Course unit title:	**Power Electronics for Renewable Energy Systems**		
Course unit code:	AEEE464		
Type of course unit:	Elective		
Level of course unit:	Bachelor (1st Cycle)		
Year of study:	4		
Semester when the unit is delivered:	2 (Spring)		
Number of ECTS credits allocated :	5		
Name of lecturer(s):	Dr. Antonis Papadakis/Dr. Photos Vryonides		
Learning outcomes of the course unit:	1. Explain the basic concepts of power electronics. 2. Be familiar with the different existing types of basic power electronic switches such as the power diodes, transistors and thyristors. 3. Understand power electronic control principles for renewable energy systems. 4. Be familiar with the general principles of AC/DC Rectifiers, DC/AC Inverters, AC/AC Changers and DC/DC Choppers. 5. Examine power electronic devices used in renewable energy sources applications. 6. Explain power electronic devices used in photovoltaic and wind applications.		
Mode of delivery:	Face-to-face		
Prerequisites:	AEEE238 Electronics I	Co-requisites:	None
Recommended optional program components:	None		
Course contents:	• **Introduction to Power Electronics:** Applications of Power Electronics, History of Power Electronics, Power Semiconductor Devices- Power Diodes, Thyristors, Power Transistors. • **Control Characteristics of Power Devices:** Characteristics and Specifications of Switches- Ideal Characteristics, Characteristics of Practical Devices, Switch Specifications, Types of Power Electronic Circuits. • **Design of Power Electronics Equipment:** Square Values of Waveforms, Peripheral Effects, Power Modules, Intelligent Modules. • **Power Diodes:** Diode characteristics and its models, Types of diodes, Series and parallel operation of diodes, Unidirectional device like a diode on RLC circuits, Freewheeling and stored-energy recovery. • **AC/DC Rectifiers, DC/AC Inverters, AC/AC Changers and DC/DC Choppers:** Principles of operation, General characteristics of these devices, Applications of the above circuits.		

	• **Photovoltaic Power Electronics:** PV Energy Basics, PV Energy Generation, Electrical Efficiency, Construction of PV Cells and Panel Modules, PV Modules and Strings, Mismatch Losses, Models of PV Cells, Output Characteristics of a PV Cell, Approximate Determination of the PV Panel Parameters, Determination of the PV Panel Maximum Power, Temperature Effects, Parameters of PV Cell, Module Inverter, String Inverter, Central Inverter, Team Concept Inverters, Energy Storage for PV, Power Electronic Topologies in PV Systems, Transformer Isolated Converters, Stand-Alone PV Systems, Series Connected Inverters, Parallel-Connected Converters, Grid-Connected PV Systems, Distributed Photovoltaic Systems, Maximum Power Point Tracking. • **Power Electronics for Wind Power:** Partially-Rated Power Electronics, Soft Starters for Fixed-Speed Turbines, Power Converter for External Resistance Control in Variable-Slip Turbines, Back-to-Bath PWM VSI for DFIG Turbines, Crowbar for Rotor Circuit of DFIG Turbines, Full Scale Power Electronics, Back-to-Back PWM VSI for Full Converter Turbines, Converter Exclusively for Full Converter Turbines with Permanent Magnet Synchronous Generators, New and Advanced Topologies, Reduced Switch Count PWM VSI Full Converter Configuration for PMSG Turbines, Multilevel Converters, Matrix Converters, FACTS Devices, HVDC Systems for Wind Power Plants, Controls for Power Electronics for Wind Power, Controlling Wind Turbines, Blade Pitch Control, Controls for Variable-Slip Turbines, Controls for DFIG Turbines, Controls for Full Converter Turbines, Controlling Wind Power Plants.
Recommended and/or required reading:	
Textbooks:	• Power Electronics Circuits, Devices and Applications, 4th Edition, Rashid M., Prentice Hall, 2013. • Power Electronics for Renewable and Distributed Energy Systems: A Sourcebook of Topologies, Control and Integration, Sudipta Chakraborty, Marcelo G. Simões and William E. Kramer, Springer, 2017, 9781138072848.
References:	• Introduction to Modern Electronics, 2nd Edition, Andrzej M. Trzynadlowski, 2010. Wiley. • Advanced DC/AC Inverters: Applications in Renewable Energy, Fang Lin Luo and Hong Ye, CRC Press, 2013, 1466511354/9781466511354.
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