



| Teaching Guide | | | | |
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| Identifying Data | | | | 2020/21 |
| Subject (*) | Power Stations | Code | 770G02024 | |
| Study programme | Grao en Enxeñaría Eléctrica | | | |
| Descriptors | | | | |
| Cycle | Period | Year | Type | Credits |
| Graduate | 1st four-month period | Third | Obligatory | 6 |
| Language | Spanish | | | |
| Teaching method | Face-to-face | | | |
| Prerequisites | | | | |
| Department | Enxeñaría Industrial | | | |
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| Lecturers | Casteleiro Roca, José Luis | E-mail | jose.luis.casteleiro@udc.es | |
| Web | | | | |
| General description | This course aims to give the student the theoretical knowledge of the different types of Power Generation Plants, as well as their operation. The aim is to achieve the necessary knowledge for its operation, analysis and design. | | | |
| Contingency plan | <p>1. Modifications to the contents:</p> <ul style="list-style-type: none"> - No changes will be made. <p>2. Methodologies:</p> <p>*Teaching methodologies that are maintained:</p> <ul style="list-style-type: none"> - Master session. - Problem solving (computes in the evaluation). - Tutored works (computed in the evaluation). <p>*Teaching methodologies that are modified:</p> <ul style="list-style-type: none"> - Mixed test (computes in the evaluation). It will be changed to exam through Teams / Moodle. - Field trip. It cannot be done. <p>3. Mechanisms for personalized attention to students:</p> <ul style="list-style-type: none"> - The Outlook / Teams / Moodle tools will be used to solve the doubts of the students. <p>4. Modifications in the evaluation:</p> <ul style="list-style-type: none"> - No changes will be made in the weighting, only in the realization of the mixed test online through Teams / Moodle. <p>5. Modifications to the bibliography or webgraphy:</p> <ul style="list-style-type: none"> - No changes will be made. | | | |

| Study programme competences / results | |
|---------------------------------------|--|
| Code | Study programme competences / results |
| A1 | Capacidade para a redacción, firma, desenvolvemento e dirección de proxectos no ámbito da enxeñaría industrial, e en concreto da especialidade de electricidade. |
| A4 | Capacidade de xestión da información, manexo e aplicación das especificacións técnicas e da lexislación necesarias no exercicio da profesión. |
| A5 | Capacidade para analizar e valorar o impacto social e medioambiental das solucións técnicas actuando con ética, responsabilidade profesional e compromiso social, e buscando sempre a calidade e mellora continua. |
| A32 | Capacidade para o deseño de centrais eléctricas. |
| B1 | Capacidade de resolver problemas con iniciativa, toma de decisións, creatividade e razoamento crítico. |
| B2 | Capacidade de comunicar e transmitir coñecementos, habilidades e destrezas no campo da enxeñaría industrial. |
| B4 | Capacidade de traballar e aprender de forma autónoma e con iniciativa. |



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| B5 | Capacidade para empregar as técnicas, habilidades e ferramentas da enxeñaría necesarias para a práctica desta. |
| B9 | CB2 - Que los estudiantes sepan aplicar sus conocimientos a su trabajo o vocación de una forma profesional y posean las competencias que suelen demostrarse por medio de la elaboración y defensa de argumentos y la resolución de problemas dentro de su área de estudio. |
| C6 | Valorar críticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben afrontarse. |

| Learning outcomes | | | |
|---|---------------------------------------|----------|----|
| Learning outcomes | Study programme competences / results | | |
| Knowing the different energy systems that can be used in power stations | A4 | B1 | |
| Understanding the processes of power generation from traditional energy sources | A1 A5 | B4 | C6 |
| Knowing the selection and resize of the elements of the generation system of the power stations | A4 | B9 | |
| Knowing the selection and resize of the auxiliary systems of the power stations | A5 A32 | B1 B5 | C6 |
| Knowing the principles of operation of the electricity market | A4 | B2 | |
| Knowing the principles of operation of energy markets | A4 | B2 | |

| Contents | |
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| Topic | Sub-topic |
| The contents described in the verification memory are developed below according to the distribution shown | <p>Electric generation systems. (Topic 1)</p> <p>Classic power stations: Components. Alternators Command, regulation, control and auxiliary services. Transformation parks. (Topics 3, 4, 5 and 7)</p> <p>Other electric generation facilities. (Topics 6 and 8)</p> <p>Introduction to the generation operation and the electricity markets. (Topic 2)</p> |
| Topic 1: Electric energy and sustainable development - Environmental impact and more efficient technologies electricity production | <p>1.1. Introduction to sustainable development</p> <p>1.2. CO2 emission costs</p> <p>1.3. Combustion processes</p> <p>1.4. Environmental impact of different technologies</p> <p>1.5. Techniques improved efficiency</p> <p>1.6. New technologies of coal use</p> <p>1.7. Technology coal gasification</p> <p>1.8. CO2 capture and storage</p> |



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| <p>Topic 2: Energy resources and electricity production - Coverage of the electricity demand</p> | <p>2.1. Reservations and energy resources</p> <p>2.2. Classification and types of power plants</p> <p>2.3. Study of different types of primary energy sources</p> <p>2.4. Study of the electricity demand</p> <p>2.5. Power System configuration</p> <p>2.6. Configuration and operation of the Spanish electricity market</p> <p>2.7. Rates, prices and costs of electricity</p> <p>2.8. Generation scheduling</p> <p>2.9. Parameters related to production</p> |
| <p>Topic 3: Coal power plants</p> | <p>3.1. Water-steam circuit. Steam turbines</p> <p>3.2. Air-gas circuit</p> <p>3.3. Fuel-ash circuit</p> <p>3.4. Cooling water circuit</p> <p>3.5. Regulation of the power station</p> |
| <p>Topic 4: Nuclear power plants</p> | <p>4.1. Nuclear fission</p> <p>4.2. Elements of a nuclear reactor</p> <p>4.3. Nuclear reactor control</p> <p>4.4. Types of nuclear reactors</p> |
| <p>Topic 5: Wiring diagrams. Auxiliary services</p> | <p>5.1. Study of different electrical diagrams</p> <p>5.2. Auxiliary services of the power stations. Energy consumption</p> <p>5.3. Reserve supply</p> |



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| Topic 6: Gas power plants. Combined cycle. cogeneration | <p>6.1. Brayton thermodynamic cycle</p> <p>6.2. Gas turbines. Components</p> <p>6.3. Otto-Diesel thermodynamic cycle</p> <p>6.4. Internal combustion engines</p> <p>6.5. Combined cycle. Heat Recovery Steam Generator</p> <p>6.6. Regulation and control of a combined cycle</p> <p>6.7. Cogeneration</p> |
| Topic 7: Conventional and pumping hydroelectric plants | <p>7.1. Description of the components of a hydroelectric plant</p> <p>7.2. Hydraulic turbines. Control and regulation</p> <p>7.3. Reversible hydroelectric power plants. Types</p> |
| Topic 8: Introduction to power plants with renewable sources | Wind, thermal, photovoltaic, biomass, marine, geothermal and mini hydro power stations |

| Planning | | | | |
|---------------------------------|--------------------------|--------------------------------------|-------------------------------|-------------|
| Methodologies / tests | Competencies / Results | Teaching hours (in-person & virtual) | Student?s personal work hours | Total hours |
| Guest lecture / keynote speech | A1 A4 A5 A32 B2 B4 | 21 | 40 | 61 |
| Problem solving | A4 A32 B1 B5 C6 | 21 | 35 | 56 |
| Supervised projects | A4 A32 B1 B2 B4 B9 C6 | 3 | 20 | 23 |
| Field trip | A32 B2 | 4 | 0 | 4 |
| Mixed objective/subjective test | A4 A5 A32 B1 B5 | 4 | 0 | 4 |
| Personalized attention | | 2 | 0 | 2 |

(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

| Methodologies | |
|---------------------------------|---|
| Methodologies | Description |
| Guest lecture / keynote speech | <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> |
| Problem solving | Solving exercises and specific problems in the classroom, from the knowledge explained. |
| Supervised projects | Performing a bulletin individual character problems, similar to those solved in the classroom exercises. In addition, within the supervised projects can include a small work of specific subjects of the assignment to ensure the correct understanding of the subject. |
| Field trip | Visit to an industrial facility related to the content of the subject. |
| Mixed objective/subjective test | It consists in carrying out a test of approximately 4 hours, in which the acquired knowledge will be evaluated. |

| Personalized attention | |
|------------------------|-------------|
| Methodologies | Description |
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| Supervised projects | <p>The student has the relevant meetings of personalized tutorials, to resolve the concerns arising from the matter.</p> <p>The realization of the problems set is individual, and each student may attend the tutoring sessions it deems appropriate to resolve the doubts that arise.</p> |
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| Assessment | | | |
|---------------------------------|------------------------|--|---------------|
| Methodologies | Competencies / Results | Description | Qualification |
| Problem solving | A4 A32 B1 B5 C6 | Resolution of a practical case. | 15 |
| Mixed objective/subjective test | A4 A5 A32 B1 B5 | Exam with part of multiple choice, development questions and exercises. | 70 |
| Supervised projects | A4 A32 B1 B2 B4 B9 C6 | Some tasks established in the subject, within the framework of this methodology. | 15 |

| Assessment comments |
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| <p>As part of the "Supervised projects" may include aspects such as attendance, personal work, proposed personal work, attitude, etc., to help to pass the subject.</p> <p>The "Mixed test" will be divided into a theoretical (multiple choice), short questions and exercises part. The grade obtained by the student with the "Supervised projects" will be weighted with the mark obtained in the exercises of the "Mixed test".</p> <p>It is necessary to exceed 50% of the score in the multiple choice part of the "Mixed test" to pass the subject.</p> <p>The students, that don't pass the "Supervised projects", have to pass bigger exercises in the "Mixed test".</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> |

| Sources of information | |
|------------------------|--|
| Basic | <ul style="list-style-type: none"> - Sanz Feito, J. (1990). Centrales Eléctricas. UPM - Orille Fernández, Á. L. (1993). Centrales Eléctricas I, II y III. UPC - Barrero, F. (2004). Sistemas de energía eléctrica. Thomson - Sabugal García, S. (2006). Centrales térmicas de ciclo combinado: teoría y proyecto. Díaz de Santos - Rojas Rodríguez, S. (1997). Centrales hidroeléctricas teoría y problemas. UNEX |
| Complementary | <ul style="list-style-type: none"> - Gómez Expósito, A. (2003). Sistemas eléctricos de potencia problemas y ejercicios resueltos. Prentice Hall - Lapuerta Amigo, M. (1998). Tecnologías de la combustión. Universidad de Castilla-La Mancha - García Ybarra, P. L. (2001). Tecnologías energéticas e impacto ambiental. McGraw-Hill |

| Recommendations |
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| Subjects that it is recommended to have taken before |
| Termodinámica/770G02012 Mecánica de Fluidos/770G02016 |
| Subjects that are recommended to be taken simultaneously |
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| Subjects that continue the syllabus |
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