UNICUSANO
ROME

Code: IIET-01/A **Credits: 9**
Course: Circuit Theory
Main language of instruction: Italian
Other language of instruction: English

Teaching Staff

Head instructor
Prof. Sara Pettinato - sara-pettinato@unicusano.it

Introduction

1. *Objective of the course:*

The objective of the course is to provide students with the necessary skills for the analysis and solution of electrical circuits with reference to the main aspects concerning electrical quantities in continuous and sinusoidal permanent regimes.

Objectives

2. *Course Structure:*

The specific learning objectives are as follows:

1. To provide the definitions of the main electrical quantities.
2. To provide the fundamental principles of electrical engineering, such as Ohm's law, Kirchhoff's first and second principles.
3. To provide the methodologies for simplifying and solving electrical circuits.
4. To provide the skills for analysing three-phase electrical systems.
5. To provide the knowledge for analysing the behaviour of electrical quantities in transient regime.

The activities associated with the course facilitate the development of the requisite skills to formulate and solve problems related to electrical engineering and electrical engineering in general.

Competencies:

A. Knowledge and understanding:

The acquisition of knowledge and understanding is a fundamental objective of this course. Upon completion of the course, the student will have demonstrated knowledge of the topics related to electrical engineering and will have acquired the ability to analyse electrical circuits in different operating regimes. Furthermore, the student will have acquired knowledge of the operation of the principal devices regulating the operation of electrical circuits, including voltage and current generators, resistors, inductors and capacitors, as well as triads of alternating voltage generators connected in star or triangle form. Finally, the student will be able to apply analytical techniques to the analysis of active and passive electrical devices, including ideal and non-ideal models, as well as interconnected systems. Furthermore, through the E-activities, students will develop the ability to formulate and solve electrical systems problems using Matlab/Simulink software.

B. Applying knowledge and understanding:

The student will be able to apply the knowledge acquired during the course of study to the dimensioning of electrical circuits, as well as to the identification of the constituent elements of an active and passive electrical circuit. The student will be able to implement algorithms for solving problems related to the design of electrical circuits and more generally to electrical engineering. The activities require the application of theoretical knowledge to practical problems, which are to be solved with the aid of calculation software (MatLab/Simulink).

C. Making judgements:

The student will be able to identify the components that make up an electrical circuit and assess their functionality. They will also be able to interpret the specifications provided by the manufacturers of the devices and select the most appropriate models from catalogues for a given application. Furthermore, they will be able to identify the cause of a malfunctioning circuit and implement a solution.

D. Communication skills:

The student will be able to describe and engage in conversations on electrotechnical and circuit-engineering topics, correctly identifying the relevant physical quantities and using appropriate terminology.

E. Learning skills:

At the end of the course, the student will have knowledge of the fundamentals necessary for the analysis of electrical circuits. This will enable him to pursue his

engineering studies with greater maturity and will provide him with the basis for learning what will be offered in the specialised courses in mechanics and electronics, with particular reference to the topics of Electrotechnics.

Syllabus

3. *Programme of the course:*

Subjects 1-2:
Definition of the main quantities used in electrical engineering: electric charge and electric current, electric potential and electric voltage, electric energy and electric power.

Subjects 3-4:
Conventions for electrical quantities in the analysis of electrical circuits.

Subjects 5-7:
Kirchhoff's Principles.

Subjects 8-16:
Elementary bipoles and Ohm's constitutive laws.

Subjects 17-18:
Power network analysis extended to coupled linear inductors.

Subjects 19-25:
Analysis of resistive electrical networks.

Subjects 26-30:
Methods for analysing electrical networks.

Subjects 31-39:
Analysis of electricity networks in continuous and sinusoidal permanent regime.

Subjects 40-42:
Electrical power in the permanent sinusoidal regime.

Subjects 43-47:
Analysis of networks in variable regime.

Subjects 48-52:
Double bipoles.

Subjects 52-54:
Elements of electricity distribution: three-phase electrical systems.

Evaluation system and criteria

The examination comprises a written test designed to ascertain the ability to analyse the concepts acquired, as well as a series of activities (E-tivity) carried out during the course in virtual classes. The evaluation of the E-tivity is carried out during the course, with the results being graded on a scale of 0 to 5 points. The exam is graded for the remaining 0 to 25 points and may be taken in written form either at the Rome site or at the teaching centres, subject to prior booking by the student.
The written examination comprises four exercises requiring the resolution of four electrical circuits in permanent continuous and permanent sinusoidal regimes. The examination assesses the expected learning outcomes in terms of knowledge of the subject and the ability to apply it. It also assesses communication skills, the ability to draw conclusions and the capacity for self-study through the activities.

Bibliography and resources

4. *Materials to consult*

Notes written by the instructor are available in Italian (part of the notes are also available in English).

5. *Recommended bibliography*

Suggested reading:

Zeng, G., & Zeng, M. (2021). Electric Circuits. Springer Nature, Switzerland AG.