COMILLAS
UNIVERSIDAD PONTIFICIA
ICAI ICADE CIHS

Syllabus
2025 - 2026

GENERAL INFORMATION

Data of the subject	
Subject name	Operation of Electric Power Systems
Subject code	DIE-MII-512
Mainprogram	Official Master´s Degree in Industrial Engineering
Involved programs	Grado en Administración y Dirección de Empresas y Máster Universitario en Ingeniería Industrial [Fifth year] Grado en Administración y Dirección de Empresas y Máster Universitario en Ingeniería Industrial [Fifth year] Máster Universitario en Ingeniería Industrial y Máster Universitario en Administración de Empresas [First year] Máster Universitario en Ingeniería Industrial + Máster in Motorsport, Mobility and Safety [First year] Máster Universitario en Ingeniería Industrial [First year] Máster Universitario en Ingeniería Industrial + Máster en Medioambiente y Transición Energética [First year] Máster Universitario en Ingeniería Industrial + Máster in Motorsport, Mobility and Safety [First year] Máster Universitario en Ingeniería Industrial + Máster in Smart Grids [First year] Máster Universitario en Ingeniería Industrial y Máster Universitario en Administración de Empresas [First year] Máster Universitario en Ingeniería Industrial y Máster Universitario en Sector Eléctrico [First year] Máster Universitario en Ingeniería Industrial y Máster Universitario en Sistemas Ferroviarios [First year] Máster Universitario en Ingeniería Industrial [First year] Máster Univ. en Ingeniería Industrial + Máster en Tecnologías Financieras: Pagos y Banca Digital [First year] Máster Universitario en Ingeniería Industrial y Máster en Industria Inteligente [First year]
Level	Postgrado Oficial Master
Quarter	Semestral
Credits	6,0 ECTS
Type	Obligatoria
Department	Department of Electrical Engineering
Coordinator	Michel Rivier Abbad
Office hours	To be checked with each teacher

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DESCRIPTION OF THE SUBJECT

Contextualization of the subject

Course contents

Contents

Chapter 1: Overview of the technical and economic operation of electric power systems.

1.1 Technical and functional description of a power system.

1.2 Introduction to the operation of power plants in a centralized and decentralized context.

1.3 Costs of the electric power system.

1.4 Generation mix. Fixed costs and variable costs. Consumption input-output curves.

1.5 Reliability and not supplied energy.

1.6 Basic generation expansion problem formulation in a centralized scheme

Chapter 2: Economic Dispatch of generation units

2.1 Single-node Economic Dispatch

2.2 System marginal cost.

2.3 Network-constrained Economic Dispatch. Loss factors and network capacity constraints.

2.4 Consideration of additional technical and environmental constraints.

Chapter 3: Unit-Commitment and hydrothermal coordination

3.1 Weekly scheduling.

3.2 Scheduling of energy-limited units.

3.3 Hydrothermal coordination in the short and in the long term.

3.4 Water value.

Chapter 4: The electricity market.

4.1 Economic theory of perfectly competitive markets.

4.2 Economic theory of oligopolistic markets.

4.3 Description of the Spanish electricity market: daily and intraday markets, ancillary services, and market of technical constraints.

4.4: The electricity tariff.

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
Final Exam	• To have acquired the minimum knowledge required to pass the course. • Application of theoretical concepts to solve practical problems. • Critical analysis and interpretation of numerical exercises' results. • Clarity of expression, layout and logical organization of written communication.	70
Quizzes and tests during class hours around weeks 8 and 12. Participation during problem-solving sessions, and guided discussions. Assignments and out-off-class activities.	• Demonstrate the concepts' understanding. • Application of the theoretical concepts to practical problem-solving. • Analysis and interpretation of the results obtained in problem-solving.	30

Grading

The grading will be set according to the following rules:

Regular examination period

- 70%: Final exam grade.
- 30%: Performance evaluation. Quizzes and tests during class hours around weeks 8 and 12 (20%), assessment of exercises and assignments (in-class and out-class), and participation (10%)

In order to pass the subject in the regular examination period, a minimum grade of 5 over 10 points will be required in the final exam.

Retakes

- 20%: Performance evaluation during the course. Quizzes and tests during class hours (15%), assessment of exercises and assignments (in-class and out-class), and participation (5%)
- 80%: Retake Final exam grade.

In order to pass the subject, a minimum grade of 5 over 10 points will be required in the retake final exam.

Class attendance is mandatory according to Article 93 of the General Regulations (Reglamento General) of Comillas Pontifical University and Article 6 of the Academic Rules (Normas Academicas) of the ICAI School of Engineering. Therefore, 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.

Students who commit an irregularity in any graded activity will receive a mark of zero in the activity and disciplinary procedure will follow (cf. Article 168 of the General Regulations (Reglamento General) of Comillas Pontifical University).

AI cannot be used in any exam or intermediate assessment test.

WORK PLAN AND SCHEDULE

Activities	Date of realization	Delivery date
Performance evaluation (quizzes and tests)	Weeks 8 and 12 (to be confirmed along the course)	
Final exam	Regular examination period	
Information search assignment	Weeks 2,3 and 4	
Market simulation, strategy games and exercises	Weeks 2, 3, and 11-14	
Review and self-study of the concepts covered in the lectures	After each lesson	
Problem-solving	Weekly	

Hand-in solved problems for correction		To be indicated
Quizzes and tests preparation	Weeks 8 and 12	
Final exam preparation	December	

BIBLIOGRAPHY AND RESOURCES

Basic References

- Allen J. Wood, Bruce F. Wollenberg, Gerald B. Sheble. Power Generation, Operation and Control, 3rd Edition. Wiley. December 2013.
- Antonio Gómez-Expósito, Antonio Conejo, Claudio Cañizares (editores). Electric Energy Systems – Analysis and Operation. CRC Press. 2009.
- Red Eléctrica de España (REE) - Spanish TSO) Web page: www.ree.es
- OMIE (Iberian Electricity Market Operator) Web page: www.omie.es
- Comisión Nacional de los Mercados y la Competencia (CNMC) - Regulator Web page: www.cnmc.es