UNIVERSIDADE DA CORUÑA

Teaching Guide			
Identifying Data			2016/17
Subject (*)	Avaliación e Optimización da Sustentabilidade de Sistemas Enerxéticos	Code	770523020
Study programme	Mestrado Universitario en Eficiencia e Aproveitamento Enerxético		

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

Language	Galician		
Teaching method	Face-to-face		
Prerequisites			
Department	Enxeñaría Industrial 2		
Coordinador	Lara Coira, Manuel	E-mail	manuel.lara.coira@udc.es
Lecturers	Caño Gochi, Alfredo del	E-mail	alfredo.cano@udc.es
	Lara Coira, Manuel		manuel.lara.coira@udc.es
Web			
General description	Knowledge of the life cycle of the main power generation systems. Study of technical and economic aspects. Analysis of different methods of assessing sustainability. Practical work with simple models of sustainability assessment. Introduction to engineering optimization methods.		

Study programme competences	
Code	Study programme competences
A11	Capacidad para aplicar métodos de análisis de datos para la creación de sistemas energéticos eficientes.
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.
B6	Buscar y seleccionar alternativas considerando las mejores soluciones posibles.
B7	Desarrollar las capacidades de análisis y síntesis; fomentar la discusión crítica, la defensa de argumentos y la toma de conclusiones.
B10	Potenciar la creatividad.
B16	Valorar la aplicación de tecnologías emergentes en el ámbito de la energía y el medio ambiente.
C2	Fomentar la sensibilidad hacia temas medioambientales.
C3	Aplicar una metodología que fomente el aprendizaje y el trabajo autónomo.
C4	Desarrollar el pensamiento crítico

Learning outcomes			
Learning outcomes	Study programme competences		
To know the main existing methods for sustainability assessment. To be able to apply them by using existing commercial software applications.	AJ11	BC1 BC2 BC6 BC7	CC2 CC4
To know the main methods for optimization in engineering. To be able to design simple models of sustainable energy systems aimed to their optimization.		BC3 BC10 BC16	CC3

Contents	
Topic	Sub-topic
1. Basic concepts. Sustainable development and sustainability. Primary energy and final energy. Assessment and optimisation of sustainability in engineering: state of the art.	Energy resources and energy reserves. Life cycle of different electricity power plants. Technical and economic comparison of energy options.
2. Main methods for assessing sustainability. Useful computing programmes.	Methods for assessing sustainability. Simple models of sustainability of energy systems. Examples of computing programmes.
3. Case study: assessing the sustainability of energy production plants, renewable and non-renewable.	Example of sustainability assessment for power plants using renewable energy sources. Example sustainability assessment for power plants using non-renewable energy sources.
4. Methods for optimization in engineering. Useful computing programmes.	Current optimization in engineering. Optimization methods in engineering. Examples of computing programmes..
5. Simple models of sustainable energy systems aimed to optimization. Conceptual framework, models and methods.	Simple models for optimization of sustainable energy systems.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	B3 B7 B10 C2 C4	10	15	25
Case study	A11 B1 B2 B6 B16 C3	11	34	45
Personalized attention		5	0	5
(*)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	Oral presentation (using audiovisual material and student interaction) designed to transmit knowledge and encourage learning. Presentations of this type are variously referred to as ?expository method?, ?guest lectures? or ?keynote speeches?. (The term ?keynote? refers only to a type of speech delivered on special occasions, for which the lecture sets the tone or establishes the underlying theme; it is characterised by its distinctive content, structure and purpose, and relies almost exclusively on the spoken word to communicate its ideas.)
Case study	Teaching-learning method in which students are presented with a specific set of real-life circumstances and a problem (?case?) which they must attempt to understand, assess and solve as a group through a process of discussion. Students should be able to analyse a series of facts relating to a particular area of knowledge or activity, and arrive at a rational conclusion via a process of discussion within small work groups.

Personalized attention	
Methodologies	Description
Case study	Professors will help the student for solving theoretical or practical doubts.

Assessment			
Methodologies	Competencies	Description	**Qualification**

Case study	A11 B1 B2 B6 B16 C3	Teaching-learning method in which students are presented with a specific set of real-life circumstances and a problem (?case?) which they must attempt to understand, assess and solve as a group through a process of discussion. Students should be able to analyse a series of facts relating to a particular area of knowledge or activity, and arrive at a rational conclusion via a process of discussion within small work groups.	100

Assessment comments

Sources of information	
Basic	Apuntes da asignaturaApuntes da asignatura

Complementary	Sustentabilidade e desenvolvemento sustentable.? United Nations. Our common future. World commission on environment and development. 1st ed. Oxford, UK: Oxford University Press; 1987, ISBN 978-0-19-282080-8. p. 416.? United Nations. The Rio declaration on environment and development [Internet]. In: The United Nations conference on environment and development (UNCED); 1992 June 3-14. Rio of Janeiro, Brazil.? Bouvier LF, Grant L. How many Americans?: population, immigration and the environment. San Francisco, CA, USA: Sierra Club Books; 1994, ISBN 978-0-87156-496-2.? Meadows D, Meadows D, Randers J. Limits to growth: the 30-year update. 3rd ed. White River Jct., VT, USA: Chelsea Green Publishing; 2004, ISBN 978-1-931498-58-6.Avaliación da sustentabilidade de centrais eléctricas renovables e non renovables. Métodos de avaliación da sustentabilidade.? Kaya T, Kahraman C. Multicriteria renewable energy planning using an integrated fuzzy VIKOR & AHP methodology: the case of Istanbul. Energy 2010; 35(6): 2517-27. ? Diakoulaki D, Karangelis F. Multi-criteria decision analysis and cost-benefit analysis of alternative scenarios for the power generation sector in Greece. Renew Sustain Energy Rev 2007; 11(4): 716-27.? Jovanovic M, Afgan A, Radovanovic P, Stevanovic V. Sustainable development of the Belgrade energy system. Energy 2009; 34(5): 532-9.? Kowalski K, Stagl S, Madlener R, Omann I. Sustainable energy futures:methodological challenges in combining scenarios and participatory multicriteriaanalysis. Eur J Operational Res 2009; 197(3): 1063-74.? Afgan NH, Carvalho MG. Multi-criteria assessment of new and renewable energy power plants. Energy 2002; 27(8): 739-55.? Afgan NH, Carvalho MG, Jovanovic M. Biomass-fired power plant: the sustainability option. Int J Sustain Energy 2007; 26(4): 179-93.? Begic F, Afgan NH. Sustainability assessment tool for the decision making in selection of energy systemdBosnian case. Energy 2007; 32(10): 1979-85.? Burton J, Hubacek K. Is small beautiful? A multi-criteria assessment of smallscale energy technology applications in local governments. Energy Policy 2007; 35(12): 6402-12.? Doukas HCh, Andreas BM, Psarras JE. Multi-criteria decision aid for the formulation of sustainable technological energy priorities using linguistic variables. Eur J Operational Res 2007; 182(2): 844-55.? Varun, Prakash R, Bhat IK. Energy, economics and environmental impacts of renewable energy systems. Renew Sustain Energy Rev 2009; 13(9): 2716-21.? Kahraman C, Kaya I, Cebi S. A comparative analysis for multiattribute selection among renewable energy alternatives using fuzzy axiomatic design and fuzzy analytic hierarchy process. Energy 2009; 34(10): 1603-16.? Dombi M, Kuti I, Balogh P. Sustainability assessment of renewable power and heat generation technologies. Energy Policy 2014; 67: 264-71. ? Gómez D, del Caño A, de la Cruz MP, Josa A. Metodología genérica para la evaluación de la sostenibilidad de sistemas constructivos. El método MIVES. In: Aguado A, editor. Sostenibilidad y construcción. Madrid, Spain: Asociación Científico-Técnica del Hormigón Estructural; 2012. p. 385-411.? de la Cruz MP, Castro A, del Caño A, Gómez D, Lara M, Cartelle JJ. Comprehensive methods for dealing with uncertainty in assessing sustainability. Part I: the MIVES e Monte Carlo method. In: García-Cascales MS, Sánchez-Lozano JM, Masegosa AD, Cruz-Corona C, editors. Soft computing applications for renewable energy and energy efficiency. Hershey, PA, USA: IGIGlobal; 2015, ISBN 978-1-4666-6631-3. p.69-p106.? Cartelle Barros JJ, et al., Assessing the global sustainability of different electricity generation systems. Energy 2015; 89(2015): 473-489.Métodos de optimización en enxeñaría. Optimización da sustentabilidade de sistemas enerxéticos.? B.D. Ripley, Stochastic simulation, Wiley & Sons, New York (1987).? C.A. Floudas and P.M. Pardalos, Encyclopedia of optimization, Springer, USA (2009).? F. Rothlauf, Design of modern heuristics: principles and application, Springer, Germany (2011).? R.L. Haupt and S.E. Haupt, Practical genetic algorithms, Wiley, Hoboken, New Jersey (2004).? A. Aboshosha and Y. Khalyfa, Genetic algorithms theories and applications, LAP Lambert, Saarbrücken, Germany (2012).? F. Glover, ?Tabu search: Part I?, in ORSA J Comput 1989, Vol. 1(3) pp. 190?260.? F. Glover, ?Tabu search: Part II?, in ORSA J Comput 1989, Vol. 2(1), pp. 4?32.? S. Kirkpatrick, C.D. Gelatt and M.P. Vecchi, ?Optimization by simulated annealing?, in Science 1983, Vol. 220(4598), pp. 671-680.? A. Dekkers and E.H. Aarts, ?Global optimization and simulated annealing?, In Mathematical Programming 1991, Vol. 50(3), pp. 367-393. ? Del Caño A, de la Cruz P, Cartelle JJ, Lara M, Conceptual framework for an integrated method to optimize sustainability of engineering systems. Journal of Energy and Power Engineering 9 (2015) 608-615.

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously

Subjects that continue the syllabus
Traballo Fin de Mestrado/770523023
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.