UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2021/2022
FIRST CYCLE COURSE	COMPUTER ENGINEERING
SUBJECT	ELECTRONICS BASICS
TYPE OF EDUCATIONAL ACTIVITY	C
AMBIT	10655-Attività formative affini o integrative
CODE	03472
SCIENTIFIC SECTOR(S)	ING-INF/01
HEAD PROFESSOR(S)	MOSCA MAURO Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	9
INDIVIDUAL STUDY (Hrs)	144
COURSE ACTIVITY (Hrs)	81
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	3
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**MOSCA MAURO** Monday 18:00 19:00 IMPORTANTE! Il docente riceve sempre alla fine della lezione e per appuntamento. Giorno e orario sono stati inseriti in modo fittizio perche richiesti dal sistema!

DOCENTE: Prof. MAURO MOSCA

PREREQUISITES	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 electronic devices; the operating principle of electronic circuits most widely employed in typical applications of automatic systems and communications; the employment of electronic systems in telecommunications and in informatics; the physical principles and the mathematical physics useful to understand the fundamentals of the electronic phenomena; a systematic vision of an electronic circuit; the multidisciplinary scientific context covering both Information and Energy 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 and of electronic converters, 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; understand how to use electronic circuits in the field of Informatics and Energy. Further, he will be able to design simple digital electronic systems. - Ability to evaluate scenarios The student will have gained the autonomy required to correctly employ the basic electronic devices, circuits and converters. - 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	Midterm examination and written final exam, or only written final exam. The evaluation of learning will be carried out by means of a midterm test (done halfway through the course) and a final written exam. The midterm examination will entitle you to a bonus of three points max., which will then be added to the final written test result. This system will allow the student to self-evaluate during the course and decide in advance when to take the exam. For this purpose, bonus points can only be used during the three sessions of the January-February session, immediately following the end of the course, or the April session (last possible session). The student may also decide to take only the final exam, without midterm test. The midterm examination will require solving one or more exercises related to the part of the program carried out so far. The mark will be range from 0 (min) to 3 (max). The final proof, instead, will be focused both on theoretical and application (exercises) topics. The questions will be aimed at ascertaining the possession of the skills and knowledge required by the course, as well as the presentation skills and written proficiency with language and fluency of analytical treatment. Each question will be given a maximum score, indicated on the text of the test. The mark of the written test will be given in thirtieths, for a maximum of 30/30, given by the sum of the scores assigned to each of the questions. Further, extra bonuses may be added that will contribute to the final mark: 1) "midterm test" bonus (max 3 points, deadline: April session); 2) "presentation" bonus (max 1 point, for exam papers presented in an excellent way from the formal point of view and exhibited with excellent properties of language and fluency of analytic treatment); 3) "duration" bonus (max 1 point, granted to students who will deliver the exam paper within no more than 3/4 of the duration assigned for it - example: if the total duration for the exam is 4 hours, the bonus will be assigned to those who deliver within 3 hours). The "presentation" and "duration" bonuses are not counted, if the sum of the scores obtained from the final exam questions (excluding the midterm test) is less than 24. The "midterm test" bonus will be always added to the mark of the final exam (until the last call of February), regardless of the sum of the scores obtained in the final exam. The goal of the final exam is to assess whether the student has a good knowledge and understanding of the devices, circuits and basic electronic

	systems and possible implementations in applications of interest for the Computer Engineering. The evaluation criteria are as follows: EXCELLENT (30-30 cum laude): Excellent knowledge of the topics and excellent processing skills and written proficiency. The student is able to apply the knowledge to solve the proposed problems. The “laude” will be awarded if the sum between the mark assigned to the final test and all the bonuses will be higher than thirty. VERY GOOD (28-29): Very good command of the topics and excellent processing skills, full ownership of language and written proficiency. The student is able to apply the knowledge to solve the proposed problems GOOD (26-27): Good command of the topics and good processing skills. The student is able to apply the knowledge to solve the proposed problems, albeit with some uncertainty. The display capacities may not be optimal. FAIR (24-25): Fair command of the topics and satisfactory processing skills. Limited ability to apply knowledge to the solution of the proposed problems. Written proficiency could not be strong. SATISFACTORY (21-23): Does not have full command of the topics but has the knowledge of them. Poor ability to apply the knowledge of the topics. Written proficiency is not evaluated. SUFFICIENT (18-20): Minimum basic knowledge both of the topics and the technical language. There are several gaps in the understanding of the topics. Minimum ability to apply the acquired knowledge. Written proficiency is not evaluated. INSUFFICIENT: Does not possess an acceptable knowledge of the topics and/ or did not intentionally study some subjects. Written proficiency is not evaluated.
EDUCATIONAL OBJECTIVES	Analysis of electronic systems and their subdivision into several functional modules. The function, the realization and the interface characteristics of the various submodules are described. The course also includes the fundamentals of the design of simple digital electronic systems.
TEACHING METHODS	Frontal lectures and tutorials
SUGGESTED BIBLIOGRAPHY	- Dispense e slide fornite dal docente. - D. Natarajan: Fundamentals of Digital Electronics (Springer Nature, Switzerland, 2020) - scaricabile gratuitamente dal Sistema Bibliotecario di Ateneo. - G. S. Tomar, A. Bagwari: Fundamentals of Electronic Devices and Circuits (Springer Nature, Singapore, 2020) - scaricabile gratuitamente dal Sistema Bibliotecario di Ateneo. - M. Di Paolo Emilio: Microelectronics - From Fundamentals to Applied Design (Springer International Publishing, Switzerland, 2016) - scaricabile gratuitamente dal Sistema Bibliotecario di Ateneo. - A.S Sedra, K.C. Smith: Circuiti per la microelettronica (Italian edition) (Edises, 2005). - A. P. Malvino: Electronic Principles (Glencoe/McGraw-Hill, 1999). - T. L. Floyd: Electronic Devices. Electronic flow version (Prentice-Hall, 2012) - R. C. Jaeger, T. N. Blalock: Microelectronic Circuits Design, (McGraw-Hill, 2011)

SYLLABUS

Hrs	Frontal teaching
1	Introduction to microelectronics: Signals. Frequency spectrum of a signal. Analog and digital signals. Amplifiers. Essential prerequisites for studying the fundamentals of electronics.
4	Combinational Logic: Binary systems and Boolean algebra. Gates. Encoders. Decoders. Multiplexers. Demultiplexer. Comparators. Adders.
5	Sequential Logic: Asynchronous and synchronous circuits. Latch. Flip-flop (or bistable multivibrator). Shift registers. Counters. Data sheets of digital integrated circuits.
2	Timing e clock circuits: Monostable and astable multivibrators. 555 timer IC
5	Operational Amplifiers: General considerations on amplifiers. Ideal operational amplifier. Open-loop operations. Closed loop operations. Linear circuits with operational amplifiers. Real operational amplifiers. Characteristics of real operational amplifiers. Analog op-amp comparators. Data sheets of operational amplifiers.
2	Semiconductor physics: The isolated atom: energy levels. The atom in a crystal: energy bands. Intrinsic semiconductors. Doped semiconductors. Conduction in semiconductors. p-n junctions
3	Semiconductor diodes: Semiconductor diode I-V characteristic. The diode as a circuit element. Diode models. Rectifiers circuits. Limit circuits. Logic diode circuits. Window comparator circuit. Zener diodes. Diodes in power supply circuits. Data sheets of diodes.
3	The Field-Effect Transistor (FET): General considerations and physical behavior. The Metal-Oxide-Semiconductor (MOS) structure. Enhancement MOSFET. Depletion MOSFET. Data sheets of FET.

SYLLABUS

Hrs	Frontal teaching
2	The Bipolar Junction Transistor (BJT): General considerations on BJT. Physical structure and operating principle of the BJT. Characteristics of the BJT. Data sheets of BJT.
2	Optoelectronic devices: Light-Emitting Diodes (LEDs). LED-based lamps. Photodiodes. Phototransistors. Photoresistors.
10	Analog circuits: Introduction to amplifiers. Operating principle of discrete amplifiers. Operating limits of discrete amplifiers. Method of analysis of amplifiers. Static analysis: biasing circuits. Dynamic analysis: amplification. Amplifier configurations. Multistage amplifiers. Design criteria.
3	Logical families: Switching BJT operation. Switching MOSFET operation. General features of integrated logical families. Overview of the TTL family. The CMOS family. The CMOS inverter. Special configurations. Driving discrete components. Data sheets of integrated digital families.
3	Signal acquisition and processing: Data acquisition and processing systems. Transducers. Quantization and sampling. Digital-analog converters (with weighted resistors). Analog-to-digital converters (flash, successive approximation, counter type).

Hrs	Practice
16	Designs of digital systems
20	Analysis of discrete and integrated analog systems