UCLouvain

lelec2520

2021

Electrical power systems

5.00 credits	30.0 h + 30.0 h	Q1

Teacher(s)	De Jaeger Emmanuel ;
Language :	English
Place of the course	Louvain-la-Neuve
Prerequisites	Knowledge and practical application of the theory of electrical circuits and electromechanical converters, as covered in the courses LELEC1370 and LELEC1310
Main themes	• Introduction to electric energy systems (generation, transmission, distribution, storage and end-use of electric power and their respective developments • Positioning of electricity as energy vector, electric energy systems overview and outlook, • Structure and architectures of electric power systems, • Modelling, calculation and optimization of electric power systems in steady state, • Planning and operation of electric power systems, • Introduction to economics of power systems and electricity markets, • Introduction to Smart Grids
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 - AA3.3 - AA6.1 **Specific LO of the course** 1 • Remember the main orders of magnitude and units in the field of electrical energy systems and more specifically power grids assets, • Understand the main technical features, functionalities and operating modes of public electricity transmission and distribution networks as well as industrial electricity distribution networks, • Understand technological specificities and apply relevant theoretical principles to model the main components of power systems (power transformers, lines, cables, sources, loads, FACTS) and solve general problems of load-flow calculation, • Use the previous competences in order to investigate and analyse practical situations, and solve technical problems regarding planning and operation of power systems in steady-state (including voltage control, frequency and power control, grid optimal and secure operation) • Understand the main principles of electric power systems economics
Evaluation methods	*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).* *One quarter of the final grade will be awarded to the project 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.*
Teaching methods	• *Lectures* • *Practical sessions (supervised exercise sessions).* • *Project to be carried out by groups of two students, based on the use of dedicated software for power systems design and analysis (This project is evaluated and taken into account in the final evaluation grade.)* *Technical visit (e.g. training centre ELIA, Belgian transmission high voltage grid operator, and the national dispatching.)*
Content	• Electricity as energy carrier, architecture and constitution of power systems, • Power systems physical concepts and modelling: transmission and distribution links (power transformers, lines, cables), generators and sources (synchronous machines, renewable energy conversion systems), power electronics devices used for grid control and operation (HVDC links, Flexible AC Transmission Systems),

	• Load-Flow calculation, • Electrical power systems planning concepts, • Optimal and secure operation of power systems (Optimal Power Flow, units commitment and economic dispatch problems, contingency analysis), • Frequency and power control, • Voltage control, • State-estimation, • Balanced faulty operation (short circuit), basic introduction to power grids protections.
Inline resources	Moodle
Bibliography	• Reference textbook: *Electric Energy Systems - Analysis and Operation* (A. Gomez-Exposito, A.J. Conejo, C. Canizares) • Copy of the slides • Complementary documentation
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		🔍