UCLouvain

lelec2595

2026

Electrical power systems dynamics and quality of supply

5.00 credits	30.0 h + 30.0 h	Q2

Teacher(s)	De Jaeger Emmanuel ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Main themes	• Electrical power systems engineering, focusing on: • Power system transients, • Power systems faulted operation, • Power systems protection, • Power systems stability, • Power systems reliability, • Power Quality
Learning outcomes	**At the end of this learning unit, the student is able to :** **Contribution of the course to the program objectives** In view of the LO frame of reference of the "Master Electrical Engineering", this course contributes to the development, acquisition and evaluation of the following learning outcomes: • AA1.1, AA1.2, AA1.3 • AA2.1, AA2.2 • AA3.2, AA3.3 • AA5.4 • AA6.2, AA6.4 **Specific LO of the course** Specifically, at the end of the course, students will be able to: • identify, describe and analyze problematic situations regarding voltage disturbances (diagnosis, curative approach), transient behaviour and faulted operation in power systems; • apply the principles of power system protection; • prevent problematic situations at the planning or project stage of electrical grids and installations (preventive approach); • propose realistic solutions, from the technical and economic perspectives, and apply appropriate measures to improve power systems stability and solve power quality problems. To this end, they will be able to: • describe precisely, explain, model and quantify underlying physical phenomena and mechanisms; • use specialized engineering software tools; • interpret and correctly apply the standardization concepts; • analyze and interpret information from technical and scientific literature relating to issues addressed in the course.
Evaluation methods	Students will be assessed: - Based on homework carried out in groups of two during the semester; - Individually on the basis of a written or oral examination relating to the content of lectures and practice sessions To constitute the final mark, the weighting given to the homework is: - 50% if the mark of the individual exam is higher than 10/20; - 0% if the mark of the individual exam is less than 8/20; - linearly progressive between 0%, if the individual exam mark is 8/20, and 50%, if the exam mark is 10/20 The homework cannot be redone; the mark is acquired in the quadrimester and kept in the event of a second session. Note: The use of generative AI software such as chatGPT is permitted only for assistance in writing of the reports requested in this course. In this instance, however, an appendix will be required detailing, for each of the sections concerned, how the AI was used (information search, drafting and/or correction of the text, ...). Furthermore, external sources of information must be systematically cited in compliance with bibliographic referencing standards.

Teaching methods	• *Lectures* • *Practical sessions (supervised classroom exercise sessions)* *Engineering practice: supervised homework and projects in groups*
Content	Electrical energy networks currently appear to be central elements of the energy transition. They are the seat of major technological challenges resulting from developments and evolutions such as the growing electrification of some energy uses (mobility, heating systems, industrial systems...), the massive integration of renewable energy sources, electrical storage, etc. These challenges affect the planning, operation and management of these complex systems, which are at the heart of the content of this course. Detailed content: • Transient analysis of power systems • Dynamics of synchronous machines • Unbalanced operation of power systems and unsymmetrical faults analysis • Power systems protection • Power systems small-disturbance stability and large-disturbance (transient) stability • Frequency stability • Voltage stability • Power quality: basic concepts of electromagnetic compatibility, harmonics, voltage rapid fluctuations and flicker, voltage dips and interruptions, overvoltages • Reliability and quality of supply costs for a power system
Inline resources	https://moodle.uclouvain.be/course/view.php?id=739
Bibliography	• Reference textbooks *Electric Energy Systems - Analysis and Operation* (A. Gomez-Exposito, A.J. Conejo, C. Canizares) *Handbook of Electrical Power System Dynamics* (M. Eremia, M. Shahidehpour) • Copy of the slides Complementary documentation
Other infos	• This course is the logical follow-up of course LELEC2520. It is recommended to have previously completed the latter or an equivalent According to the opportunities and practical availability, the course can be completed by a technical visit and / or seminars given by experts from industry
Faculty or entity in charge	ELEC

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Electrical Engineering	ELEC2M	5		🔍
Master [120] in Electro-mechanical Engineering	ELME2M	5		🔍
Master [120] in Energy Engineering	NRGY2M	5		🔍