Fundamentals of transient phenomena in power grids

Academic Year: (2023 / 2024) **Review date: 27/04/2023 08:54:26**

Department assigned to the subject: Electrical Engineering Department

Coordinating teacher: ALONSO MARTINEZ, MONICA

Type: Compulsory ECTS Credits : 3.0

Year : 2 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Calculus I, Calculus II, Linear Algebra, Physics II

It is needed to follow, simultaneously, Electric Power Engineering Fundamentals.

LEARNING OUTCOMES

CB1. Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study.
CB2. Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.
COCIN3. Knowledge of basic and technological subject areas that will capacitate them to acquire new methods and theories and endow them with the versatility to adapt to new situations.
COCIN4. Ability to resolve problems with initiative, decision-making, creativity, and critical reasoning skills and to communicate and transmit knowledge, skills and abilities in the Industrial Engineering field.
CEP1. Capacity to design a system, component or process in the area of electrical engineering in compliance with required specifications.
CEP2. Knowledge and ability to apply computational and experimental tools for analysis and quantification of electrical engineering problems.
CEB1. Ability to solve the mathematic problems arising in engineering. Aptitude for applying knowledge of: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and partial derivatives: numerical methods; numerical algorithms, statistics and optimization.
CER4. Knowledge and use of the principles of electrical circuits and electric machinery theory.

By the end of this content area, students will be able to have:
RA1.1. Knowledge and understanding of the mathematical principles underlying their branch of engineering.
RA1.2. A systematic understanding of the key aspects and concepts of electrical circuits.
RA2.1. The ability to apply their knowledge and understanding to identify, formulate and solve mathematical problems using established methods.
RA2.1. The ability to apply their knowledge and understanding to identify, formulate and solve electrical circuits problems using established methods.
RA4.2. The ability to design and conduct appropriate experiments, interpret the data and draw conclusions.
RA4.3. Workshop and laboratory skills.
RA5.2. The ability to combine theory and practice to solve electrical circuits problems.

OBJECTIVES

By the end of this subject, students will be able to have:
1. knowledge and understanding of the mathematical principles underlying their branch of engineering;
2. the ability to apply their knowledge and understanding to identify, formulate and solve mathematical problems using established methods;

3. a systematic understanding of the key aspects and concepts of electrical circuits;
4. the ability to apply their knowledge and understanding to identify, formulate and solve electrical circuits problems using established methods;
5. the ability to design and conduct appropriate experiments, interpret the data and draw conclusions;
6. workshop and laboratory skills.
7. the ability to combine theory and practice to solve electrical circuits problems;

DESCRIPTION OF CONTENTS: PROGRAMME

TEMA 1:METHODS OF RESOLUTION OF DIFFERENTIAL EQUACIONES
1.1. Resolution of D.E. in time domain.
1.2. Numerical methods to resolve D.E.

TEMA 2: FIRST ORDER ELECTRICAL CIRCUITS
2.1. Obtaining the free response and and the forced response.
2.2. Time constant

TEMA 3: SECOND ORDER ELECTRICAL CIRCUITS
3.1. Obtaining the free response and the forced response.
3.2. Natural frequency and damping. System stability.
3.3. Series resonance. Paralel resonance.
3.4. Modelling electrical transients by means of software tools.

LEARNING ACTIVITIES AND METHODOLOGY

Theoretical and practical lessons solving problems. Practical lessons using computers.

ASSESSMENT SYSTEM

% end-of-term-examination/test:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

Partial and final examination and practical assessment.
The continuous evaluation also includes tests in the classes and exercises for home.

Students whose weighted average mark exceeds 5 do not need to take the final exam for the subject.

BASIC BIBLIOGRAPHY

- Allan Greenwood Electrical Transients in Power Systems, John Wiley and Sons.

- Fraile Mora, Jesús Electromagnetismo y circuitos eléctricos, McGraw-Hill.

- Paul J. Nahin Transient for Electrical Engineers Elementary Switched circuit Analysis in the Time and Laplace Transform Domains, Springer.

- R.K. Nagle Fundamentals of Differential Equations, Pearson.

- Usaola, Julio y Moreno, Mª. Ángeles, Circuitos eléctricos. Problemas y ejercicios resueltos, Pearson Educación.