UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2017/2018
MASTER'S DEGREE (MSC)	ELECTRONIC ENGINEERING
SUBJECT	INDUSTRIAL ELECTRONICS
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50364-Ingegneria elettronica
CODE	19223
SCIENTIFIC SECTOR(S)	ING-INF/01
HEAD PROFESSOR(S)	VITALE GIANPAOLO Professore incaricato esterno Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	9
INDIVIDUAL STUDY (Hrs)	144
COURSE ACTIVITY (Hrs)	81
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**VITALE GIANPAOLO** Monday 09:00 10:00 Aule 321 Ed. 9 - Universita di Palermo Wednesday 09:00 10:00 Aule 321 Ed. 9 - Universita di Palermo

DOCENTE: Prof. GIANPAOLO VITALE

PREREQUISITES	Knowledge acquired during the degree course in Electronic Engineering , in particular: electronic components , analysis of linear circuits , circuit analysis in sinusoidal regime , network functions, control systems.
LEARNING OUTCOMES	Expected learning outcomes The course deals with the analysis and design of power electronic circuits for electric energy static conversion for industrial applications , in the automotive sector and in the use of renewable energy . The contents are highly application oriented and addressed to the understanding of the role and prospects of power electronics in modern applications . Knowledge and understanding The student , at the end of the course , will acquire knowledge and methodologies for the analysis and design of power converters that use electronic devices for switching and will acquire the theoretical and practical tools for the design and implementation of conversion systems . The student will achieve an overview knowledge of modern research topics in industrial and academic field and the main problems related to the construction of an electric power conversion system with high performance and high efficiency . The student will be able to finalize the design of the system to a specific application, using the most appropriate solutions for the proposed case . Finally, the student will also be able to use the dedicated software for the design and simulation of electronic circuits among the most widely adopted in the field of academic and industrial research power . Applying knowledge and understanding The student will be able to design a conversion system aimed at a specific application , critically evaluating the possible solutions in relation to modern trade-off in terms of performance , cost and volume of the overall device . Communication skills The student will be able to communicate with competence and properties of language complex problems related to power electronic systems . The student will acquire the knowledge and the skills needed to deal with specific problems in the field of the design of an electronic power system , discussing the advantages of the control techniques of their limitation among the most commonly used for the solution of specific problems of the sector , such as the optimization of the static performance and dynamics of the system , the response speed. Finally the student will be able to critically indicate the best solution with regard to the minimization of the cost and requirements of the final volume of the device . Learning ability The student will be able to address the problem independently of the project , the analysis , the choice of components in complex power systems independently and to continue in the study and research in the field of power electronics .
ASSESSMENT METHODS	The candidate will answer at least three oral questions, on all covered program, with reference to the recommended texts. The questions are designed to assess the capacity of analysis and synthesis of conversion circuits through simulations, the exposure of an argument among those covered by the program and discussion of a conversion circuit used in practical applications. Final assessment aims to evaluate whether the student has acquired knowledge and mastery of the techniques used for the conversion of electric power, correctness of the language and exposure and ability to solve a complete problem. The pass mark is achieved when the student shows knowledge and understanding of the subjects at least in general terms, and he has minimal application skills (choice of circuit topology and circuit operation description) regarding the resolution of specific cases; It will also have presentation skills capable to allow the transmission of his knowledge to the examiner. Below this threshold, the examination will be insufficient. The evaluation will be more positive the more the student will be able to interact constructively, detailing its knowledge, with the examiner. The assessment is carried out of thirty. Description of evaluation methods Excellent (30-30 laude): excellent knowledge of the topics, excellent properties of language, good analytical and synthesis skills, the student is able to independently apply the knowledge to solve the problems proposed

	Very Good (26-29) Good knowledge of the topics, language, analytical and synthesis skills, ability to apply knowledge to solve proposed problems Good (24 -25) Basic knowledge of the main topics, discrete properties of language, with limited ability to independently apply the knowledge to the solution of the proposed problems Satisfactory (21-23) does not have full knowledge of the main topics of teaching but it has the knowledge, satisfactory property language, poor ability to independently apply the acquired knowledge Sufficient (18-20) shallow knowledge and technical language issues, very little or no ability to independently apply the acquired knowledge Insufficient: it does not have an acceptable knowledge of the contents of the topics covered.
EDUCATIONAL OBJECTIVES	The student at the end of the course will have acquired the skills necessary to address independently the design and analysis of a power system. The student will be able to choose critically the topology and the control technique most suitable in relation to the specific application. The student will also be able to use the most widely used circuit simulation tools in the power electronics field.
TEACHING METHODS	Front lessons, exercises in the classroom
SUGGESTED BIBLIOGRAPHY	A. educational material distributed during the course B. N. Mohan, Power Electronics: A First Course, Wiley. Reference books: C. Ang S. Oliva A, “Power-switching converters”, CRC press, Boca Raton FL, USA, 2011. D. Di Piazza, Vitale, ‘Photovoltaic Sources: Modelling and Emulation’, Springer, 2013. M. Cirrincione, Pucci, Vitale, ‘Power Converters and AC Electrical Drives with Linear Neural Networks’, CRC PRESS of Taylor and Francis Group, June 2012 F. M. H. Rashid, Power Electronics: Circuits, Devices, and Applications, 3rd Edition, Prentice-Hall, 2003.

SYLLABUS

Hrs	Frontal teaching
4	Introduction to the course . Analysis of non-linear circuits containing electronic power components operated in switching mode.
2	power electronic components : diodes, , BJTs, thyristors, MOSFETs, IGBTs.
4	The AC / DC conversion. Single-phase and three-phase rectifiers
10	The DC / DC conversion. non- isolated converters , basic topologies . high gain converters
4	The DC / DC conversion. Small signal model of a converter , control systems and the stability criteria . stability analysis . Design criteria of a compensation network .
4	The DC / DC conversion. non- isolated converters , derived topologies. Isolated converters .
4	Resonant Converters
6	The conversion DC / AC: single-phase and three-phase inverter
2	The conversion DC / AC: multilevel inverters
4	Grid Side Converters for connection to the electricity distribution network
2	Losses analysis and minimization
2	Thermal design
6	Applications of power electronics: - Energy conversion from a fuel cell - Energy conversion in automotive applications - Energy conversion in a photovoltaic system - Energy conversion in a wind power plant - EMI Analysis

Hrs	Practice
27	The exercises aim to the design and simulation of conversion systems in PSIM simulation environment . Experimental exercises are provided at the Power Electronics Laboratory aimed at acquiring the knowledge of the tools for the characterization of experimental prototypes of converters .