UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2019/2020
FIRST CYCLE COURSE	ENERGY ENGINEERING AND RENEWABLE ENERGIES
SUBJECT	ELEMENTS OF ELECTRICAL ENGINEERING
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50298-Ingegneria elettrica
CODE	05767
SCIENTIFIC SECTOR(S)	ING-IND/31
HEAD PROFESSOR(S)	ALA GUIDO Professore Ordinario Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	12
INDIVIDUAL STUDY (Hrs)	192
COURSE ACTIVITY (Hrs)	108
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	

DOCENTE: Prof. GUIDO ALA

PREREQUISITES	Sufficient knowledge of the basic concepts and methods of mathematical analysis and geometry. Sufficient knowledge of the basic concepts of physics.
LEARNING OUTCOMES	Knowledge and understanding At the end of the course, the students will have acquired knowledge and understanding capacity on: • methods of analysis of linear electrical network; steady-state, transients and steady-state sinusoidal behaviour; • frequency domain analysis of linear electric network; • three-phase systems; • steady-state electromagnetic fields analysis, particularly with reference to industrial applications. Verification of this objective is made during the written test and the interview. Applying knowledge and understanding The student, at the end of the course, will be able to: • discern, in the context of linear electrical networks, different physical phenomena, identifying cause-and-effect relationships, identifying, formulating and analyzing these phenomena by means of methods, techniques and instruments up to date; • apply the main theorems of linear electrical networks; • set the time domain analysis of linear electrical networks; • set the frequency analysis of linear electrical networks; • set the symmetrical, balanced and unbalanced three-phase systems analysis; • identify, formulate and analyze electromagnetic problems, typically encountered in industrial applications, by using methods, techniques and tools up to date. Verification of this objective is made during the written test and the interview. Making judgements The student will have acquired the necessary autonomy to be able to assess critically stationary electromagnetic analysis results and circuit analysis. Verification of this objective is made during the written test and the interview. Communications skills The student will have acquired the ability to communicate, using appropriate technical language, the fundamental aspects related to the steady-state electromagnetic analysis and the analysis of linear circuits at any scheme, proposing standard solutions in specialized contexts. The acquisition of communication skills will be verified through the final interview. Learning skills The student will be able to study electromagnetic devices and electrical machines, typically used in industrial engineering, and will have acquired the main criteria and terms associated with their design; The student will be able to study electrical power systems with particular reference to the electrical systems in civil and industrial applications; The student will be able to study electronic systems. The student will be able to address more advanced topics, through the use of bibliographic resources and with growing independence. The learning skills will be tested during the final test in which the student will give evidence of awareness achieved, critical capacity of analysis and synthesis of theoretical and practical aspects of the course.
ASSESSMENT METHODS	The assessment is carried out through a written test and a subsequent interview. There will be a trial in progress, even in a structured way, to be held at the end of the first module. Its aim is to initiate actions of self-control of the cognitive process aimed to verify its temporal stability at the short and medium term. Both the written test and the interview are supported by the student at the end of the cycle of lectures and tutorials, in one of the exam session provided in the academic calendar of the Polytechnic School. The written test, lasting no more than an hour, consists of one or more exercises: they can be solved by using the acquired skills. During the written test it is allowed the use of only drawing and writing tools as well as the Pocket Calculator. The written test can be faced in any call of the exam session: the written test can be repeated in any appeal of the same exam session. The student accesses the interview only if he passes the written test. The interview

	is held in one of the days immediately following the written test, with reference to the active call. If the written test is passed, the student can face the interview in any call of the active exam session. The written test is evaluated by a judgement declined as follows: fail, just sufficient, sufficient, moderate, good, very good. The evaluation criteria are described below. Rating: very good (excellent knowledge and ability to understand the topics, great capacity for analysis and synthesis, the student possesses excellent ability to apply the acquired knowledge to solve the proposed problems). Rating: good (good knowledge and ability to understand the topics, good capacity for analysis and synthesis, the student has good ability to apply the acquired knowledge to solve the proposed problems). Rating: moderate (moderate knowledge and ability to understand the arguments, discrete capacity for analysis and synthesis, the student possesses moderate ability to apply the acquired knowledge to solve the proposed problems). Judgment: sufficient (sufficient knowledge and ability to understand the arguments, sufficient capacity for analysis and synthesis, the student has sufficient ability to apply the acquired knowledge to solve the proposed problems). Judgment: just sufficient (minimum knowledge and capacity for understanding of the topics, minimal capacity for analysis and synthesis, the student possesses minimal ability to apply the acquired knowledge to solve problems). Judgment: fail (insufficient knowledge and ability to understand the arguments, insufficient capacity for analysis and synthesis, the student has not acquired the ability to apply the knowledge to solve the proposed problems). During the interview the student is involved in the discussion of the written test and in the response/discussion to two open questions. It is intended to complete the assessment of the achievement of the expected results. At the end of the interview a 30-point scale rating is proposed: this rating represents the synthesis of overall judgment on the written test and the interview itself. The evaluation criteria are described below. Rating: 30 with distinction (Learning outcomes have been achieved to an excellent level. The student possesses excellent knowledge and ability to understand the topics, great ability to apply the acquired knowledge, he demonstrates full autonomy of judgment, he is fully aware and he has full capacity analysis and synthesis of critical methodological aspects and applications of the course; he has full ability to communicate knowledge, analyses and conclusions, with an excellent level of clearness, fluency and correct use of language; he also shows full evidence for autonomously undertaking further studies). Rating: 28-30 (Learning outcomes have been achieved to a good level. The student possesses good knowledge and ability to understand the topics, good ability to apply the acquired knowledge, he demonstrates good autonomy of judgement, he has good awareness and good critical analysis and synthesis capabilities of methodological aspects and applications of the course; he has good ability to communicate knowledge, analyses and conclusions, with a good level of clearness, fluency and correct use of language; he also shows good evidence for autonomously undertaking further studies). Rating: 25-27 (Learning outcomes have been achieved to a moderate level. The student possesses moderate knowledge and ability to understand the topics, moderate ability to apply the acquired knowledge, he demonstrates moderate autonomy of judgement, he has discrete awareness and moderate critical analysis and synthesis capabilities of methodological aspects and applications of the course; he has moderate ability to communicate knowledge, analyses and conclusions, with a moderate level of clearness, fluency and correct use of language; he also shows moderate evidence for autonomously undertaking further studies). Rating: 21-24 (Learning outcomes have been achieved to a satisfactory level. The student possesses satisfactory knowledge and ability to understand the

	topics, satisfactory ability to apply the acquired knowledge, he demonstrates a satisfactory autonomy of judgement, he has satisfactory awareness and satisfactory critical analysis and synthesis capabilities of methodological aspects and applications of the course; he has satisfactory ability to communicate knowledge, analyses and conclusions, with a satisfactory level of clearness, fluency and correct use of language; he also shows a satisfactory evidence for autonomously undertaking further studies). Rating: 18-20 (the student possesses sufficient knowledge and ability to understand the arguments, a sufficient ability to apply the knowledge acquired, is expressed with sufficient property of language and demonstrates sufficient autonomy of judgement, has sufficient knowledge and sufficient critical capacity for analysis and synthesis of methodological aspects and applications ofcourse; he also shows sufficient evidence for autonomously undertaking further studies).
EDUCATIONAL OBJECTIVES	Development of professional knowledge and insight in the field of steady-state electromagnetics applied to industrial engineering. Ability to solve linear circuits and to make performance evaluation of electrical systems.
TEACHING METHODS	The teaching activities are organized as follows. Lectures and exercises (also by using a free simulation software), conducted in the classroom by the teacher; classwork carried out by students under the guidance of the teacher; classwork carried out independently by students, both individually and in groups: in this case the teacher interacts directly with the individual student by supporting the elaboration of knowledge and its application, learning skills and independence of judgement; interaction and continuous dialogue between teacher and students during the lectures, through questions posed so impromptu and aimed at stimulating attention, communication skills, property of language, the autonomy of judgement.
SUGGESTED BIBLIOGRAPHY	• G. Chitarin, F. Gnesotto, M. Guarnieri, A. Maschio, A. Stella: “Elettrotecnica 1 - Principi” – Societa' Editrice Esculapio, 2017. • R Perfetti: “Circuiti elettrici” - Zanichelli, 2012 • M. Repetto, S. Leva: “Elettrotecnica - Elementi di teoria ed esercizi” – CittaStudi Edizioni, II Ed. 2018. • D.J. Griffiths: “Introduction to Electrodynamics” – Cambridge University Press, 2017. • Esercitazioni proposte dal docente, disponibili sul portale studenti unipa. --- • Bagatin, Chitarin, Desideri, Dughiero, Gnesotto, Guarnieri, Maschio: Esercizi di Elettrotecnica - reti elettriche - Societa' Ed. Esculapio, 2013. • Geri, Maccioni: Raccolta di esercizi d'esame di Elettrotecnica - Societa' Ed. Esculapio, 2013. • Liberatore, S. Manetti, M.C. Piccirilli, A. Reatti: "Circuiti elettrici ed elettronici - Esercizi commentati e risolti" – Progetto Leonardo, Bologna, 2003. --- • C. Desoer, E. Kuh: "Fondamenti di teoria dei circuiti" - Edizioni Franco Angeli, 2001. • M. Guarnieri, G. Malesani: Elettromagnetismo Stazionario e quasi stazionario - Ed. Progetto Padova, 2002. • M. D'Amore: "Elementi di Elettrotecnica - Campi e circuiti” - Edizioni Scientifiche Siderea, 1995. • R. Schifani, S. Farruggia Bonura: “Fondamenti di Elettrotecnica – Teoria di base dei circuiti elettrici” – Hoepli, 2013 • G. Martinelli, M. Salerno: "Fondamenti di Elettrotecnica - Circuiti lineari e permanenti" - voll. I e II, Ed. Siderea, 1996. • V. Daniele, A. Liberatore, R. D. Graglia, S. Manetti: "Elettrotecnica" - Monduzzi Editore, 1996.

SYLLABUS

Hrs	Frontal teaching
18	Analytical and circuital models of electromagnetic field for steady-state and dynamical analysis in linear media.
22	Principles, theorems and methods for the analysis of linear circuits (DC circuits, transients, steady-state sinusoidal circuits), in time domain and in frequency domain.
10	Transfer functions. Frequency domain analysis of passive circuits. Characterization of two-port circuits.
6	Magnetic materials; magnetic circuits.
4	Induction phenomena, electrodynamics and theory of operation of electromechanical converters.
9	Three-phase systems: properties and general methods of analysis.

Hrs	Practice
17	Time domain analysis of electrical linear circuits. Steady-state sinusoidal analysis of electrical linear circuits.
8	Transfer functions; resonance conditions and characterization of passive circuits filter behavior. Characterization of two-port circuits. Applications of Laplace transform for linear circuits analysis.
5	Analysis of magnetic circuits.
4	Induction phenomena, electrodynamics and theory of operation of electromechanical converters.
5	Three-phase systems analysis.