UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2021/2022
BACHELOR'S DEGREE (BSC)	ENERGY ENGINEERING AND RENEWABLE ENERGIES
SUBJECT	ELECTRONICS
TYPE OF EDUCATIONAL ACTIVITY	C
AMBIT	10657-Attività formative affini o integrative
CODE	02943
SCIENTIFIC SECTOR(S)	ING-INF/01
HEAD PROFESSOR(S)	CRUPI ISODIANA Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	9
INDIVIDUAL STUDY (Hrs)	144
COURSE ACTIVITY (Hrs)	81
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	PRINCIPLES OF ELECTRONICS - Corso: CYBERNETIC ENGINEERING PRINCIPLES OF ELECTRONICS - Corso: INGEGNERIA CIBERNETICA
YEAR	3
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**CRUPI ISODIANA** Tuesday 17:00 19:00 Viale delle Scienze, Building 9, 2nd floor, room U218

DOCENTE: Prof.ssa ISODIANA CRUPI

PREREQUISITES	To address the topics covered during the course, the student should have knowledge of the analysis techniques for circuits acquired in the Electrotechnics course, good knowledge of Mathematics, Physics I and II.
LEARNING OUTCOMES	- Knowledge and comprehension capacity At the end of the course, the student will have acquired knowledge and comprehension capacity on: the fundamental characteristics and the working principle of the most widely used semiconductor devices; the operating principle of electronic circuits most widely employed in typical applications of systems of interest; the physical principles and the mathematical physics useful to understand the electronic phenomena; a systematic vision of an electronic circuit; the multidisciplinary scientific context covering the Engineering fields. - Ability to apply the acquired knowledge At the end of the course, the student will be able to: identify, formulate and analyze the fundamental set of problems related to the use of electronic circuits, by means of up-to-date methods, techniques and tools; understand electronic phenomena, circuits and systems; be acquainted with the physical parameters and the terminology related to the electronics field. - Ability to evaluate scenarios The student will have gained the autonomy required to correctly employ the basic electronic circuits. - Communication skills The student will be able to: communicate and express problems related to electronics; be acquainted with the physical parameters and the terminology of the electronics fields; talk about the up-to-date subject matters applicable to electronic circuits; to competently talk about electronic cases also with the general public. - Learning ability The student will be able to: deal with the study of electronic circuits; recognize the need for an independent learning during all the lifetime; independently carry out bibliographical researches on electronic systems; independently read and understand a specialized text; attend seminars and workshops in the electronic fields and understand the oral speeches and the proceedings.
ASSESSMENT METHODS	Written exam, or midterm examinations, oral exam. The learning evaluation will be carried out by means of two midterm examinations, valid only for the three appeals immediately after the conclusion of the course, or a written exam. The first midterm test, during the interruption of the didactic activity, will deal with exercises related to the part of the program carried out up to that moment and will allow the student to self-evaluate in the middle course; the second one, immediately after the conclusion of the course, will focus on the topics covered in the remaining part of the course. The student that will not attend the midterm examinations or will not reach a sufficient score (minimum 18 out of 30), will have to take a written examination that will also deal with topics covered during the course. Also in this case, the minimum score needed to pass the written test will be 18 out of 30. During the written exam students are allowed to consult books and notes and to use an electronic calculator for numerical work; mobile phones, tablets or any other device that is web-enabled must be turned off. The written exam will last 3 hours. The aim of the final examination will be to evaluate whether the student has a good knowledge and comprehension of basic electronic devices, circuits and systems and of their potential applications in the field of Engineering. Each exam session provides, only for the students who have successfully passed the written exam, the possibility of taking the oral exam. The final oral examination consists of a series of questions, which are meant to assess whether the student has acquired the skills and subject knowledge expected from the course. For each question, the student will first have to contextualize the subject within the course, describe its meaning and importance, for example by means of formal definitions and scope of applications, and define the study methods and eventually the validity limits. Finally, the student will have to discuss the topic by a correct use of language and a fluent analytical treatment. At the end of the oral examination, students will receive a second evaluation with a score between -3 and +3. This score will be added to the one achieved in the written test and the sum will give the final evaluation. The grades, expressed on a 30-point scale, are divided into: EXCELLENT (30 - 30 cum laude): the student demonstrates an excellent knowledge of the topics and mastery of the course contents, excellent mastery of language and high analytical capability; the student is able to apply his knowledge to solve the proposed problems. Laude is given to students who have demonstrated a particular brilliance in the exposition and in the written test. VERY GOOD (28 – 29): the student demonstrates a very good knowledge of the subjects, a full mastery of language, analytical-synthetic ability and is able to apply knowledge to solve the proposed problems. GOOD (26-27): the student demonstrates good knowledge of the main topics and good analytical skills. The student is able to apply the knowledge to solve the proposed problems, but with some uncertainty. Communication skills may

	not be optimal. QUITE GOOD (24-25): the student demonstrates a fair knowledge of the main topics, a discrete command of language and a limited ability to independently apply the knowledge to the solution of the proposed problems SATISFACTORY (21 – 23): the student does not have full capabilities but has the knowledge, a satisfactory command of language and a poor ability to independently apply the knowledge SUFFICIENT (18 – 20): the student has minimal knowledge of topics and minimal technical language, very little or no ability to independently apply the knowledge INSUFFICIENT: the student does not have an acceptable knowledge of the topics and/or did not deliberately studied some topics of the subject.
EDUCATIONAL OBJECTIVES	Analysis of a complex electronic system and its subdivision into several functional modules. The function, the realization and the interface characteristics of the various submodules are described. The course also includes the fundamental notions related to electronic equipment and measurements.
TEACHING METHODS	Frontal and/or online lectures and tutorials.
SUGGESTED BIBLIOGRAPHY	Materiale didattico di riferimento sugli argomenti svolti durante le lezioni e sulle applicazioni sviluppate nelle esercitazioni verra' reso disponibile dal docente sul sito del corso. I testi ausiliari sono: “Microelectronics Circuits”, Adel S. Sedra and Kenneth C. Smith, Oxford University Press. (Italian edition by EdiSES – Napoli); ISBN 978-0-19-514252-5; “Microelectronic Circuits Design”, Richard C. Jaeger, Travis N. Blalock, McGraw-Hill; ISBN: 978-0-07-338045-2

SYLLABUS

Hrs	Frontal teaching
2	Introduction to the course. History of microelectronics. Prerequisites for the study of electronics.
3	Semiconductor basics; doping and current mechanisms; pn junction
5	Semiconductor diode: characteristic of the semiconductor diode; models of the diode; rectifier circuits; diode logic circuits; Zener diodes, voltage regulator applications.
5	The field effect transistor MOSFET: general considerations; physical structure and principle of operation; i-v characteristics; large-signal model; small-signal model.
5	The bipolar junction transistor BJT: general considerations; physical structure and principle of operation; i-v characteristics; large-signal model; small-signal model.
10	Analog Circuits: general information on amplifiers; principle of operation of discrete amplifiers; operating limits of the discrete amplifiers; method of analysis of the amplifiers; static analysis: bias networks; analysis of dynamic amplification; configurations of amplifiers; multistage amplifiers; design criteria.
6	Operational Amplifiers: general information on amplifiers; ideal operational amplifier; inverting and non-inverting configurations; open-loop operation; closed-loop operation; linear circuits with operational amplifiers; negative feedback; active filters; characteristics of real operational amplifiers.
6	Logic families: MOSFET as a switch; general characteristics of the integrated logic families; CMOS family; CMOS inverter; special configurations.
3	Combinatorial and sequential circuits Encoders; decoders; multiplexer; demultiplexer; asynchronous and synchronous networks; latch; flip-flop
3	Semiconductor-based memories ROM; PROM; EPROM; EEPROM; FLASH; SRAM; DRAM.

Hrs	Practice
33	Exercises on the analysis and design of the circuits presented in the course.