



Teaching Guide

| Teaching Guide | | | | |
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| Identifying Data | | | | 2022/23 |
| Subject (*) | Cogeneration and Biomass Systems | | Code | 730547003d |
| Study programme | Máster Universitario en Eficiencia Enerxética e Sustentabilidade (a distancia) | | | |
| Descriptors | | | | |
| Cycle | Period | Year | Type | Credits |
| Official Master's Degree | 1st four-month period | First | Obligatory | 4.5 |
| Language | Spanish | | | |
| Teaching method | Non-attendance | | | |
| Prerequisites | | | | |
| Department | Enxeñaría Industrial | | | |
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| Lecturers | Casteleiro Roca, José Luis | E-mail | jose.luis.casteleiro@udc.es | |
| Web | | | | |
| General description | This subject aims to give the student knowledge about the various Thermal Systems used today; In addition, the different Cogeneration Systems used to increase the efficiency of the facilities will also be explained; and Biomass will be presented as an option to switch to renewable energy. | | | |

Study programme competences

| Code | Study programme competences |
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| A5 | CE5 - Analyze energy consumption and its associated costs |
| A7 | CE7 - Have knowledge of the fundamentals, potential, technology, applications and regulations of renewable energy sources |
| A8 | CE8 - Analyze and include renewable energies in different facilities |
| A9 | CE9 - Make decisions in a technological environment where materials are used in efficiency applications |
| A11 | CE11 - Design and analyze cogeneration systems |
| A12 | CE12 - Design and analyze biomass systems |
| A13 | CE13 - Analyze, apply and optimize energy use systems |
| B2 | CB7 - That students know how to apply the knowledge acquired and their ability to solve problems in new or little-known environments within broader (or multidisciplinary) contexts related to their area of study |
| B5 | CB10 - That students have the learning skills that allow them to continue studying in a way that will be largely self-directed or autonomous |
| B11 | CG6 - Acquire new knowledge and skills related to the professional field of the master's degree |
| B14 | CG9 - Apply knowledge of advanced sciences and technologies to professional or research practice of efficiency |
| C3 | CT3 - Use the basic tools of information and communication technologies (ICT) necessary for the exercise of their profession and for learning throughout their lives |
| C5 | CT5 - Understand the importance of entrepreneurial culture and know the means available to entrepreneurs |
| C6 | CT6 - Gain life skills and healthy habits, routines, and lifestyles |
| C8 | CT8 - Value the importance of research, innovation and technological development in the socioeconomic and cultural progress of society |

Learning outcomes

| Learning outcomes | Study programme competences | | |
|--|-----------------------------|-------------|------------|
| Know the environmental problems related to the generation of electrical energy | AC5 AC7 AC9 | BC5 BC11 | CC3 CC8 |
| Analyze and know how to design systems based on heat pump | AC7 AC9 AC13 | BC2 BC11 | CC3 CC6 |
| Analyze and know how to design cogeneration systems | AC8 AC9 AC11 | BC5 BC14 | CC5 CC6 |



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|---|--------------------|-------------|------------|
| Analyze and know how to design biomass generation systems | AC5 AC8 AC12 | BC2 BC14 | CC5 CC8 |
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| Contents | |
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| Topic | Sub-topic |
| Contents described in the verification report | Environmental problems in generation. Systems based on heat pump. Use of residual heat. Biomass cogeneration. |
| Topic 1: Environmental considerations | 1.1. Environmental problems 1.2. Solutions to environmental problems. Renewable energy |
| Topic 2: Systems based on heat pump | 2.1. Operating principle of a heat pump 2.2. Installations based on heat pump 2.3. Facilities sizing |
| Topic 3: Use of waste heat. Cogeneration | 3.1. General aspects of cogeneration 3.2. Technology applied to cogeneration and trigeneration 3.3. Cogeneration and trigeneration power stations |
| Topic 4: Biomass | 4.1. Energy sources 4.2. Municipal Solid Waste 4.3. Process of using biomass 4.4. Domestic applications |

| Planning | | | | |
|---|--------------------|----------------------|-------------------------------|-------------|
| Methodologies / tests | Competencies | Ordinary class hours | Student's personal work hours | Total hours |
| Problem solving | A5 A7 B11 C6 | 20 | 25 | 45 |
| Workshop | A11 A12 A13 B14 C8 | 1 | 25 | 26 |
| Mixed objective/subjective test | A8 A9 B5 C5 | 2 | 12 | 14 |
| Workbook | A11 A12 A13 B2 C3 | 14 | 25 | 39 |
| Personalized attention | | 1 | 0 | 1 |
| (*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students. | | | | |

| Methodologies | |
|---------------------------------|---|
| Methodologies | Description |
| Problem solving | Solving exercises and specific problems in the classroom, from the knowledge explained. |
| Workshop | Realization of an individual work of a specific subject of the subject and sharing in a group to share knowledge. Later the works will be joined in a common one that will be presented in class by groups. |
| Mixed objective/subjective test | It consists in carrying out an objective test of approximately 3 hours, in which the acquired knowledge will be evaluated. |

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| Workbook | <p>Keynote speech complemented with the use of audiovisual media and the introduction of some questions to students, in order to transmit knowledge and facilitate learning.</p> <p>The order of the topics covered will not have to be the one described in the teaching guide. In addition, there will be topics that can be seen together on the development of others, and the division between them may not be strict.</p> |
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| Personalized attention | |
|------------------------|---|
| Methodologies | Description |
| Workshop | The student has the relevant meetings of personalized tutorials, to resolve the concerns arising from the matter. |

| Assessment | | | |
|---------------------------------------|--------------------|--|---------------|
| Methodologies | Competencies | Description | Qualification |
| Problem solving | A5 A7 B11 C6 | Some tasks established in the subject, within the framework of this methodology | 5 |
| Workshop | A11 A12 A13 B14 C8 | Accomplishment of an individual and group work, as well as its exhibition in class | 35 |
| Mixed objective/subjective test | A8 A9 B5 C5 | Exam type objective test | 60 |

| Assessment comments |
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| <p>As part of the "Laboratory practice" may include aspects such as attendance, personal work, attitude, etc., to help to pass the subject.</p> <p>The "Mixed test" will be divided into a multiple choice and some questions.</p> <p>It is necessary to exceed 15% of the score in the "Mixed test" to pass, as well as to approve the works proposed in "Workshop".</p> <p>Students with recognition of part-time dedication and academic waiver of attendance exemption, second establishes the "NORMA QUE REGULA O RÉXIME DE DEDICACIÓN AO ESTUDO DOS ESTUDANTES DE GRAO NA UDC (Arts. 2.3; 3.b e 4.5) (29/5/212)", will be evaluated in the same way, allowing one more week of margin in the assignments.</p> <p>For the second opportunity, there will be no second deadline for assignments, and the evaluation will be done in a similar way to the first opportunity.</p> <p>The evaluation criteria of the early December call will be the same as those of the second opportunity of the previous year.</p> |

| Sources of information | |
|------------------------|---|
| Basic | <p>- Sala Lizarraga, José María (1994). Cogeneración: aspectos termodinámicos, tecnológicos y económicos. Bilbao: Universidad del País Vasco, Servicio Editorial</p> <p>- García Garrido, Santiago (2012). Centrales termoeléctricas de biomasa. Fuenlabrada: Renovetec</p> |
| Complementary | <p>- Boyce, Meherwan P. (2010). Handbook for cogeneration and combined cycle power plants. New York: ASME</p> <p>- Villares Martín, Mario (2003). Cogeneración. Madrid: Fundación Confemetal</p> |

| Recommendations |
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| Subjects that it is recommended to have taken before |
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| Subjects that are recommended to be taken simultaneously |
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| Subjects that continue the syllabus |
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| Other comments |
| To help achieve an immediate sustainable environment and meet the objective of action number 5: "Healthy and sustainable environmental and social teaching and research" of the "Green Campus Ferrol Action Plan": 1. The delivery of the documentary works that are made in this matter: 1.1. They will be requested in virtual format and / or computer support 1.2. They will be made through Moodle, in digital format without the need to print them |



(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.