

## DIE-GITI-441 Electric power plants and Electrical substations

**SEMESTER:** Fall  
**CREDITS:** 4.5 ECTS (3 hrs. per week)  
**LANGUAGE:** Spanish  
**DEGREES:** GITI

### Course overview

General description and fundamental principles of thermal and hydroelectric power plants are studied. Electrical substation topologies and their basic design are presented.

### Prerequisites

Knowledge of power systems analysis.

Basic knowledge of electric machines.

### Course contents

#### Theory:

- 1. Power plants.** Types and Technologies. Investment and Generation Costs, profitability, Technology Mix. Social and Environmental Impact. Particularities of the different kinds of generation: analysis of environmental, operating, technological, economic and sustainability aspects. Base settings in Auxiliary services, impact on the stations availability, island operation, black-start. Performance requirements set by the transportation network.
- 2. High voltage switchgear.** Single line diagrams, substation layouts plan. Air-insulated technologies, SF6 technologies and mixed. Pros and cons. Cost and availability analysis. Social and environmental impact: noise, fire, electromagnetic compatibility. Integration with natural environment, landscaping. Earthing and bonding design, Spanish regulation. Insulation Coordination procedures, over voltages, creepage distances. Control and Protection system. Auxiliary services. Switchgear general characteristics. Regulation. Manufacture and testing. New technologies: future vision.
- 3. Electrical components in electrical substations.** Equipment specifications, standards, manufacture and testing. Selection criteria. Switches, types and technologies. Isolator, types and technologies. Current and Voltage Transformers, types and technologies, accuracy class. Tap changers in Transformers, types and arrangements. Surge arrester, types and selection procedure. Busbars, types and arrangements.

## Textbook

- Reglamento de Instalaciones Eléctricas de Alta Tensión y sus fundamentos técnicos. Aplicación al Reglamento de Instalaciones de Alta Tensión. Real Decreto 337/2014 del 9 de mayo. Varios Autores. Editorial Garceta
- Subestaciones eléctricas. Jesús Trashorras Montecelos. Editorial Paraninfo
- Transmission and Distribution Electrical Engineering. Colin Bayliss and Brian Hardy. Editorial Newnes.

## Grading

The following condition must be accomplished to pass the course:

- A minimum overall grade of at least 5 over 10.

The overall grade is obtained as follows:

- Final exam 60%
- Other exams: 20%
- Technical homework (individual or in team) 10%.
- Seminars or technical visits attendance: 5%
- Class attendance and participation 5%