UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2021/2022
BACHELOR'S DEGREE (BSC)	ELECTRICAL ENGINEERING FOR THE E-MOBILITY
SUBJECT	POWER ELECTRONICS
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50298-Ingegneria elettrica
CODE	02957
SCIENTIFIC SECTOR(S)	ING-IND/32
HEAD PROFESSOR(S)	MICELI ROSARIO Professore Ordinario Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	96
COURSE ACTIVITY (Hrs)	54
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**MICELI ROSARIO** Monday 12:00 13:00 ufficio personale Tuesday 15:00 18:00 studio terzo piano Friday 15:00 18:00 studio terzo piano

DOCENTE: Prof. ROSARIO MICELI

PREREQUISITES	Basic skills of physics, electrotechnics and electrical machines are needed.
LEARNING OUTCOMES	- Knowledge and understanding skills At the end of the class the student will have acquired the knowledge of the working principles, mathematical models, control and design issues of electrical power systems. Particularly he will be able to choice and to design electric components, basing on specific requirements, in the field of electric power systems. The student will be aware in advanced topics in the field of electronic power converters. The verification of these objectives is foreseen within the oral test, also by means of discussion of the exercises carried out during the course and presented by each student during the examination. - Ability in applying knowledge and understanding The student will be able to use the mathematical, physical and engineering instruments for the investigation, the design and the realization of systems, or parts of them, within power electronics. He will be able to pose or hold reasonings dealing with the study, the application, the design and the setting up of power converters. To achieve these objectives, the course includes lectures, case studies, guided classroom exercises, autonomous exercises, use of specialized software, use of commercial catalogs. The verification of these objectives is foreseen within the oral test. - Autonomy of judgement The student will be able to know and interpret the main electrical data and parameters of power electronic components; he will be able to collect the data in order to carry out the correct sizing, to interpret their operation and to evaluate their correct operation during service. He will be able even to acquire a sufficient general knowledge of many aspects dealing with the electronic power converters. The verification of these objectives is foreseen within the oral test, also through discussion of the exercises carried out during the course presented by each student during the examination. - Communication skills The student will acquire skills to communicate information and ideas and to express issues related to the course topics. In addition, he will be not only able to hold discussions on topics concerning the electrical machines design, but also to highlight problems on the choice and on the adequate use of power electronic components and converters, proposing possible solutions. To achieve these objectives the course includes lectures, discussion of case studies. The verification of these objectives is foreseen within the oral test. - Learning skills The student will gain learning skills on further comprehension of power electronics and their operating principles. He will acquire the ability to synthesize information and to judge the interactions between different topics and between the fundamental branches of knowledge regarding electrical engineering. These abilities will allow the student to continue the study with higher autonomy and discernment. To achieve these objectives the course includes lectures and numerical applications. The achievement of these objectives will be verified during the oral exam.
ASSESSMENT METHODS	Oral test with the presentation and discussion of the numeric exercises carried out during the course. The exam consist in an oral mandatory test. The assessment of the whole exam is expressed in thirtieth. In the learning evaluation oral test the student will have to argument on 3 questions, at least, concerning the issues of the module. - Learning evaluation The pass mark (18/30) will be reached only if the student demonstrates adequate knowledge and comprehension of at least the general outlines of the topics discussed during the course. Moreover, he must own adequate application skills, allowing the resolution of specific case studies. Particular attention will be given to his clarity of exposition and argumentation, so that his knowledge can be transmitted to the examiner. Otherwise, the test will be declared inadequate. In dependence of both the argumentation/exposition skills of the student with the examiner (more than sufficient, fair, good, more than good, excellent) and the level of knowledge/application skills of the topic shown by the student (more than sufficient, fair, good, more than good, excellent), the rating can be increased up to 30/30 "cum laude".
EDUCATIONAL OBJECTIVES	Goal of this course is to give the general knowledges to enable students to evaluate and to solve problems connected to the exploitation of electronic power converters. The achievement of such goal requires the development of the following student's capabilities: - knowledge of the application context and the design constraints of power electronic systems;

	- knowledge of functional design principles and technical specifications of electronic power converters; - knowledge of different technological options according to required performances; - knowledge of the dynamic behaviour of electronic power converters and of the estimation of the limiting conditions of their exploitation within the application context.
TEACHING METHODS	The course includes the following teaching activities: lectures, class exercises, laboratory exercises. The above activities are organized such a way to facilitate the achievement of learning objectives and learning outcomes, reported in the appropriate frameworks of this form. In particular, during the laboratory exercises each student is guided: - to analyze, through mathematical models, computer simulations and experimental verification, the behavior of the main electrical power components, both at steady-state and during transients; - to acquire the ability to apply methodologies allowing analyze and solve typical problems of design, development and fine-tuning of the systems, even operating autonomous choices.
SUGGESTED BIBLIOGRAPHY	Educational material used during the course will be placed at student's disposal by means of the website. Il materiale didattico impiegato durante le lezioni ed esercitazioni sara' reso disponibile agli studenti tramite il portale studenti. For detailed study: Per approfondimenti: 1) Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics: converters, applications and design", 3rd Edition, John Wiley & Sons, inc, ISBN 0-471-22693-9 (https://eds.a.ebscohost.com/eds/detail/detail?vid=11&sid=e3a257d0-62cf-41dc-bf0b-fd53ad1e74bd%40sessionmgr4006&bdata=Jmxhbmc9aXQmc2l0ZT1lZHMtbGl2ZSZzY29wZT1.000648709&db=cat06211a). (Consigliato)2) Rashid, Muhammad H., Power Electronics: Circuits, Devices, and Applications, 4th Edition, Edinburgh: Pearson, 2014, ISBN 978-0-273-76908-8. (https://eds.a.ebscohost.com/eds/detail/detail?vid=12&sid=e3a257d0-62cf-41dc-bf0b-fd53ad1e74bd%40sessionmgr4006&bdata=Jmxhbmc9aXQmc2l0ZT1lZHMtbGl2ZSZzY29wZT1.001140813&db=cat06211a)

SYLLABUS

Hrs	Frontal teaching
4	Introduction to power electronic systems.
4	Overview of power electronic devices.
4	Mathematical modeling and simulations of power electronic devices.
8	Line-commutated rectifiers. Controlled and non-controlled rectifiers. Cycloconverters.
10	DC-DC converters and their control. Isolated and non isolated dc-dc convertrs.
12	Single-phase and three-phase inverters and their control methods. Pulse width modulation.

Hrs	Practice
12	Numerical and laboratory excrcises.