Transmission and distribution of energy

Academic Year: (2020 / 2021) **Review date: 29-07-2020**

Department assigned to the subject: Electrical Engineering Department

Coordinating teacher: LEDESMA LARREA, PABLO

Type: Electives ECTS Credits : 6.0

Year : Semester :

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Solution of AC electrical circuits using phasors (e.g. Electrical Power Engineering Fundamentals in UC3M)

OBJECTIVES

CB1. Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study
CB2. Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
CB3. Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
CB4. Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
CB5. Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
CG2. Learn new methods and technologies from basic scientific and technical knowledge, and being able to adapt to new situations.
CG3. Solve problems with initiative, decision making, creativity, and communicate and transmit knowledge, skills and abilities, understanding the ethical, social and professional responsibility of the engineering activity. Capacity for leadership, innovation and entrepreneurial spirit.
CG4. Solve mathematical, physical, chemical, biological and technological problems that may arise within the framework of the applications of quantum technologies, nanotechnology, biology, micro- and nano-electronics and photonics in various fields of engineering.
CG5. Use the theoretical and practical knowledge acquired in the definition, approach and resolution of problems in the framework of the exercise of their profession.
CG6. Develop new products and services based on the use and exploitation of new technologies related to physical engineering.
CG7. Undertake further specialized studies, both in physics and in the various branches of engineering.
CE6. Solve problems of applied thermodynamics, heat transmission and fluid mechanics in the field of engineering.
CE20. Understand and address the general problems of the field of Energy, as well as the scientific and technological foundations of its generation, conversion, transport and storage.
CT1. Work in multidisciplinary and international teams as well as organize and plan work making the right decisions based on available information, gathering and interpreting relevant data to make judgments and critical thinking within the area of study.
RA1. To have acquired sufficient knowledge and proved a sufficiently deep comprehension of the basic principles, both theoretical and practical, and methodology of the more important fields in science and technology as to be able to work successfully in them;
RA2. To be able, using arguments, strategies and procedures developed by themselves, to apply their knowledge and abilities to the successful solution of complex technological problems that require creating and innovative thinking;
RA3. To be able to search for, collect and interpret relevant information and data to back up their conclusions including, whenever needed, the consideration of any social, scientific and ethical aspects relevant in their field of study;
RA4. To be able to successfully manage themselves in the complex situations that might arise in their academic or professional fields of study and that might require the development of novel approaches or solutions;

RA6. To be aware of their own shortcomings and formative needs in their field of specialty, and to be able to plan and organize their own training with a high degree of independence.

DESCRIPTION OF CONTENTS: PROGRAMME

Transmission and distribution grids
- Transmission voltages
- Meshed and radial grids
- Power quality
- Basic mathematical models of lines, transformers, loads and generators
- Per unit quantities

Power lines
- Conductors
- Insulators
- Pylons
- Mechanical tension
- Mathematical models of a line
- Power flow and voltages in a line
- Corona effect

The power flow problem
- Power flow equations
- Newton-Raphson method
- Modified N-R methods

Voltage control
- Shunt-connected coils and capacitors
- Automatic voltage regulation in power plants
- Tap changer transformers
- Ferranti effect
- Voltage control in a distribution system
- Voltage control in a transmission system

Substations
- Disconnectors
- Circuit breakers
- Measurement transformers
- Substation configurations

Frequency control
- Primary regulation
- Secondary regulation
- Tertiary regulation

Protection systems
- Characteristics of a protection system
- Time/current relay
- Fault clearing time and transient stability

Emerging technologies in power systems
- Energy load management
- Electric vehicles
- Smart meters
- Smart grid

LEARNING ACTIVITIES AND METHODOLOGY

Practical work in the computer laboratory
Theoretical classes
Solution of practical problems in class
Individual tutorials
Individual presentations of the students

ASSESSMENT SYSTEM

SE1. FINAL EXAM. Global assessment of knowledge, skills and capacities acquired throughout the course.The percentage of the evaluation varies for each subject between 60% and 0%.
SE2. CONTINUOUS EVALUATION. Assesses papers, projects, class presentations, debates, exercises,

internships and workshops throughout the course.The percentage of the evaluation varies for each subject between 40% and 100% of the final grade.

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

BASIC BIBLIOGRAPHY

- Grainger Power System Analysis, McGraw-Hill.
- P. Kundur Power System Stability and Control, EPRI.
- Schavemaker, van der Sluis Electrical Power System Essentials, John Willey & Sons.