Course guide
340109 - SIEP-E6O09 - Electrical Power Systems

Last modified: 04/06/2024

Unit in charge: Vilanova i la Geltrú School of Engineering
Teaching unit: 709 - DEE - Department of Electrical Engineering.

Degree: BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Optional subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Optional subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: Font Mateu, Josep

Others:

PRIOR SKILLS

It is recommended to have taken the subjects of Electrical Systems (SIEL), Electrical Circuits (CIEL), Power Lines (LIEL) and Electrical Machines I (MAE1)

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. CE24. Knowledge of electrical power systems and its applications.

Transversal:
2. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.
3. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

TEACHING METHODOLOGY

Theoretical, problem and practical classes with projection teaching material. The theoretical aspects of the proposed topics will be presented and developed in the theoretical classes. Participation, discussion, and critical analysis will be encouraged through active student participation in individual and group discussion and presentation activities.
In the problem classes, the approach and resolution of exercises corresponding to the subjects of the subject will be done, partly by the teacher and also by the students, individually and/or in groups.
Specific software for the subject will be applied to the practical classes. The students will prepare the subject of each session in advance, carry out the proposed studies and deliver a report of the activity with the calculations, results and conclusions.
The subject's tasks are based on individual study, the student's search for information, and group work.

LEARNING OBJECTIVES OF THE SUBJECT

Knowing of the components and functions of an electrical power system.
Knowing how to calculate short-circuit currents, their effects and protection needs.
Design of the different methods to regulate the voltages in an electrical energy transport and distribution network.
Know the different topologies of electrical networks and the tools necessary for their analysis.
Analyze the operation of an electric power system in a permanent regime.
Knowing how to calculate the synthesis of passive filters for electrical power systems.
Knowing how to distribute the demand for energy between the different generating units of the system from an economic point of view.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours large group	45,0	30.00
Hours small group	15,0	10.00

Total learning time: 150 h

CONTENTS

Unit 1: Components i modelat d'un Sistema Elèctric de Potència

Description:
1.1 Fundamental characteristics of Electrical Power Systems.
1.2 Basic studies in Electrical Power Systems.
1.3 Models of the basic components of an Electrical Power System.

Full-or-part-time: 12h
Theory classes: 2h 30m
Guided activities: 2h
Self study : 7h 30m

Unit 2: Estudi de defectes

Description:
2.1 Transformaciones trifásicas.
2.2 Impedancias secuenciales.
2.3 Tipo de defectos en las redes trifásicas.
2.4 Cálculo de los distintos tipos de cortocircuitos.

Full-or-part-time: 34h
Theory classes: 8h
Practical classes: 2h
Laboratory classes: 2h
Guided activities: 2h
Self study : 20h

Unit 3: Regulació de la tensió

Description:
3.1 Justification of voltage regulation.
3.2 Classification of regulation methods. Advantages and disadvantages.
3.3 Regulation methods without affecting the nature of the load.
3.4 Regulation methods for load compensation.

Full-or-part-time: 27h
Theory classes: 6h
Practical classes: 2h
Laboratory classes: 2h
Guided activities: 2h
Self study : 15h

Unit 4: Topologia i Matrius de Xarxa

Description:
4.1 Topology of electrical networks: graphs.
4.2 Topological matrices.
4.3 Network analysis methods.
4.4 Applications of Thevenin's theorem to Electrical Power Systems.
4.5 Network matrix formation algorithms.

Full-or-part-time: 18h 30m
Theory classes: 5h
Laboratory classes: 1h 30m
Guided activities: 2h
Self study : 10h

Unit 5: Estudis de Flux de Càrregues

Description:
5.1 Introduction: definition and interest of the study.
5.2 Analytical formulation: load flow equations. Types of bars.
5.3 Gauss-Seidel method. Networks without controlled voltage.
5.4 Newton-Raphson method.
5.5 Decoupled methods. Acceleration of convergence.
5.6 Power flow control.

Full-or-part-time: 36h
Theory classes: 10h
Practical classes: 2h
Laboratory classes: 2h
Guided activities: 2h
Self study : 20h

Unit 6: Harmonics in electrical power systems. Synthesis of passive filters for electrical power systems.

Description:
Study of the effects of non-sinusoidal, harmonic quantities in electrical power systems. Synthesis of Filters.

Full-or-part-time: 10h
Theory classes: 4h
Practical classes: 2h
Guided activities: 2h
Self study : 2h

Unit 7: Operació econòmica de Sistemas de Potència

Description:
7.1 Introduction to the financial office.
7.2 Load distribution between units of the same plant.
7.3 Economic distribution of load between power stations.
7.4 Equation of energy transport losses. Calculation of incremental losses.
7.5 Optimal load flow.

Full-or-part-time: 22h 30m
Theory classes: 6h
Practical classes: 1h 30m
Guided activities: 2h
Self study : 13h

GRADING SYSTEM

Exams: E1 (PARTIAL), E2 (FINAL)
Practices and work: PR
RATING = 0.3*E1+0.5*E2+0.20*PR
Re-evaluation: there will be a re-evaluation test of the part corresponding to the exams, according to the re-evaluation criteria set out in the EPSEVG regulations

EXAMINATION RULES.

The exams are in person and individual.
In the simulation practices and group work, the presentation of the results of the activity will be evaluated.

BIBLIOGRAPHY

Basic:
- Grainger, John J.; Stevenson, William D. Análisis de sistemas de potencia [on line]. México [etc.]: Mc Graw-Hill, 1996 [Consultation: 29/01/2024]. Available on: https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=3196480. ISBN 9701009088.
- Barrero, Fermín. Sistemas de energía eléctrica. Madrid: Thomson, 2004. ISBN 8479322835.
- Gómez Expósito, Antonio... [et al.]. Sistemas eléctricos de potencia : problemas y ejercicios resueltos. Madrid: Prentice Hall, 2003. ISBN 8420535583.
- Nasar, Syed A. Sistemas eléctricos de potencia. México, [etc.]: McGraw-Hill, 1991. ISBN 9684227973.
- Zamora Belver, Mª inmaculada... [et al.]. Simulación de sistemas eléctricos. Madrid [etc.]: Prentice Hall, 2005. ISBN 8420548081.

RESOURCES

Audiovisual material:
- Nom recurs. Resource