



## Teaching Guide

| Teaching Guide           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                        |           |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------------------------|-----------|
| Identifying Data         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                        | 2020/21   |
| Subject (*)              | Distributed Generation, Polygeneration and Micropower-Nets.<br>Smartgrid                                                                                                                                                                                                                                                                                                                                                                                                                                              |        | Code                   | 770523012 |
| Study programme          | Mestrado Universitario en Eficiencia e Aproveitamento Enerxético                                                                                                                                                                                                                                                                                                                                                                                                                                                      |        |                        |           |
| Descriptors              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                        |           |
| Cycle                    | Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Year   | Type                   | Credits   |
| Official Master's Degree | 2nd four-month period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | First  | Optional               | 3         |
| Language                 | SpanishGalicianEnglish                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |                        |           |
| Teaching method          | Hybrid                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |        |                        |           |
| Prerequisites            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |                        |           |
| Department               | Enxeñaría Industrial                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |        |                        |           |
| Coordinador              | Masdias y Bonome, Antonio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | E-mail | antonio.masdias@udc.es |           |
| Lecturers                | Masdias y Bonome, Antonio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | E-mail | antonio.masdias@udc.es |           |
| Web                      | pcmasdias.cdf.udc.es                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |        |                        |           |
| General description      | The course aims to give an introduction to electrical microgrids and generation systems employed therein providing the fundamentals and important issues that address the various technologies used in distributed generation systems. the importance and characteristics of decentralized generation systems over conventional systems is introduced. Finally, hybrid systems that combine two or more technologies of energy generation and storage, as well as cogeneration and trigeneration systems are studied. |        |                        |           |
| Contingency plan         | 1. Modifications to the contents<br><br>2. Methodologies<br>*Teaching methodologies that are maintained<br><br>*Teaching methodologies that are modified<br><br>3. Mechanisms for personalized attention to students<br><br>4. Modifications in the evaluation<br><br>*Evaluation observations:<br><br>5. Modifications to the bibliography or webgraphy                                                                                                                                                              |        |                        |           |

## Study programme competences

| Code | Study programme competences                                                                                                                                                                                                                                                                               |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A1   | Análise e aplicación de metodoloxías e normativa para unha xestión eficiente da enerxía.                                                                                                                                                                                                                  |
| A2   | Análisis e implantación de medidas de ahorro y eficiencia energética en los sectores industrial, terciario y residencial.                                                                                                                                                                                 |
| A16  | Capacidad para buscar, analizar, identificar y aplicar nuevas fuentes de energía eléctrica o nuevas técnicas de gestión de la electricidad bajo criterios como eficiencia, sostenibilidad o cooperación, así como el empleo de éstas sobre nuevas aplicaciones.                                           |
| B1   | Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio.                                                                  |
| B2   | Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios. |
| B3   | Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación.                                                                                                                                |



|     |                                                                                                                                                                     |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| B4  | Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo. |
| B10 | Potenciar la creatividad.                                                                                                                                           |
| B15 | Conocer la legislación vigente y reglamentación aplicable al sector de las energías renovables y de la eficiencia energética.                                       |
| C2  | Fomentar la sensibilidad hacia temas medioambientales.                                                                                                              |
| C3  | Aplicar una metodología que fomente el aprendizaje y el trabajo autónomo.                                                                                           |
| C5  | Adquirir la capacidad para elaborar un trabajo multidisciplinar                                                                                                     |

| Learning outcomes                                                                                                                                                                                |                             |              |            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------|------------|
| Learning outcomes                                                                                                                                                                                | Study programme competences |              |            |
| Concepts and terms of generation, cogeneration and polygeneration and the different elements in electrical networks and micro-networks.                                                          | AJ16                        |              |            |
| Knowledge of elements used in micro-networks, generating elements with or without renewable energies and energy storage elements and elements of consumption or energy supply to specific loads. |                             | BC10<br>BC15 |            |
| Know the basic methods and processes related to the elements that are part of micro-networks that have notability from a point of view of energy efficiency.                                     | AJ1<br>AJ2                  | BC2<br>BC3   | CC5        |
| Have knowledge to understand the fundamentals of intelligent micro-networks, as well as managing the interconnection between micro-networks within analysis of energy efficient.                 |                             | BC1<br>BC4   | CC2<br>CC3 |

| Contents                                                            |                                                                                                                                                                                                                |
|---------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Topic                                                               | Sub-topic                                                                                                                                                                                                      |
| BLOCK 1: Distributed generation, opportunity and development needs. | Regulatory framework<br>Integration of Generation (Autoconsumo and net balance)<br>Counters and deployment of Network Management Equipment<br>Customer participation in the Electricity Market                 |
| BLOCK 2: polygeneration.                                            | New technologies for generation, storage and distribution.                                                                                                                                                     |
| BLOCK 3: Managing Energy Networks Smart Grid and Smart Metering     | Infrastructure and Control Technologies<br>Smart Network Devices<br>As advanced infrastructure<br>Implementation and management of distributed energy resources<br>Advanced network management.<br>EMS systems |

| Planning                                                                                                                        |                    |                      |                               |             |
|---------------------------------------------------------------------------------------------------------------------------------|--------------------|----------------------|-------------------------------|-------------|
| Methodologies / tests                                                                                                           | Competencies       | Ordinary class hours | Student?s personal work hours | Total hours |
| Case study                                                                                                                      | A1 A2 A16 C5       | 5                    | 10                            | 15          |
| ICT practicals                                                                                                                  | B3 B1 B2 B10 C2 C3 | 7                    | 20                            | 27          |
| Objective test                                                                                                                  | B4 B15             | 2                    | 0                             | 2           |
| Guest lecture / keynote speech                                                                                                  | A1 A2 A16          | 9                    | 21                            | 30          |
| 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                                                                                                                     |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Case study                     | Case studies will be exposed cases to illustrate the application of the theoretical and practical Contender exposed in lectures |
| ICT practicals                 | Practices through ICT includes the preparation of jobs that may be assisted by ICT both Moodle and in the laboratory.           |
| Objective test                 | Objective test consists of a theoretical and practical examination in which knowledge and skills acquired skills are evaluated. |
| Guest lecture / keynote speech | Lecture Exhibition of the basics and work methodologies to develop distribution facilities, etc. polygeneration                 |

| Personalized attention       |                                                                                                                                                                                                                                 |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Methodologies                | Description                                                                                                                                                                                                                     |
| Case study<br>ICT practicals | personalized attention and monitoring both case studies and the preparation and development of laboratory practice is performed. Attention and monitoring refers not only to classroom attention but assisted by ICT or e-mail. |

| Assessment     |                    |                                                                                                                                    |               |
|----------------|--------------------|------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Methodologies  | Competencies       | Description                                                                                                                        | Qualification |
| Case study     | A1 A2 A16 C5       | Different case studies will be evaluated by the teacher will be analyzed.                                                          | 40            |
| ICT practicals | B3 B1 B2 B10 C2 C3 | It includes the development of practices both assisted and laboratory data may be made with both real and virtual instrumentation. | 10            |
| Objective test | B4 B15             | Theoretical and practical test that must be overcome by the student and which aims to quantify the knowledge and skills acquired.  | 50            |

| Assessment comments |
|---------------------|
|                     |

| Sources of information |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Basic                  | <ul style="list-style-type: none"><li>- IEEE (2013). IEEE 1547 Standard for Interconnecting Distributed Resources.</li><li>- Fundación de la Energía de la CCAA Madrid (2012). Guía de Microgeneración. Madrid.</li><li>- James Momoh (2012). SMART GRIDS Fundamentals of Design and Analysis. New Jersey. USA</li><li>- David Flin (2010). Cogeneration. UK</li><li>- ANTONIO COLMENAR SANTOS (2015). GENERACIÓN DISTRIBUIDA, AUTOCONSUMO Y REDES INTELIGENTES. Madrid 2015</li></ul> |
| Complementary          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

| Recommendations                                          |
|----------------------------------------------------------|
| Subjects that it is recommended to have taken before     |
|                                                          |
| Subjects that are recommended to be taken simultaneously |
|                                                          |
| Subjects that continue the syllabus                      |
|                                                          |
| Other comments                                           |
|                                                          |



(\*)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.