



Code: ING-IND/33

Credits:9

Matter: Electrical Systems

Main language of instruction: Italian

Other language of instruction: English

Teaching Staff

Head instructor

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Introduction

1. Objective of the course :

The general objective of the course is to provide the student with the skills necessary for the analysis and solution of electrical circuits with reference to the main aspects concerning the electrical quantities in continuous and sinusoidal permanent conditions. Specific training objectives are: to provide the definitions of the main electrical quantities, to provide the fundamental principles of electrical engineering, such as Ohm's law, first and second Kirchhoff principles, to provide the simplification and resolution methodologies of electrical circuits, to provide the skills for the analysis of three-phase electrical systems, provide the knowledge for the analysis of the behavior of electrical quantities in transient conditions. The activities associated with the course develop the skills necessary to formulate and solve problems related to electrical and electrical engineering through references to theory and practical application of calculation techniques.

Objectives

2. Course Structure:

Tests and assessment exercises that accompany the pre-recorded lessons and allow students to ascertain both the understanding and the degree of knowledge acquired of the contents of each of the lessons.

The interactive teaching is carried out in the forum of the "virtual class" and includes 2 activities that apply the knowledge acquired in the theory lessons to the solution, through calculation codes developed in Matlab /Simulink by the student, of typical practical and theoretical problems of electrical systems.

In particular, the Electrotechnical Course includes 9 credits. The total study load for this teaching module is between 220 and 250 hours divided as follows:

approximately 170 hours for viewing and studying the videotaped material (27 videorecorded hours of Theory and 5 hours of exercises).

About 40 hours of Interactive Education for the development and delivery of 2 Eivities.

About 10 hours of Interactive Teaching for the execution of self-assessment tests. It is advisable to distribute the study of the subject evenly over a period of 8 weeks by dedicating between 20 to 25 hours of study per week.

Competencies:

- **Knowledge and understanding**
- **Ability to apply knowledge and understanding**
- **Autonomy of judgment**
- **Communication skills**
- **Learning ability**

Knowledge and understanding:

At the end of the course, the student will have demonstrated knowledge of the topics relating to electrical engineering, and will have acquired the ability to analyze electrical circuits in the various operating modes. Furthermore, the student will acquire the knowledge of the functioning of the main devices that regulate the functioning of electrical circuits such as: voltage and current generators, resistor, inductor and capacitor, triples of alternating voltage generators connected in star or delta. Finally, the student will acquire methods for the analysis of active and passive electrical devices, ideal and otherwise, interconnected with each other. Furthermore, through the Eivity, students will acquire the ability to formulate and solve electrical system problems using Matlab / Simulink software.

Application of knowledge:

The student will be able to use the knowledge acquired during the study of the course regarding the sizing of electrical circuits and will know the constituent elements of an active and passive electrical circuit. He will be able to implement algorithms for solving problems related to the design of electrical circuits and more generally to electrical engineering. The Eivities provide for the application of theoretical knowledge to practical problems to be solved with the aid of

Software of calculation (MatLab / Simulink).

Capacity of conclusions:

The student will be able to identify the components that make up an electrical circuit and understand if they are working correctly, to interpret the specifications provided by the manufacturers of the devices, and to choose the models of the different equipment most appropriate for the application. It will also be able, in the event of a circuit malfunction, to understand the cause and to remedy it.

Communication skills:

The student will be able to describe and hold conversations on issues relating to electrical engineering and circuit-plant engineering, correctly identifying the relevant physical quantities, and using appropriate terminology.

Ability to learn:

At the end of the course, the student will have knowledge of the fundamental notions necessary for the analysis of electrical circuits.

Syllabus

3. Programme of the course:

Modules 1 - 2(2 videotaped lessons, 2 days)

introduction. Definition of the main quantities used in the field of electrical engineering: electric charge and electric current, electric potential and electric voltage, electric energy and electric power.

·Didactic materials by the teacher

Conventions for electrical quantities in the analysis of electrical circuits.

·Didactic materials by the teacher

Kirchhoff's principles.

·Didactic materials by the teacher

Elementary bipoles and Ohm's constitutive laws.

Modules 3 - 4(2 videotaped lessons, 2 days)

Modules 5 - 7(3 videotaped lessons, 3 days)

Modules 8 - 16 (9 videotaped lessons, 7 days)

Modules 17 - 18(2 videorecorded lessons, 2 days)

Analysis of the electrical network extended to coupled linear inductors.

Modules 19 - 25(7 videotaped lessons, 7 days)

Analysis of resistive electrical networks.

·Didactic materials by the teacher



Modules 26 - 30(5 videotaped lessons, 5 days)

Modules 31 - 39(9 videotaped lessons, 7days)

Modules 40 - 42(3 videotaped lessons, 3days)

Modules 43 - 47(5 videotaped lessons, 5days)

Modules 48 - 52(5 videotaped lessons, 5days)

Modules 53 - 54(2 videotaped lessons, 2days)

*Etivity 1 –
5 hours*

*Etivity 2 –
5 hours*

Methods of analysis of electrical networks.

·Didactic materials by the teacher

Analysis of electrical networks in continuous continuous and sinusoidal regime.

·Didactic materials by the teacher

Electric power in the sinusoidal steady state.

·Didactic materials by the teacher

Analysis of networks in variable regime.

·Didactic materials by the teacher

Double bipoles.

·Didactic materials by the teacher

Elements of electricity distribution: three-phase electrical systems.

·Didactic materials by the teacher

Solving problems related to three-phase electrical systems.

Laplace transform for the resolution of transient electrical circuits.

Evaluation system and criteria

The exam consists in carrying out a written test aimed at ascertaining the ability to analyze and rework the concepts acquired and a series of activities (Etivity) carried out during the course in virtual classrooms. The evaluation of the Etivity from 0 to 5 points is carried out during the duration of the course. The exam is evaluated for the remaining from 0 to 25 and can be carried out in writing both at the Rome office and at the teaching centers upon prior reservation by the student. The written test includes 3 exercises in solving three electrical circuits in continuous continuous and sinusoidal permanent regime. The expected learning outcomes about the knowledge of the subject and the ability to apply them are assessed by the written test, while the communication skills, the ability to draw conclusions and the ability to self-learn are assessed through the Etivities.

Bibliography and resources

4. *Materials to consult:*



The didactic material on the platform is divided into 55 modules + 1 module concerning an introduction to electric machines. They cover the entire program and each of them contains handouts, slides and video lessons in which the teacher comments on the slides. This material contains all the elements necessary to tackle the study of the subject.

Recommended texts: Electrotechnics Hardcover – September 13, 2007 by John Henderson (Author);