AEEE464 - Power Electronics and Renewable Energy Systems

Course Title	Power Electronics and Renewable Energy Systems				
Course Code	AEEE464				
Course Type	Technical Elective				
Level	BSc (Level 1)				
Year / Semester	3 or 4				
Teacher's Name	Dr Antonis Papadakis / Dr Photos Vryonides				
ECTS	6	Lectures / week	3	Laboratories / week	
Course Purpose and Objectives	The aim of the course is to familiarize students with the concepts and the principles underlying the field of Power Electronics, to provide students with deep knowledge of the theories and methodologies related to power electronic control and to enable students develop the skills required for the analysis and the design of power electronic devices for photovoltaic and wind generation applications.				
Learning Outcomes	By the end of the course, students must be able to: 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.				
Prerequisites	AEEE238	Required	None		
Course Content	• **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.
Teaching Methodology	Students are taught the course through lectures (3 hours per week) in classrooms or lectures theatres, by means of traditional tools or using computer demonstration. Auditory exercises, where examples regarding matter represented at the lectures, are solved and further, questions related to particular open-ended topic issues are compiled by the students and answered, during the lecture or assigned as homework. Topic notes are compiled by students, during the lecture which serve to cover the main issues under consideration and can also be downloaded from the e-learning platform or the lecturer's webpage. Students are also advised to use the subject's textbook or reference books for further reading and practice in solving related exercises. Tutorial problems are also submitted as homework and these are solved during lectures or privately during lecturer's office hours. Furthermore, design projects may be assigned to the students, where literature search is encouraged to identify a specific problem related to some issue, gather relevant scientific information about how others have addressed the problem, implement to implement the design and report the results in written or orally.
Bibliography	**Textbook** • 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.
Assessment	The Students are assessed via continuous assessment throughout the duration of the Semester, which forms the Coursework grade and the final written exam. The coursework and the final exam grades are weighted 40% and 60%, respectively, and compose the final grade of the course. Various approaches are used for the continuous assessment of the students, such as mid-term written exam, oral exam, quizzes, design assignments, design projects and laboratory experiments. The assessment weight, date and time of each type of continuous assessment is being set at the beginning of the semester via the course outline. An indicative weighted continuous assessment of the course is shown below:

	• Assignments 10% • Homework 10% • Mid-Term written exams 40% • Design Project 30% • Quizzes 10% Students are prepared for final exam, by revision on the matter taught, problem solving and concept testing and are also trained to be able to deal with time constrains and revision timetable. The criteria considered for the assessment of each type of the continuous assessment and the final exam of the course are: (i) the comprehension of the fundamental concepts and theory of each topic, (ii) the application of the theory in solving related problems and (iii) the ability to apply the above knowledge in more complex design problems. The above criteria are weighted 30%, 40% and 30%, respectively. The final assessment of the students is formative and summative and is assured to comply with the subject's expected learning outcomes and the quality of the course.
Language	English