Bachelor in Mining Exploitation and Energy Resources Engineering

Course information

Year 2019-20

GENERAL SPECIFICATIONS			
English name			
Alternative energies			
Spanish name			
Energías Alternativas			
Code	**Type**		
606810228	Obligatory		
Time distribution			
	Total	**In class**	**Out class**
Working hours	150	60	90
ECTS: 6			
Standard group	**Small groups**		
	Classroom	**Lab**	**Practices**	**Computer classroom**
4	1.5	0	0,5	0
Departments	**Knowledge areas**		
Mining, Mechanical, Energy and Building Engineering	Exploitation of Mines		
Year	**Semester**		
3º	2º		

TEACHING STAFF			
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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 ENRGIES: 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 photovoltaic). The cogeneration.
1.2. In Spanish
La energía: definición, clasificación, unidades de medida y fuentes. FUENTES DE ENERGÍA ALTERNATIVAS O RENOVABLES: La bomba de calor y sus aplicaciones (energía geotérmica). La energía 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. Nuclear fusion

2. Background

2.1.Situation within the Degree:

This subject is part of the 3rd course of the DEGREE IN ENGINEERING IN MINING EXPLOITATIONS AND ENERGY RESOURCES as mandatory in the Energy Resources itinerary.
It is a necessary and fundamental subject in the mining and civil works context, since many private and public companies are making investments in the alternative energy sector and hire mining professionals to develop their activities.

2.2. Recommendations:

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

3. Objectives (as result of teaching):

It is about developing the contents of the general guidelines set by the Government, on the mandatory subject ALTERNATIVE ENERGIES in the Degree in Engineering in Exploitation of Mines and Energy Resources.
It is intended to provide an adequate response to questions that are so fundamental for the graduate, such as the acquisition of knowledge that meets the needs demanded by today's society, on the one hand, and to train it with the precise competences for the exercise of their profession in a convenient and competitive way.
It is intended that the student knows about ALTERNATIVE AND / OR RENEWABLE ENERGY SOURCES:
The pump heat and its applications (geothermal energy). Hydraulic power. Wind power. Biomass, Hydrogen and batteries. Oceanic power. Solar energy (thermal, thermoelectric and photovoltaic power). The 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:

CB1. Demonstrate to understand and have acquired knowledge about an area of study that starts from basic Secondary Education, and is often at supported by advanced textbooks, but also includes some aspects that involve knowledge related to the forefront of their field of study.

CB2. Know how to apply their knowledge to their work or vocation in a professional way. They should also possess the skills that are usually demonstrated through the elaboration and defence of arguments and in problem solving within their area of study.

CB3. Gather and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical issues.

CB4. Be able to convey information, ideas, problems and solutions to both specialised and non-specialised audiences.

CG07: Capacity for analysis and synthesis
CG16: Sensitivity for environmental issues
CG17: Capacity for critical reasoning

T01: Use and mastery of a second language, especially English

T02: Knowledge and improvement in the field of ICT

5. Training Activities and Teaching Methods

5.1. Training Activities:

- Theory sessions on the contents of the Program.
- Field sessions to approach the industrial reality.
- Academically Directed Activities by the Faculty: seminars, conferences, individual projects
- Collective tutorials, evaluation activities and self-evaluation.

5.2. Teaching Methods:

- Participatory Master Class.
- Development of Field Practices in small groups.
- Individual or Collective Tutorials. Direct interaction teachers-students.
- Approach, Realization, Tutoring and Presentation of Works.
- Conferences and Seminars.
- Evaluations and Exams.

5.3. Development and Justification:

A teaching method adapted to the EUROPEAN SPACE OF HIGHER EDUCATION (EESS) is proposed in this subject, in which the student is the fundamental axis of the teaching-learning process to acquire an integral training. To this end, a cultural change is proposed in which the roles of teachers and students are modified (Monereo &Pozo, 2003) and a change in more technical aspects is proposed (Martínez & Sauleda, 2006), such as the use of ICTs, new professional demands etc.

To achieve the objectives on the degree studies, this option takes the students to acquire sufficient competence in both personally (scientific, technical, ethical and social), and professionally skills, that allow them to reason, make judgments, communicate and manage complex systems with social and ethical responsibility.

Traditional training based on the master class to train specialized graduates to carry out a profession is not sufficient in today's society, which demands other competences (academic, instrumental, interpersonal and cognitive). Some studies (García Ruiz, María Rosa, 2006) propose the attainment of knowledge more related with the adaptability to change, with integration, versatility, mobility, availability, involvement of the students and its commitment with the subject and always focused on their future jobs.

The aim is to make the professor assume responsibility with a teaching focused on the student. For this purpose, the old role of the student focused on obtaining positive grades to pass the course is transformed on an active role in learning, to encourage their autonomous character in the search for information, in the generation of new knowledge, promoting their ability to reflect. The new role allows them to apply strategies to solve problems and possible obstacles, with a cooperative and responsible spirit.

Thus, an evaluative method is established with different activities or tests, assessing the student's in their learning process and evolution, which will allow their improvement as the course progresses.

The professor will attend and help the students to preserve and increase their self-esteem taking them to understand and dominate the subject matter through the acquisition of knowledge and skills and preparing them for the incorporation into the labor market and employment competitiveness. The teaching staff becomes a facilitator, supervisor and guide of the learning process.

The teaching activity acquires new approaches in which the learning method must take into account several factors: requirements and objectives of the subject, characteristics of the students, personality of the teacher, the application of the ICT's, the physical and material conditions of the class (group size, resources, audiovisual media, laboratories, networks, libraries etc.) and the atmosphere of it. It will also be necessary to make a selection of the teaching materials and follow the established schedule.

The methodological proposal consists of a harmonic combination of several techniques supervised by the teaching staff: participatory master class, document analysis, stand-alone project work, exhibitions and seminars, in addition to laboratory and field practices (visits to mining industrial facilities).

The first lectures will be focused on the explanation of this new way of learning by the professor. Subsequently and following the course schedule, each student must present orally in class 3 program topics that will have been prepared previously. The rest will prepare two questions on the subject and a question time will open. The moderator will be the student who exposes the topic of the day. The teacher will supervise the development of these activities, as mentioned in previous paragraphs. They will be exhibitions or presentations of approximate 20-30 minutes in which they will be evaluated in the assimilation of all the basic concepts of each subject and in the oral and visual presentation of the slides. Participative attendance to the lectures is very recommended.

Weekly the student will deliver a report with the complete contents of each program subject topic (as they are exhibited in class), consisting in summaries and conceptual maps. These will be corrected and returned to the students as feedback.

In addition, the professor may ask the students to prepare some articles of interest that will be discussed in class or the accomplishment of some voluntary bibliographic work to raise note. To those students who do not carry the continuous assessment will be proposed a knowledge test. Those with good progress will not realize final examination.

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". 2nd 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)

PROGRAM OF PRACTICES

Consisting of exercises related to the agenda.

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.

7.2. Additional Bibliography:

- SABONNADIERE, J. C.; (2009). "Renewable Energy Technologies". ISTE Ltd. & Wiley & Sons
- VIERIRA DA ROSA, A; (2009). "Fundamentals of Renewable Energy processes". 2nd Ed. Elsevier.
- ZILBERMAN, D. et al. (2010) "Handbook of Bioenergy Economics and Policy". Springer
- CREUS SOLÉ, A. (2009); "Energías Renovables" 2ª Ed. Editorial técnica. Capítulo 6.
- MADRID VICENTE, A. (2008); "Energías renovables Fundamentos, Tecnologías y Aplicaciones"; AMV EDICIONES Capítulo

8. Systems and Assessment Criteria

8.1. System for Assessment:

- Theory / problems exam
- Defense of Written and oral Works and Reports
- Student Individual learning plan
- Practice exam

8.2. Assessment Criteria and Marks:

CONTINUOUS ASSEMENT

The continuous evaluation presents a series of benefits in the educational context. Firstly, allows the student to overcome the subjects easier, since both the contents, such as competences, are assimilated and learned in a more gradual and profound way, receiving a constant support of the teaching staff. In addition, by having information and continuous feedback, the student will be able to know their own rhythm of learning, having the opportunity to rectify and reorient their educational process, improving habits and studing methods. It favors, therefore, an autonomous learning, increasing their own organizational capacity. According to Glasser (1999), we learn 95% of what we teach to others (classifying, summarizing, arranging, defining, generalizing, elaborating, testing and illustrating), 80% of

what we learn self-direct, 70% of what we discuss with others, compared to what we see, hear and read.

The evaluation will be based on the following criteria:

PROBLEMS AND THEORY EXAMINATION (MIN-MAX 0-65 %)

The exhibition of 3 topics of the program. The assimilation of the basic concepts of each subject and the oral and visual presentation of the slides

STUDENT INDIVIDUAL LEARNING PLAN (MIN-MAX 0-10 %)

DEFENSE OF WRITTEN AND ORAL WORKS AND REPORTS (MIN-MAX 0-15 %)

PRACTICE EXAMINATION. (MIN-MAX 0-10 %).

Compulsory attendance (maximum 2 absences without justification). Participative and respectful attitude in class

FOR THOSE WHO DO NOT ATTEND CLASS OR DO NOT EXCEED THE CONTINUOUS EVALUATION

PROBLEMS AND THEORY EXAMINATION (MIN-MAX 0-65 %)

STUDENT INDIVIDUAL LEARNING PLAN (MIN-MAX 0-10 %)

DEFENSE OF WRITTEN AND ORAL WORKS AND REPORTS (MIN-MAX 0-15 %)

PRACTICE EXAMINATION. (MIN-MAX 0-10 %).

Exam of the total content of the program: Exam with five short questions (1 point each) and a topic to develop to choose between two proposed (5 points).