Teaching Guide			
Identifying Data			2023/24
Subject (*)	Distributed Generation, Polygeneration and Micropower-Nets. Smartgrid	Code	730547011d
Study programme	Máster Universitario en Eficiencia Enerxética e Sustentabilidade (a distancia)		

Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	2nd four-month period	First	Optional	3

Language	SpanishGalician		
Teaching method	Non-attendance		
Prerequisites			
Department	Enxeñaría Industrial		
Coordinador	Masdias y Bonome, Antonio	E-mail	antonio.masdias@udc.es
Lecturers	Masdias y Bonome, Antonio Saa Filgueiras, Carlos	E-mail	antonio.masdias@udc.es carlos.saa@udc.es
Web	pcmasdias.cdf.udc.es		
General description	The subject aims to give an introduction to electrical microgrids and the generation systems used in them, providing the most important fundamentals and aspects that address the different technologies used in distributed generation systems. The importance and characteristics of decentralized generation systems compared to conventional systems are introduced. Finally, hybrid systems that group two or more energy generation and storage technologies are studied, as well as cogeneration and trigeneration systems.		

Study programme competences	
Code	Study programme competences
A1	CE1 - Apply methodologies and regulations for efficient energy management
A2	CE2 - Analyze and implement energy saving and efficiency measures in the industrial, tertiary and residential sectors
A16	CE16 - Search, analyze, identify and apply new sources of electrical energy or new electricity management techniques under criteria such as efficiency, sustainability or cooperation, as well as the use of these on new applications
B1	CB6 - Possess and understand knowledge that provides a foundation or opportunity to be original in the development and/or application of ideas, often in a research context
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
B3	CB8 - That students are able to integrate knowledge and face the complexity of formulating judgments based on information that, being incomplete or limited, includes reflections on the social and ethical responsibilities linked to the application of their knowledge and judgments
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
B10	CG5 - Boost creativity
B15	CG10 - Know the current legislation and regulations applicable to the renewable energy and energy efficiency sector
C2	CT2 - Master the oral and written expression and comprehension of a foreign language
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
C7	CT7 - Develop the ability to work in interdisciplinary or transdisciplinary teams, to offer proposals that contribute to sustainable environmental, economic, political and social development

Learning outcomes	
Learning outcomes	Study programme competences

You will learn concepts and terms of generation, cogeneration and polygeneration, as well as the different elements in electrical networks and micro-grids	AC1 AC2 AC16	BC1 BC2 BC3 BC5 BC10 BC15	CC2 CC3 CC5 CC7
Will have knowledge about elements used in micro-grids, generation elements with or without renewable energy, as well as energy storage elements and elements of energy consumption or supply to specific loads	AC1 AC2 AC16	BC1 BC2 BC3 BC5 BC10 BC15	CC2 CC3 CC5 CC7
Know the basic methods and processes related to the elements that are part of micro-grids that are notable from an energy efficiency point of view	AC1 AC2 AC16	BC1 BC2 BC3	CC2 CC3 CC5 CC7
Have knowledge to understand the fundamentals of intelligent micro-grids, as well as the management of the interconnection between micro-grids within an energy efficient analysis	AC1 AC2 AC16	BC1 BC2 BC3 BC5 BC10 BC15	CC2 CC3 CC5 CC7

Contents	
Topic	**Sub-topic**
BLOCK 1: Distributed Generation, opportunity and development needs.	Regulatory Framework Integration of Generation (Self-consumption and Net balance) Deployment of Meters and Network Management Teams Participation of Clients in the Electricity Market.
BLOCK 2: Polygeneration.	New Technologies of generation, storage and distribution.
BLOCK 3: Management of Energy Networks	Management of Smart Grid and Smart Metering Energy Networks. Infrastructure and Control Technologies Smart Network Devices Advanced Metering Infrastructure (AMI) Application and management of Distributed Energy Resources (DER) Advanced Network Management. (DMS). EMS systems (Energy Management System).

Planning				
Methodologies / tests	**Competencies**	**Ordinary class hours**	**Student?s personal work hours**	**Total hours**
ICT practicals	A1 A2 A16 B1 B2 B3 B5 B10 B15 C2 C3 C5 C7	0	14	14
Case study	A1 A2 A16 B1 B2 B3 B5 B10 B15 C2 C3 C5 C7	0	50	50
Objective test	A1 A2 A16 B1 B2 B3 B5 B10 B15 C2 C3 C5 C7	1	0	1
Document analysis	A1 A2 A16 B1 B2 B3 B5 B10 B15 C2 C3 C5 C7	0	9	9

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
ICT practicals	Comprende a elaboración de traballos que podrán estar asistidos mediante TIC tanto en Moodle como no laboratorio
Case study	Exporanse casos para ilustrar a aplicación dos contendidos teórico-prácticos expuestos nas sesiones maxistrales
Objective test	Consiste nun examen teórico practico no que se evalúan os conocimientos destrezas e habilidades adquiridos.
Document analysis	Exposición dos fundamentos e das metodoloxías de traballo para desarrollar instalacions distribuidas, polixeneración etc.

Personalized attention	
Methodologies	Description
Case study	Personalized attention and follow-up is carried out both in case studies and in the preparation and development of laboratory practices. Care and follow-up refers not only to face-to-face care but to assisted care through ICT or e-mail.

Assessment			
Methodologies	Competencies	Description	Qualification
ICT practicals	A1 A2 A16 B1 B2 B3 B5 B10 B15 C2 C3 C5 C7	Comprende a elaboración de practicas tanto asistidas como de laboratorio que poderán realizarse con datos obtidos tanto con instrumentación real como virtual.	25
Case study	A1 A2 A16 B1 B2 B3 B5 B10 B15 C2 C3 C5 C7	Mediante o estudo de casos se analizarán diferentes casos prácticos que serán evaluados polo profesor.	25
Objective test	A1 A2 A16 B1 B2 B3 B5 B10 B15 C2 C3 C5 C7	Prueba teorico-práctica que deberá ser superada polo alumno e que ten por obxetivo cuantificar os coñecementos e habilidades adquiridas.	50

Assessment comments
Full-time and part-time students will be evaluated equally, both in the 1st and 2nd opportunity, as well as in the extraordinary one. The student is reminded of the importance of deadlines when submitting work, as well as the importance of complying with the rules and regulations of the UDC, and referencing all documentation and content not prepared by the student. Specifically, the fraudulent performance of the tests or evaluation activities, once verified, will directly imply the qualification of failing "0" in the subject, in the corresponding call, thus invalidating any qualification obtained in all the evaluation activities for the extraordinary summons

Sources of information	
Basic	- IEEE (2013). IEEE 1547 Standard for Interconnecting Distributed Resources.- Fundación de la Energía de la CCAA Madrid (2012). Guia de Microgeneración. Madrid.- James Momoh (2012). SMART GRIDS Fundamentals of Design and Analisys. New Jersey. USA- David Flin (2010). Cogeneration. UK- ANTONIO COLMENAR SANTOS (2015). GENERACIÓN DISTRIBUIDA, AUTOCONSUMO Y REDES INTELIGENTES. Madrid 2015
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.