UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2020/2021
BACHELOR'S DEGREE (BSC)	MANAGEMENT ENGINEERING
SUBJECT	ELECTRICAL DEVICES AND CIRCUITS
TYPE OF EDUCATIONAL ACTIVITY	C
AMBIT	10657-Attività formative affini o integrative
CODE	02965
SCIENTIFIC SECTOR(S)	ING-IND/31
HEAD PROFESSOR(S)	VIOLA FABIO Professore Associato 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	**VIOLA FABIO** Friday 9:00 13:00 Studio del docente - secondo piano, edificio 9

DOCENTE: Prof. FABIO VIOLA

PREREQUISITES	The student must have the knoledge of mathematical analysis and physics 2. The fundamental skills required, without which no one has the ability to follow the course, can be found here. 1) analysis of time varying functions, in particular those aperiodic exponential to those sinusoidal periodic. 2) the algebra of complex numbers, analytic operations with rectangular and exponential representation and graphical operations on the Argand-Gauss plane 3) solving of linear systems of equations with matrix algebra. 4) resolution of the differential equations of first and second order, with free and forced response. 5) basic knowledge of electrical phenomena: charge, electric field, potential, moving charge, magnetic field. Representation of the field figures.
LEARNING OUTCOMES	D.1: KNOWLEDGE AND SKILLS OF UNDERSTANDING The student, at the end of the course, will have acquired knowledge and understanding of: • methods of analysis of linear electrical networks in steady state, transient, sinusoidal steady; • methods of analysis of linear electrical networks in the frequency domain; • methods of analysis of three-phase systems; • methods of analysis of electromagnetic devices that involve the aspects relating to the electromagnetic field in a stationary or quasi-stationary regime, with particular reference to typical applications in the fields of electrical systems for the energy, electrical machinery, electronics applied to industrial systems automated. D.2: APPLYING KNOWLEDGE AND UNDERSTANDING The student, at the end of the course, will be able to: • discern in the context of linear electrical networks the different physical phenomena, identifying relationships of cause and effect, identifying, formulating and analyzing these phenomena by means of methods, techniques and tools; • apply the main theorems of linear electrical networks; • set the analysis in the time domain of linear electrical networks; • set the frequency analysis of linear electrical networks; • set the analysis of symmetrical and asymmetrical three-phase systems, balanced and unbalanced; • identify, formulate and analyze the typical electromagnetic problems of Electrical Engineering using methods, techniques and tools. D.3: JUDGING AUTONOMY The student will have acquired the necessary autonomy to be able to critically judge the results of stationary electromagnetic and circuit analysis. D.4: COMMUNICATION SKILLS The student will have acquired the ability to communicate and express with good properties of language, the fundamental aspects of electromagnetic analysis in steady state and quasi-steady state and analysis of linear circuits in any regime, while also offering standard solutions in specialized contexts. D.5: LEARNING SKILLS The student will be able to: • approaching the study of electromagnetic devices and of the electric machines typically used in electric power systems and will have acquired the elements to deepen the criteria and the related procedures with their maximum design; • approaching the study of electrical power systems, with particular reference to the electrical systems in civil and industrial applications of the service sector; • approaching the study of electronic systems.
ASSESSMENT METHODS	EXAMS OUTLINE Written test and oral exam, oral one optional . The written test consists of solving exercises similar to those proposed in the lessons. Test duration is 1,5 hours. At the end of the test, the student shall describe the developed work and discuss the programming choices and solutions with the examiner. The oral exam is a discussion with essay questions on the whole course programme. Before taking the oral exam, the student must pass the practical test. In the written test are evaluated: - Mastery and ability to use the basic circuit analysis concepts; - ability to describe and discuss the programming choices and solutions. Oral exam looks at: - knowledge and understanding of the course programme; applying such skills for problem solving within the course or related contexts; - correct use of language, clearness, fluency; concepts reinterpretation, critical faculties, and connection skills in disciplinary or interdisciplinary contexts. Marks are out of 30 for both tests. Minimum mark for passing each test: 18/30. Final mark: mean of practical test and oral exam marks. ASSESSMENT CRITERIA For each test, marks are awarded considering to what extent the student has achieved the learning outcomes. The following scheme can be assumed for reference (see learning outcomes section,

	descriptors D.1-D.5). Best fit applies when learning outcomes are met at different levels. 28-30 / 30 with distinction D.1/D.2: full contents mastery; no errors; self-corrections/integrations of inaccuracies/omissions; correct and rigorous approach to problems; correct, complete and effective solutions; some originality evidence D.3/D.4/D.5: effective concepts reworking, coherent and autonomous approaches and judgments, disciplinary/interdisciplinary connections; very clear presentation, structured arguments, correct use of language. 24-27 D.1/D.2: good knowledge and understanding of course contents; few minor errors, partially fostered self-corrections or integrations; good approach to problems, essentially correct solutions; D.3/D.4/D.5: good coherence in linking concepts and approaching disciplinary or related subjects; good presentation, adequate use of language. 18-23 D.1/D.2: sufficient knowledge of contents; feasible approach to problems although with limited autonomy, acceptable solutions; errors or omissions not serious; D.3/D.4/D.5: sufficient concepts links within disciplinary contexts, although tentative and guided; basic presentation and use of language. below 18 (mark not awarded) D.1-D.5: learning outcomes are not sufficiently met.
EDUCATIONAL OBJECTIVES	• Acquisition of the principle of the circuit models of the main operating components: resistors, capacitors, inductors, coupled inductors, independent generators, independent sources, ideal transformer, two-ports, multipoles; • Acquisition of skills related to the analysis of linear electrical networks in steady state, transient, sinusoidal regime, employing methods in the time domain, and domain phasor; • Acquisition of skills related to the analysis of linear electrical networks concentrated in the frequency domain; • Acquisition of skills related to the analysis of three-phase systems; • Acquisition of skills related to the analysis of two-port networks.
TEACHING METHODS	Lectures, exercises, projects/case studies development, analysis and classroom discussion. Teaching activities are organized to help the achievement learning outcomes (see learning outcomes section, descriptors D.1-D.5). The course contents are offered through lectures, guided exercises and use of dedicated software, emphasizing the applications and the synergy between the different topics (D.1). During the course, the contents are applied to problem solving issues and works on projects/case studies, thus stimulating the development of the ability to apply the acquired knowledge and skills (D.2). During lectures (partly carried out through dialogues and interactions with students), exercises and activities related to projects/case studies, students are fostered to critically analyze the proposed issues; this helps the development of students analytical abilities and autonomous judgment (D.3). At the same time, the dialogue and interaction opportunities foster students to improve their skills of communication, argumentation and use of language (D.4). Finally, all course activities contribute to the development of learning skills, through knowledge reworking, links to real and interdisciplinary applications and stimulus in facing new problems autonomously (D.5).
SUGGESTED BIBLIOGRAPHY	lezioni Hambley elettrotecnica, pearson oppure Rizzoni, elettrotecnica, mcgraw hill progettazione impianti: Losi, Casolino, progettazione di impianti elettrici di bassa tensione, pearson Esercitazioni Viola, Quaderno di elettrotecnica, tangram edizioni scientifiche

SYLLABUS

Hrs	Frontal teaching
1	Objectives of the discipline and its subdivision. diversified analysis of electrical circuits: lumped and distributed circuits.
5	The electric dipole. Voltage and current. the associated reference conditions. Electric power. energy function. Resistor, capacitor, inductor, open circuit, short circuit, diode. Plans definition of one-ports, correlation between voltage and current. bipoles linear time-invariant and time-varying. One-ports in series and in parallel. graphic interpretation.
5	active elements: voltage and current sources. Parallel and series of generators: cases and not eligible. real generators. Controlled generators.

SYLLABUS

Hrs	Frontal teaching
4	Network Definition node and branch. Principles of Kirchhoff. Examples of application of the principles of Kirchhoff.
4	Main methods and theorems of linear electric circuits: the principle of superimposition of the effects, the method of the current loop, the method of the potential nodal, Thevenin's theorem, Norton theorem, Tellegen's theorem, Theorem of Millman, theorem of maximum power transfer.
6	eriodic functions. network definition in sinusoidal regime. Traditional methods of resolution by means of trigonometric laws. Transformed phasor. Application of Kirchhoff's laws in the domain of the phasor. bypass operation and integration in the domain phasor. Transformation of the dipoles in the domain phasor.
6	Phase shift and power factor. sinusoidal steady power: active, reactive and apparent. Triangle of impedances, the triangle of tensions, the triangle of power. The power of resistors, inductors and capacitors. RLC series and parallel circuits. Resonance. Power factor correction.
4	three-phase systems. Connection of generators and loads in star and delta. instantaneous and average power for a balanced three-phase load. economic benefits of the use of three-phase systems.
6	power electrical systems design: objective and subjective criteria. The sizing of conductors with temperature criteria and verification with the criterion of industrial fall. Automatic switch: protection with thermal magnetic, operation and choice. differential switch. basis knoledge on the transformer.

Hrs	Practice
2	Application of Kirchhoff's laws to generic circuits.
4	Application of the methods of the potential of the node and of the mesh currents. Application of Thevenin's theorem and Norton.
4	Application of the laws of Kirchhoff in sinusoidal regime. Resolution of networks using the main methods and theorems.
3	Solving three-phase networks.