UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria		
ACADEMIC YEAR	2018/2019		
BACHELOR'S DEGREE (BSC)	ELECTRONIC ENGINEERING		
INTEGRATED COURSE	ELECTRONICS I + ELECTRONICS LABORATORY - INTEGRATED COURSE		
CODE	19233		
MODULES	Yes		
NUMBER OF MODULES	2		
SCIENTIFIC SECTOR(S)	ING-INF/01		
HEAD PROFESSOR(S)	LULLO GIUSEPPE	Professore Associato	Univ. di PALERMO
OTHER PROFESSOR(S)	CUSUMANO PASQUALE LULLO GIUSEPPE	Ricercatore Professore Associato	Univ. di PALERMO Univ. di PALERMO
CREDITS	12		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	3		
TERM (SEMESTER)	1° semester		
ATTENDANCE	Not mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	**CUSUMANO PASQUALE** Monday 8:00 8:01 Si prega di concordare il ricevimento via mail: pasquale.cusumano@unipa.it Please arrange in advance by sending an email request to: pasquale.cusumano@unipa.it **LULLO GIUSEPPE** Monday 11:00 12:00 Studio del docente (DEIM, II piano), previa conferma dell'appuntamento.		

DOCENTE: Prof. GIUSEPPE LULLO

PREREQUISITES	Good understanding of the topics covered in the former courses of Mathematics, Physics, Circuit Theory and Electronic Devices.
LEARNING OUTCOMES	Knowledge and understanding At the end of the course the student will acquire basic knowledge in analog electronics and on the operation of amplifiers in general. More in detail, the student will learn about circuits based on operational amplifiers, the properties of semiconductor materials, the characteristics and applications of junction diodes, field effect transistors and bipolar junction transistors. For the latter two devices, their use as amplifiers in the different configurations will be emphasized. The basic techniques of analog integrated circuit design will also be illustrated. Applying knowledge and understanding The student will be able to use simple electronic simulation tools, to design simple electronic circuits with independent operation or to be used as interface between pre-existing analog electronic circuits. He will also be able to supporting discussions related to the use of electronic circuits and, more in general, of electronic systems. Making judgements The student will be able to understand the operation of the main electronic circuits, to evaluate the electrical-electronic problems in the interaction between the various parts of an electronic system and their performance limits, to collect the data needed to assess the characteristics of electronic components or subsystems and to make choices about their optimal use. These capabilities will allow the student to design simple electronic systems. Communication The student will acquire the ability to communicate and express matters concerning the subjects studied during the course. He will be able to sustain conversations on topics related to the physical principle of operation of the main electronic devices and of basic analog electronic circuits. Lifelong learning skills The student will learn the interactions between the various parts of an electronic system and their performance limits. This will allow the student to continue his engineering studies with greater autonomy and understanding.
ASSESSMENT METHODS	The exam consists of a written test and an oral interview. In the written test the candidate will face questions related to the theory, analysis or the design of the circuits studied during the course. The evaluation of the test is carried out considering the reasoning flow for each proposed question. Errors are evaluated according to their severity: one point if the error is probably due to distraction, two points if the error is due to uncertainties in the application of the studied methods, three points for mistakes which clearly demonstrate a lack of knowledge of the subject. At the end of correction, all points related to the errors are subtracted from a starting score of 28. A few "bonus" points can be added depending on the average result of the written tests and the complexity of proposed questions. The written test is passed if the final score is at least 18. The oral interview begins with a discussion of the results of the written test. The candidate is asked three questions, the first of which focuses on topics related to the laboratory activities carried out during the course. The answer to every question, if considered sufficient, is evaluated with a score ranging from -1 to +1 depending on the adequacy and completeness of exposure. These scores are added to the points previously obtained in the written test, thus generating the final grade. The candidate may, however, fail during the oral interview if the answer to at least one of the three questions does not achieve a sufficient level.
TEACHING METHODS	The course consists of a group of lectures, describing the main analog circuits found in modern electronic equipment. Basic methodologies for the analysis and design of circuits are also treated. During the course numerical exercises are proposed and mostly carried out, covering all the concepts explained in the lectures. Moreover, the parallel laboratory activities allow the students to realize some of the circuits studied in theory, in order to verify the real operation and to measure by themselves the main circuit parameters, using the modern instrumentation available in the Didactic Laboratory of Electronics.

MODULE
ELECTRONICS 1

Prof. GIUSEPPE LULLO

SUGGESTED BIBLIOGRAPHY

- Sedra-Smith, “Circuiti per la Microelettronica”, Edizioni EDISES
- Jacob Millman, Arvin Grabel, “Microelettronica”, McGraw-Hill
- Richard C. Jaeger, “Microelettronica”, McGraw-Hill

- Sedra-Smith, "Microelectronic Circuits", 6th Edition, Oxford University Press
- Jacob Millman, Arvin Grabel, “Microelectronics”, McGraw-Hill College
- Richard C. Jaeger and Travis N. Blalock, "Microelectronic Circuit Design", 5th Edition, McGraw-Hill Education

AMBIT	50287-Ingegneria elettronica
INDIVIDUAL STUDY (Hrs)	102
COURSE ACTIVITY (Hrs)	48

EDUCATIONAL OBJECTIVES OF THE MODULE

The course provides basic knowledge related to the analysis and design of the main analog electronic circuits.

SYLLABUS

Hrs	Frontal teaching
2	Introduction to the Integrated Course of "Electronics 1 + Electronics Laboratory ". Hints about basic concepts of network theory and about the electrical characteristics and the models of the main passive electronic devices.
2	Quadrupole parameters and the concept of amplification.
9	Operational amplifiers: basic concepts and their use.
10	Various configurations of amplifiers based on bipolar junction transistors and field effect transistors. Frequency response of the amplifiers.
9	Circuit configurations used in linear integrated circuits: differential amplifier, current mirror, active loads, voltage references, Darlington configuration.
10	Negative feedback in amplifiers: benefits and design criteria.
6	Positive feedback and oscillators.

MODULE
ELECTRONICS - LABORATORY

Prof. PASQUALE CUSUMANO

SUGGESTED BIBLIOGRAPHY

- Sedra-Smith, “Circuiti per la Microelettronica”, Edizioni EDISES
- M. Rashid, “Fondamenti di elettronica”, Apogeo Editore
- P. Horowitz, W. Hill, The Art of Electronics, III Ed., Cambridge University Press
- Dispense-guida sulle esercitazioni sperimentali del Corso, fornite dai docenti.

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INDIVIDUAL STUDY (Hrs)	102
COURSE ACTIVITY (Hrs)	48

EDUCATIONAL OBJECTIVES OF THE MODULE

The course provides the tools and practical skills needed for the analysis and design of the main analog electronic circuits. This objective is achieved through numerical exercises on the analysis and design of the circuits illustrated in the lectures, alongside with practical laboratory exercises on the operation and verification of the electronic circuits including the execution of measurements using the modern instrumentation of the "Laboratorio Didattico di Elettronica".

SYLLABUS

Hrs	Practice
2	Basic concepts about tracing Bode plots. Exercises on the time domain and frequency responses of low-pass, high-pass, and bandpass RC filters.
3	Exercises on amplifier circuits and filters based on the use of operational amplifiers.
4	Exercises on the different configurations of single stage amplifiers based on bipolar junction transistors and field effect transistors.
4	Exercises on circuits with multiple active components: differential amplifiers, current mirror, active loads, voltage references, Darlington configuration.
4	Exercises on the frequency response of amplifier circuits.
6	Exercises on negative feedback amplifiers.
2	Exercises on oscillating electronic circuits.

Hrs	Workshops
2	Time domain and frequency domain responses of low-pass, high-pass, and bandpass RC filters.
2	Experimental measurement of the frequency response of a bandpass RC filter.
2	Measurements in circuits with operational amplifiers.
2	Measurement of static and dynamic parameters of a real operational amplifier.
3	Measurements on a common emitter BJT amplifier.
3	Measurements on BJT amplifiers in various configurations.
3	Measurements on a BJT differential amplifier.
3	Measurement in circuits based on a BJT differential amplifier.
3	Wien oscillator circuit.