

**GENERAL INFORMATION**

Data of the subject	
Subject name	Electric Power Lines
Subject code	DIE-MII-631
Main program	Official Master's Degree in Industrial Engineering
Level	Posgrado Oficial Master
Quarter	Semestral
Credits	4,5 ECTS
Type	Obligatoria
Department	Department of Electrical Engineering
Coordinator	Pablo Rodríguez Herrerías
Schedule	As per official timetable
Office hours	By appointment

Teacher Information	
Teacher	
Name	Pablo Rodríguez Herrerías
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DESCRIPTION OF THE SUBJECT

Contextualization of the subject
Prerequisites
It is advisable that students have prior knowledge on the following areas: • Circuit theory. • Mechanical and structural calculations. • Heat transfer problem resolution. • Resolution of practical problems and report preparation • Skills in the use of calculation software (such as MS Excel or Matlab).

Course contents

Contents
Subject 1: Introduction



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1. Definitions. Overhead lines main components.
2. Basic design. Line configurations and future challenges.

Subject 2: Electrical calculations

1. Line constants. Equivalent circuits.
2. Corona effect.
3. Impacts of electrical origin. Influence of line configuration.
4. Thermal transmission capacity.

Subject 3: Sag-tension calculations

1. Span geometry. Parabola and Catenary. Catenary constant. Sag.
2. Loading cases on conductors and ground wires
3. Sag-tension calculations. State Change Equation. EDS. Stress-Strain behavior
4. Ruling span theory. Line section. Stringing chart.
5. Wind-induced vibrations in overhead conductors. Types and mitigation.

Subject 4: Towers and foundations

1. Tower types. Lattice. Tubular. Self-support. Guyed.
2. Loading assumptions for tower calculations. Wind span. Weight span. Loading trees. Interaction diagrams.
3. Tower top geometry. Lightning and grounding design.
4. Tower foundations. Block and separate footing foundations. Theory and calculations.

Subject 5: Insulation

1. Insulator types. Characteristics and performance comparison.
2. Electrical and mechanical design. Pollution levels.

Subject 6: Electric Power Lines Project

1. National Electrical Safety Code. Minimum clearances.
2. Line routing. Graphical Information Systems (GIS). Tower spotting.
3. Minimum project content.
4. Basic project management.
5. Overhead line construction. Civil works. Tower erection. Conductor stringing.

Subject 7: Underground cables

1. Introduction. Overhead vs underground electric power lines.
2. Components. Cables and accessories. Basic design.
3. Grounding and sheath bonding systems. Transmission capacity.
4. Underground cables construction. Trench types. Galleries.

Subject 8: Line uprating

1. Needs and solutions.
2. Voltage increase solutions. Line modifications.



3. Ampacity increase solutions. HTLS conductors. Dynamic Line Rating (DLR)

EVALUATION AND CRITERIA

The use of AI to produce full assignments or substantial parts thereof, without proper citation of the source or tool used, or without explicit permission in the assignment instructions, will be considered plagiarism and therefore subject to the University's General Regulations.

Evaluation activities	Evaluation criteria	Weight
Midterm exams	- Understanding of theoretical concepts. - Problem resolution by means of theoretical concepts application. - Problem results analysis and interpretation.	20
Technical report assignment	- Understanding of theoretical concepts. - Problem resolution by means of theoretical concepts application. - Problem results analysis and interpretation. - Written and oral communication skills. - Learned skills in the use of line design software.	20
Final Exam	- Understanding of theoretical concepts. - Problem resolution by means of theoretical concepts application. - Problem results analysis and interpretation.	60

Grading

Regular assessment

- Final Grade:** 20% midterms, 20 % technical report assignment, 60% final exam.

Retakes

- Final Grade:** 40% grade from regular assessment (20% midterms and 20% technical report assignment), 60 % retake exam.

Class attendance is mandatory according to Article 93 of the General Regulations (Reglamento General) of Comillas Pontifical University and Articles 6 and 7 of the Academic Rules (Normas Académicas) of the ICAI School of Engineering. Not complying with this requirement may have the following consequences:



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- Students who fail to attend more than 15% of the lectures may be denied the right to take the final exam during the regular assessment period as well as the retake.

Use of AI in grading activities

In the technical report assignment, AI may be used for pre-task activities such as brainstorming, outlining and initial research. This level focuses on the effective use of AI for planning, synthesis, and ideation, but assessment should emphasise the ability to develop and refine these ideas independently.

In the rest of the grading activities, the use of AI is prohibited.

BIBLIOGRAPHY AND RESOURCES

Basic References

- Overhead Power Lines. F. Kiessling, P. Nefzger, J.F. Nolasco, U. Kaintzyk. Springer, 2003
- CIGRE Green Book on Overhead Lines. CIGRE, París 2014
- CIGRE Green Book on Compact Overhead Line Design. CIGRE, París 2024

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