Course unit title:	Renewable Energy Sources		
Course unit code:	AEEE457		
Type of course unit:	Elective		
Level of course unit:	Bachelor (1st Cycle)		
Year of study:	4		
Semester when the unit is delivered:	8 (Spring)		
Number of ECTS credits allocated :	5		
Name of lecturer(s):	Dr. Antonis Papadakis		
Learning outcomes of the course unit:	1. Explain the basic concepts behind available renewable energy sources, and their impact on the environment and economy markets. 2. Describe the different existing silicon and non-silicon based photovoltaic technologies and identify future disruptive technologies. 3. Explain wind turbine operational principles and the various existing technologies. 4. Analyze biomass energy sources and various techniques used for fuel production. 5. Examine fusion principles and fundamentals, as well as current and future fusion experiments worldwide.		
Mode of delivery:	Face-to-face		
Prerequisites:	None	Co-requisites:	None
Recommended optional program components:	None		
Course contents:	• **Introduction to Renewable Energy Sources:** Renewable Energy Sources, impact on the environment and the economy markets. • **Solar Energy:** Various Photovoltaic technologies, such as silicon or non-silicon based, the existing generations of PV, as well as the emerging technologies of thin film and concentrate Various Photovoltaic technologies, such as silicon or non-silicon based. Three existing generations of PV, various categories of silicon-based PVs, which are monocrystalline, polycrystalline, ribbon and sheet, and amorphous silicon, as well as the emerging technology of thin film and concentrated PVs, market analysis of the aforesaid past and present technologies, including price evolution, factory capacity evolution at different countries, installation facilities, and external factors affecting the PV industry, such as the silicon crisis, oil prices, and exchange rates, comparison between current and future technologies, future prospects of going beyond silicon, using non-silicon thin film solar cells of type CIGS. • **Wind Energy:** Basic systems of wind turbines such as mechanical and aerodynamics systems, connection possibilities of Grid Connected Wind Farms to High Voltage, Medium Voltage and Low Voltage networks, aerodynamic control (Stall) and step control (pitch), constant and variable speed operation, inverters, existing wind turbine technologies investigated in terms of cost, reliability and practicality. • **Biomass energy:** Energy from plants and plant derived materials such as wood, food crops, grassy and woody plants, residues from agriculture or forestry, and the organic component of municipal and industrial wastes.		

	• **Fusion Energy:** General principles of fusion reaction, Electromagnetic and Inertia Confinement, Tokamaks (ITER, JET, JT-60, EAST, MAST, ALCATOR C-Mod), Lawson criterion, Incentives for Developing Fusion, Advantages and Disadvantages of Fusion Energy.
Recommended and/or required reading:	
Textbooks:	• John Twidell, and Tony Weir, Renewable Energy Resources, Taylor & Francis, 3rd Edition, 2015. • Lecturer's notes.
References:	• B. Sharpe, Wind Energy Handbook, 2nd Edition, John Wiley & Sons, 2011. • M. Rogers, Wind Energy Explained, 2nd Edition, John Wiley & Sons, 2010. • T. Ackermann, Wind Power in Power Systems, 2nd Edition, John Wiley & Sons, 2012. • J. P. Freidberg, Plasma Physics and Fusion Energy, Cambridge University Press, 2007. • A.A.Harms, Principles of Fusion Energy: An Introduction to Fusion Energy for Students of Science and Engineering, World Scientific Publishing, 2005. • D. L. Klass, Biomass for Renewable Energy, Fuels, and Chemicals, Elsevier, 2006. • F. Rosillo-Calle, The Biomass Assessment Handbook: Bioenergy for a Sustainable Environment, Earthscan, 2008. • M.A. Green, Third Generation Photovoltaics: Advanced Solar Energy Conversion, Springer Verlag, 2013. • V.P. Koch, R. Hezel, and A. Goetzberger, High-Efficient Low-Cost Photovoltaics: Recent Developments, Springer Verlag, 2008.
Planned learning activities and teaching methods:	Teaching is based on lectures. The course delivery will be based on theoretical lecturing, assignments and exercises solved in class. Exercises will be handed to students and their solutions shall be analysed at lecture periods. Additional tutorial time at the end of each lecture will be provided to students. Students are expected to demonstrate the necessary effort to become confident with the different concepts and topics of the course.
Assessment methods and criteria:	• Assignments 10% • Tests: 30% • Final Exam 60%
Language of instruction:	English
Work placement(s):	No