Course guide  
340109 - SIEP-E6009 - Electrical Power Systems

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: 2023  
ECTS Credits: 6.0  
Languages: Catalan

LECTURER  
Coordinating lecturer: Font Mateu, Josep

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

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>60.00</td>
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<tr>
<td>Hours large group</td>
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<td>30.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>15,0</td>
<td>10.00</td>
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</tbody>
</table>

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

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### 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

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### 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:** 8h  
Theory classes: 4h  
Practical classes: 2h  
Laboratory classes: 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

BIBLIOGRAPHY

Basic:

RESOURCES

Audiovisual material:
- Nom recurs. Resource