UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2023/2024
MASTER'S DEGREE (MSC)	ELECTRONICS AND TELECOMMUNICATIONS ENGINEERING (FULLY ONLINE)
SUBJECT	APPLIED ELECTRONICS
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50364-Ingegneria elettronica
CODE	21740
SCIENTIFIC SECTOR(S)	ING-INF/01
HEAD PROFESSOR(S)	LULLO GIUSEPPE Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	9
INDIVIDUAL STUDY (Hrs)	162
COURSE ACTIVITY (Hrs)	63
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**LULLO GIUSEPPE** Monday 11:00 12:00 Studio del docente (DEIM, II piano), previa conferma dell'appuntamento.

DOCENTE: Prof. GIUSEPPE LULLO

PREREQUISITES	Good knowledge of the topics covered in the first cycle degree course in Electronic Engineering, with particular attention to the analysis of linear circuits during transient and in sinusoidal regime, to electronic devices, to control systems and to analogue and digital Electronics.
LEARNING OUTCOMES	Knowledge and understanding At the end of the course the student will gain advanced knowledge in the field of Electronics and its applications in complex systems. The purpose of the course is to provide theoretical and practical methods for the analysis, the design and the fabrication of the commonest circuits and subsystems that are used in modern electronic systems. A special emphasis will be given to the design of circuits with a "mixed signal" approach, as it is almost impossible to make a clear distinction between purely analogue or digital circuits, and considering also the ubiquity of wireless technologies in modern electronic systems. Moreover study cases will be faced relating to high performance and high efficiency Power Electronic Systems for static conversion of electrical energy, systems that have gained a central role for industrial applications, in the automotive sector and in the use of renewable energy. Applying knowledge and understanding The student will be able to use adequate software tools to simulate the operation of the main electronic circuits that make up a modern electronic apparatus, for applications at low frequencies, at high frequencies and in Power Electronics. He will also be able to undertake the design of the various circuits, critically evaluating the possible solutions, with a trade-off among performances, costs and overall system size. At this stage he will be able to independently deepen his knowledge of the characteristics of the discrete and integrated devices and subsystems to be used in the project. Making judgements The student will be able to understand the operation of the main electronic circuits, to assess the problems in the interaction among the various parts of a system and the performance limits of the parts, to collect the data needed to evaluate the characteristics of the electronic components or of the subsystems in order to make choices about their optimal use. These capabilities will allow the student to design electronic systems of varying complexity. Communication The student will acquire the ability to communicate and express matters concerning the subjects of the course. It will be able to sustain conversations or to create technical reports on topics related to the operating principle, the characteristics and the performance limits of the main electronic systems that employ either an analogue or a digital processing of signals, as well as related to power electronic systems. He will also be able to face discussions on the main electronic technologies currently available on the market, on the identification of the best solution, with regards to design specifications and to the requirements of minimization of cost and volume for the final device, and on the optimization of the system performances. Lifelong learning skills The student will learn the interactions among the various parts of an electronic system and the performance limits of the same parts. This will allow him to autonomously address the problem of the project, the analysis, the choice of the components in complex electronics systems and to continue his engineering studies in the field of the applications of Electronics, even beyond graduation, with greater autonomy and understanding.
ASSESSMENT METHODS	At the end of the course there will be an oral interview. The exam begins with the discussion of the report relating to one of the e-tivities carried out during the course. At least two other questions are then formulated to the student, relating to the theoretical topics covered in the course. The overall grade for the exam is assigned on the basis of the clarity and completeness of the presentation of the required topics and the ability to re-elaborate and apply the learned concepts to real problems. The assigned grade is based on a 30-point scale according to the following criteria: (30-30 cum laude, ECTS grade A): excellent knowledge of the topics, excellent use of technical language, good analytical ability, the student is able to apply knowledge to solve the proposed problems; (27-29, ECTS grade B): good knowledge of the topics, good use of technical language, the student is able to apply knowledge to solve the proposed problems; (24-26, ECTS grade C): basic knowledge of the main topics, discrete use of technical language, limited ability to independently apply the knowledge to the solution of the proposed problems; (21-23, ECTS grade D): the student knows the main topics but has not a full

	grasp of them, satisfactory use of technical language, poor ability to independently apply the acquired knowledge; (18-20, ECTS grade E): minimal knowledge of the main topics and basic use of technical language, very little or no ability to independently apply the acquired knowledge; (Fail, ECTS grade F): the student does not have a minimum acceptable knowledge of the topics covered in the course.
EDUCATIONAL OBJECTIVES	The course provides the methods for the analysis and the design of the main circuits used in today's complex electronic systems. During the course theoretical and practical methods are considered for the analysis, the design and the fabrication of the commonest circuits and subsystems that are used in modern electronic systems. A special emphasis is given to the design of circuits with a "mixed signal" approach, as it is almost impossible to make a clear distinction between purely analogue or digital circuits, and considering also the ubiquity of wireless technologies in modern electronic systems. Moreover study cases are faced relating to high performance and high efficiency Power Electronic Systems for static conversion of electrical energy, systems that have gained a central role for industrial applications, in the automotive sector and in the use of renewable energy.
TEACHING METHODS	The course includes a number of videorecorded lectures illustrating the main functional blocks present in modern electronic equipment, as well as the basic methodologies for the analysis and the design of circuits. During the course, via the Moodle e-learning platform, some e-tivities are proposed to the students, relating to the analysis, design and simulation with SPICE software of some circuits covered in the lectures. Further videos are also provided relating to some experimental exercises carried out in the laboratory by the teacher. All these activities will give rise to written reports to be returned through the e-learning platform and which will be evaluated during the final exam.
SUGGESTED BIBLIOGRAPHY	- Maurizio Di Paolo Emilio, "Microelectronics - From Fundamentals to Applied Design", Springer, e-book available on UniPa Discovery Service, eBook ISBN: 978-3-319-22545-6 - Sedra-Smith, "Microelectronic Circuits", 7th Edition, Oxford University Press, ISBN-10: 0199339147 - Paul H. Young: "Electronic Communications Techniques", 5th Ed., Pearson - Prentice Hall, ISBN-10: 0130482854 - H.L.Kraus, C.W. Bostian, F.H. Raab: "Solid state radio engineering", Wiley & Sons, ISBN: 0-471-03018-X - Notes and datasheets supplied by the lecturer.

SYLLABUS

Hrs	Frontal teaching
1	Introduction and presentation of the "Applied Electronics" course.
5	Basic concepts for the analysis and the design of simple linear power supplies.
3	Basics on the operation and the main topologies in switching power supplies.
3	Analogue modulation techniques for a sinusoidal carrier: amplitude and angle modulations.
6	Frequency mixers.
7	Modulators and demodulators for analogue transmissions. Structure of a superheterodyne receiver.
2	Basic concepts on noise. Understanding the S /N ratio in analogue systems.
5	The phase locked loop (PLL): analysis and design of the circuits. Digital PLL circuits.

Hrs	Practice
31	Interactive teaching will be carried out, through the Moodle e-learning platform, by assigning e-tivities related to the analysis, design and simulation with SPICE software of some circuits covered in the lectures. Part of these activities will be guided by the teacher through appropriate introductory videos. Discussion forums will also be activated on the platform for the exchange of ideas among students. Further videos will relate to some experimental tests carried out in the laboratory by the teacher.