


Teacher(s)	De Jaeger Emmanuel ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	<ul style="list-style-type: none"> • Challenges in electrical power systems facing increasing decarbonization, decentralization and digitalization • Power systems evolution with focus on anticipating and resolving issues related to the increasing electrical power generation from renewable energy sources and the electrification of energy usages • Smart Grids
Learning outcomes	<p>At the end of this learning unit, the student is able to :</p> <p>Contribution of the course to the program objectives</p> <p>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:</p> <ul style="list-style-type: none"> - AA1.1, AA1.2, AA1.3 - AA2.1, AA2.2 - AA3.3 - AA6.1 <p>Specific LO of the course</p> <p>Specifically, at the end of the course, students will be able to:</p> <ol style="list-style-type: none"> 1 <ul style="list-style-type: none"> • Understand the technical and economic challenges for electrical power systems, anticipating and resolving issues related to the increasing electrical power generation from renewable energy sources. • Explain the characteristics and features, and models power electronic systems used in the context of the transmission and distribution of electricity, • Design and analyse micro-grids, including control, in particular incorporating various low-carbon technologies and distributed energy resources • Master specific engineering and calculation questions related to the mentioned themes <p>Transversal learning outcomes:</p> <ul style="list-style-type: none"> • Use of specialized software tools • Review published research related to smart grids • Address the question of the changing energy landscape, particularly the role of renewable energies and the new challenges linked to them (to be taken up by the various actors in the power systems)
Evaluation methods	<p><i>Students are assessed during a written and/or oral examination dealing with both theoretical concepts and the discussion of practical situations (practical industrial case study, numerical exercises).</i></p> <p><i>Half of the final grade will be awarded to the homework and projects assessment, provided that the student passes the oral exam (that is, score # 10/20). In case the student does not obtain at least 50% of the points for the exam, the final grade is equal to the grade obtained for the exam.</i></p>
Teaching methods	<ul style="list-style-type: none"> • Lectures • Seminars given by the students on the basis of scientific and technical literature • Related engineering practice based on small projects and supervised homework
Content	<ul style="list-style-type: none"> • Smart grids <p>management of the massive integration of Distributed Energy Resources in power systems, active demand and energy storage management and control, active network management, evolution of the concept of ancillary services, transmission grids: HVDC links and Flexible AC Transmission Systems, supergrids, micro-grids, modern power systems monitoring and automation smart metering</p> <ul style="list-style-type: none"> • Introduction to data analytics and artificial intelligence for power systems

	<ul style="list-style-type: none"> • Introduction to markets and regulatory schemes, including TSO-DSO coordination, taking into account significant increase in Distributed Energy Resources and their participation in various electricity markets.
Inline resources	Moodle
Bibliography	<p>Reference textbooks</p> <p><i>Electric Energy Systems - Analysis and Operation</i> (A. Gomez-Exposito, A.J. Conejo, C. Canizares)</p> <p><i>Handbook of Electrical Power System Dynamics</i> (M. Eremia, M. Shahidehpour)</p> <ul style="list-style-type: none"> • Copy of the slides <p>Complementary documentation</p>
Other infos	<ul style="list-style-type: none"> • It is recommended to have previously completed at least the course LELEC2520 or an equivalent. <p>According to the opportunities and practical availability, the course can be completed by a technical visit and / or seminars given by experts from industry</p>
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		