MIN-MAX 0-65 %)
3 topics of th 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, CT3.

INDIVIDUAL STUDENT MONITORING (MIN-MAX 0-10%)
Competencies acquired: CG16, CT6.

DEFENSE OF WRITTEN WORKS OR ESSAYS (MIN-MAX 0-15%)
Bibliographic work on any topic related with those of the syllabus. Weekly delivery of an essay (summary and mind map) of the lesson with the topics of the Syllabus in 4-5 pages. Send it by email. Print it and take it to the class.
Competencies acquired: CB1, CB2, CG07, CG17, CT2.

PRACTICE EXAM. (MIN-MAX 0-10%).
Compulsory attendance (maximum 2 unjustified fouls). Participatory and respectful attitude in class
Skills acquired: ER08

Attendance obligatory.

Participatory and respectful attitude in class.

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 program:

a) Examination with five short questions (one point each one) and a development question

choosing between two proposed topics (five points). It accounts for 75% of the grade. The 25 % left is taking in account the work during the semester.

FINAL UNIQUE EVALUATION BASED IN:

THEORETICAL/ PROBLEMS EXAM (MIN-MAX 0-65 %)
Examination with five short questions (1 point each) and one topic to be developed to choose between two proposals (5 points).

INDIVIDUAL STUDENT TRACKING (MIN-MAX 0-10%)

DEFENSE OF WRITTEN WORKS OR REPORTS (MIN-MAX 0-15%)
Bibliographic essay on a topic related to the program of the subject.
PRACTICE EXAMINATION. (MIN-MAX 0-10%).
Competencies acquired: ER08, CB4, CT3. CB1, CB2, CG07, CG17, CT2.