



# UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2021/2022
BACHELOR'S DEGREE (BSC)	BUILDING ENGINEERING, INNOVATION AND RETROFITTING
SUBJECT	PRINCIPLES OF ELECTRICAL EQUIPMENT
TYPE OF EDUCATIONAL ACTIVITY	C
AMBIT	10685-Attività formative affini o integrative
CODE	12655
SCIENTIFIC SECTOR(S)	ING-IND/33
HEAD PROFESSOR(S)	MINEO LILIANA      Ricercatore      Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	103
COURSE ACTIVITY (Hrs)	47
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	3
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	<b>MINEO LILIANA</b> Tuesday    10:00    11:00    Piano 2° edificio 9

<b>PREREQUISITES</b>	Knowledge of the basic concepts of mathematical analysis. Knowledge of the basic concepts and methods of Physics.
<b>LEARNING OUTCOMES</b>	<p><b>KNOWLEDGE AND UNDERSTANDING</b> The student at the end of the course will have acquired knowledge of the basic problems of electrical engineering, related to industrial electrical power applications. He will be able to interpret the diagrams of electrical networks. You will have acquired knowledge on electrical safety and regulatory requirements for the protection of people and systems from the dangers of electricity. He will have acquired the general criteria for the design and verification of elementary low voltage electrical networks.</p> <p><b>ABILITY TO APPLY KNOWLEDGE AND UNDERSTANDING</b> At the end of the course the student will be able to analyze and understand the functioning of electrical circuit components, also establishing the necessary links with mathematical analysis and the concepts of electromagnetism. The student will be able to conduct the analysis of simple linear circuits, in stationary and sinusoidal conditions, carry out the design and verification of simple electrical energy distribution networks; will be able to make the choice of electrical machines such as transformers. He will have developed sensitivity towards the problems of the safety of people and plants towards the risks of electricity.</p> <p><b>AUTONOMY OF JUDGMENT</b> The student will have acquired the ability to independently proceed to the analysis of direct current and sinusoidal alternating current circuits, make the choice of transformers and proceed with the design of simple low voltage electrical networks. In the design choices he will be able to take into account safety problems as well.</p> <p><b>COMMUNICATION SKILLS</b> The student will have acquired the ability to speak, with clarity and language properties, about information, ideas, problems and solutions regarding problems of analysis and synthesis of electrical circuits and the most common electrical plant engineering problems.</p> <p><b>LEARNING SKILLS</b> The student will have acquired the methodological basis for dealing with aspects of electrical systems and electrical safety and will be able to find and learn new information compared to that provided during the training activity. Furthermore, he will be able to continue his training path with greater autonomy, managing to apply the knowledge and skills he has acquired even in working contexts.</p>
<b>ASSESSMENT METHODS</b>	<p><b>METHOD OF EXAMINATION:</b> Oral exam, consisting of an interview, with open-ended questions, on the entire course program. The oral exam is aimed at ascertaining: the degree of knowledge and understanding of the course contents; the ability to apply the acquired skills to problems and applications inherent in the disciplinary context or related to it, with coherence, effectiveness and autonomy of judgment; the property of language, the clarity of presentation, the capacity of synthesis; the degree of awareness and autonomy in the application of problem-solving theories; the ability to re-elaborate the concepts acquired and connect them between them, within the context of the course themes and / or interdisciplinary themes related to it. The criteria adopted for the evaluation will be the following:</p> <p>Rating: excellent. Mark: 30-30 with honors. Excellent knowledge of the topics, excellent language properties, good analytical skills, the student is able to apply the knowledge to solve the proposed problems.</p> <p>Evaluation: very good. Rating: 26-29. Good command of the topics, full ownership of language, the student is able to apply the knowledge to solve the proposed problems.</p> <p>Evaluation: good. Rating: 24-25. Basic knowledge of the main topics, good language properties, with limited ability to autonomously apply the knowledge to the solution of the proposed problems.</p> <p>Evaluation: satisfactory. Rating: 21-23. He does not have full mastery of the main teaching topics but possesses the knowledge, satisfactory language properties, poor ability to independently apply the acquired knowledge.</p> <p>Evaluation: sufficient. Rating: 18-20. Minimum basic knowledge of the main teaching topics and technical language, very little ability to independently apply the acquired knowledge.</p> <p>The evaluation is expressed out of thirty. The minimum grade to pass the test is 18/30.</p>
<b>EDUCATIONAL OBJECTIVES</b>	<p>The course aims to introduce the fundamental principles of electrical systems. For this purpose, the general concepts of circuit analysis are introduced, to provide the methodological basis and the theoretical tools necessary for understanding the applications of electrical engineering in the sector and being able to manage its operation. In particular, the training objectives are the following:</p> <ul style="list-style-type: none"> <li>- develop the understanding of simple electric circuits in direct current and sinusoidal alternating current;</li> <li>- make known the constitutive elements and functions of the single-phase and</li> </ul>

	<p>three-phase electrical power system;</p> <ul style="list-style-type: none"> <li>- to acquire the operating principles and main properties of transformers;</li> <li>- acquire the ability to dimension simple low-voltage cable electrical conduits, make the choice of protections and the relative coordination;</li> <li>- raise awareness of the problems of electrical safety and develop knowledge of the regulatory criteria for protecting people and systems from the dangers of electricity;</li> <li>- know the appropriate specific terminology, to represent in a clear and simple way the concepts and issues with which he is confronted.</li> </ul>
<b>TEACHING METHODS</b>	The educational activities are organized as follows: lectures and exercises, carried out in the classroom by the teacher; exercises carried out in the classroom by students under the guidance of the teacher who interacts directly with the individual student, encouraging the re-elaboration of knowledge and their application, the ability to learn and autonomy of judgment.
<b>SUGGESTED BIBLIOGRAPHY</b>	<p>Giorgio Rizzoni Elettrotecnica - Principi e applicazioni terza edizione. Ed. Graw Hill (ISBN 978-8838667602)</p> <p>Dispense fornite dal docente</p>

## SYLLABUS

<b>Hrs</b>	<b>Frontal teaching</b>
2	Introduction to the course: Objectives and its articulation. Electric circuits as models. Fundamental components of the circuits. Electrical circuit quantities: voltage, current.
2	Elements of topology of electrical networks. Characterization of active and passive fundamental bipoles and their constitutive relations; models and properties. Energy, power.
2	Analysis of resistive linear electrical networks in steady state. Equivalent transformations (series/parallel transformations, triangle/star transformations, real source transformations). Kirchhoff laws
4	Analysis of linear electric networks in sinusoidal regime. Representation of sinusoidal quantities by phasors. Extension of properties, principles, theorems and methods of analysis of stationary electrical networks to symbolic networks. Power in sinusoidal regime.
2	Generalities on the Electric Power System and regulatory references.
2	Load analysis. Users systems. Graphic representation of the plants.
2	General information on three-phase systems.
2	Transformers: construction features and operating principle.
2	Circuit model of electrical distribution lines and calculation of voltage drops.
2	Components for power lines.
3	Electric cables. Electrical behavior of cables. Sizing and verification criteria.
1	Power factor correction.
1	Overloads: overcurrents and short circuits.
3	Protection and switching devices: Relays, Automatic switches for LV, Fuses, Switches.
2	Fundamentals of electrical safety. Dangers of electricity to humans.
2	Ground plants.
1	Protections from direct and indirect contacts.
<b>Hrs</b>	<b>Practice</b>
3	Analysis of steady state electricity networks.
3	Analysis of networks in sinusoidal regime.
3	Application of sizing and verification methods of low voltage power distribution lines. Choice of protection switches.
3	Design of a LV system - Case study.