COURSE DATA

Data Subject	
Code	33117
Name	Energy management. Renewable energy
Cycle	Grade
ECTS Credits	6.0
Academic year	2019 - 2020

Study (s)

Degree	Center	Acad. year	Period
1104 - Degree in Environmental Sciences	Faculty of Biological Sciences	4	First term

Subject-matter

Degree	Subject-matter	Character
1104 - Degree in Environmental Sciences	185 - Energy management. Renewable energies	Optional

Coordination

Name	Department
GOMEZ AMO, JOSE LUIS	345 - Earth Physics and Thermodynamics
MARTINEZ SORIA, VICENTE	245 - Chemical Engineering
UTRILLAS ESTEBAN, MARIA DEL PILAR	345 - Earth Physics and Thermodynamics

SUMMARY

Energy Management. Renewable Energy is a Fourth Year optional subject, taught in the first quarter of the Degree in Environmental Sciences. The course consists of a part of theory and problems that are explained in the classroom with the whole group and part of laboratory practice, seminars and computer practices taught to smaller subgroups of 16 students per subgroup.

It is a subject to be studied in the last bachelor year of Environment Sciences. It is eminently practical and strongly connected with the potential development of the students.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

Students must know the mathematical tools they have learned in previous courses and know also the basic concepts of physics they have studied in the previous years such as the ones related to energy, mechanics, fluids, heat and power transmission. They must also know some basic aspects of biology and chemistry. All these fields have been part of their training in previous courses.

OUTCOMES

1104 - Degree in Environmental Sciences

- Have capacity for analysis and synthesis and for critical reasoning.
- Be able to communicate orally and in writing.
- Be able to use new information and communication technologies.
- Be able to learn independently and to adapt to new situations.
- Have problem-solving skills, be able to apply knowledge to practice and show motivation for quality.
- Be able to work in a team.
- Be sensitive to environmental issues.
- Acknowledge fundamental rights and equality between men and women, respect and promote human rights and the principles of universal accessibility and design for all, and respect democratic values.
- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.
- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.

LEARNING OUTCOMES

- Mastery of the main strategies associated with energy management in companies.
- Knowledge of energy audit procedures.
- Elaboration of practical cases.
- Understanding of the physicochemical principles of the different renewable energies.
- Ability to select alternatives applied in different scenarios.

and...
• Understand and analyze critically the current situation of energy, and its impact on the industry.
• Know the energy saving techniques and determine their possible applicability.
• Perform calculations of energy savings, including economic evaluation.
• Know the fundamental properties of the different types of renewable energies.
• Accurately assess the achieved yields and the energy production associated with each type of renewable application.
• Master the mathematical and computer tools associated with the evaluation of renewable energies and energy management.
• Know how to evaluate the characteristic curves of a cell or a photovoltaic module.
• Know how to solve the energy balance equation of a thermal collection system.
• Resolution of problems that involve the prey of qualitative and quantitative data in the laboratory, the analysis of these data and their interpretation in a theoretical context.

DESCRIPTION OF CONTENTS

1. Wind Energy

Origin and performance of the wind. Wind resources. Estimated energy production. Wind machines. Power generated. Advantages, disadvantages and environmental impact.

2. Fotovoltaic Solar Energy

The photovoltaic effect and the characteristic curve. The maximum power point. The solar cell, the solar module and PV system. Applications. Advantages, disadvantages and environmental impact.

3. Thermal Solar Energy

Converting the sun's energy into heat. Optical and thermal losses of materials. The flat solar collector, performance evaluation. Concentration systems. Advantages, disadvantages and environmental impact.

4. Biomass

Concept of biomass. Organic waste. Energy crops. Conversion of biomass into energy. Biofuels. Advantages, disadvantages and environmental impact.

5. Other forms of renewable energy

Hydropower. Geothermal energy. Energy from the sea.

6. Energy, Environment and Management

Energy perspectives. Consumption and energy costs. Energy management. Energy policies. Tools and techniques of energy management

7. Energy Audit

The role of the energy audit. Energy data: production process, consumption, costs, etc.. Comparative analysis: indicators, sector specific consumption, use of best practices, etc.. Analysis of opportunities for improvement. Economic calculations: estimate of benefits. UNE 216501

8. Energy Efficiency

Concept of efficiency and energy savings. Efficiency techniques Thermal recycling, insulation, process analysis. Efficient energy systems. Process integration. Energy management systems ISO 50001

9. Cogeneration

Cogeneration. Benefits. Types of systems. Gas turbine. Steam turbine. Combustion engine. Combined cycle. Measure of efficiency. Economic prospects

10. Computer lab

Activity where exercises related to wind energy are carried out using spreadsheet software to solve them. Attendance is mandatory for computer sessions.

11. Laboratory

Laboratory practical works are carried out related to the solar photo thermal and photovoltaic energy. Attendance is mandatory for laboratory sessions.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	36,00	100
Laboratory practices	9,00	100
Classroom practices	9,00	100
Computer classroom practice	3,00	100
Tutorials	3,00	100
Development of group work	8,00	0
Development of individual work	16,00	0
Study and independent work	30,00	0
Preparation of evaluation activities	10,00	0
Preparing lectures	10,00	0
Preparation of practical classes and problem	10,00	0
Resolution of case studies	6,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The course consists of several parts, with a distinct methodology.

• **Theory and Problems**:
Where the teacher explains the contents programmed using various support materials such as slides, film, notes, figures or diagrams. These materials are provided in advance to the students.

• **Tutorials**:
The tutorials are given to subgroups that have a maximum of 16 students. In them, the teacher monitors the work and the progress made by pupils. In the development of tutoring, the teacher should resolve any doubts raised.

• **Seminars:**
The seminars are intended as teaching sessions and additional learning. They provide students with some current issues in support of the subject and related to the environment.

• **Laboratory**:
The laboratory sessions consists of three sessions of three hours each. These sessions are taught to small groups of a maximum of 16 students led by the teacher concerned. The sessions are dedicated to proper laboratory work, where students, in pairs, make the experimental setup and data collection. The team must submit a report for each procedure showing the collection of experimental values obtained and their treatment (errors, graphics, settings, etc..), and the conclusions reached. With emphasis on the proper use of appropriate software for the processing of data. This work will be performed in the laboratory by using computers there available.

• **Computing**:
The computing session will be devoted to the handling of the tools available for the proper use of data and information pertaining to the subject. Calculation programs, data processing, graphics, setting lines, etc.. In learning these techniques, the students may use data sets that have been taken in the laboratory. This session also will be used for parallel simulations on subjects related to the development of the course.

EVALUATION

The evaluation of the subject is made considering the set of differentiated parts that consists of the subject:

• Theory and problems

• Tutorials, papers and seminar

• Laboratory and information technology.

The evaluation of each of these parts is done separately using the criteria detailed below.

a) Evaluation of theory and problems:

This part of the subject will be evaluated by means of written exams, which will consist of a set of theoretical development questions, questions of application of the theoretical aspects and which may have numerical content and problems proper, where the students show their acquired capacity to solve them. The distribution of the three aspects in the whole of the written exam will obey to the criteria of times used in the development of the classes for each one of those aspects.

b) Evaluation of tutorials, papers and seminars:The problems and work carried out by the students during the course will be duly evaluated and scored by the teacher. The total grade will be the sum of the scores of the problems solved and presented normalized to the total of problems proposed during the course for its realization. The exercises that can be evaluated and carried out in class will not be recoverable.

c) Evaluation of laboratory practices and computer sessions:Attendance at laboratory and computer sessions will be mandatory. The work of this part is evaluated based on the reports and the reports that the students have to do in each of the corresponding sessions throughout the course.

The final evaluation of the subject will be done, for all the calls, according to the following criteria:• Written individual exam done on the date established in the call: 6 points. Minimum 2.5 to be able to do average.• Probos in class and work: 2.0 point. Exercises, problems, questionnaires, etc., delivered during the course or made during the tutorial work sessions.• Laboratory and computer session: 2.0 points. Work done to the own laboratory / computer room, and the memories delivered. Minimum 1.0 to be able to do average.

The final grade will result from the sum of the three partial notes obtained in the previous sections, after considering the corresponding minimums.

REFERENCES

Basic

- F. Jarabo y N. Elórtegui. Energías Renovables. SAPT Publicaciones Técnicas. Madrid. 2000.
- M. Ortega. Energías Renovables. Paraninfo. Madrid. 2000.
- J. González. Energías Renovables. Reverté. Barcelona. 2009.
- IDAE, Guías Técnicas de Ahorro y Eficiencia Energética 2007-2010.
- J.M. Lujan, J.L. Peidró y C. Guardiola. Problemas de Tecnología y Gestión Energéticas. Universidad Politécnica de Valencia 2003
- Cámara Oficial de Comercio e Industria de Madrid y Comunidad de Madrid. Manual de Auditorías Energéticas. Madrid 2003

Additional

- P. Gipe. Energía Eólica Práctica. PROGENSA. Sevilla. 2000.
- M. Alonso. Sistemas Fotovoltaicos. SAPT Publicaciones Técnicas. Madrid. 2001
- R. Lemwigh-Müller. Instalaciones de Energía Solar Térmica. Madrid. 2000.
- CIEMAT. La Biomasa. Fuente de energía y productos para la agricultura y la industria. Serie de ponencias. Madrid. 1996.
- M. Sanchotello, AV Orchilles Transmissió de calor Universitat de València 2007
- R. Smith Chemical Process. Design and Integration. Editorial Wiley, 2005.
- Y Calventus et al Tecnologia energética y medioambiente UPC 2006

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

English version is not available