Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

Syllabus
Course description

Course title	Smart Grids
Course code	45550
Scientific sector	ING-IND/33 "Electrical Power Systems"
Degree	Master Energy Engineering
Semester	2
Year	*OPT*
Academic year	2025/2026
Credits	6
Modular	No

Total lecturing hours	60
Total lab and exercise hours	0
Attendance	Not mandatory but recommended
Recommended preliminary knowledge	Students attending this course should already be familiar with the topics dealt in previous bachelor's and master's degree level courses, such as Physics II, Electrotechnics and Electrical Systems Engineering.
Connections with other courses	The Smart Grids Course is strictly related to the Electrical Systems Engineering course
Course page	https://www.unibz.it/en/faculties/engineering/master-energy-engineering/

Specific educational objectives	The course and develops mainly the subjects of the operation and regulation of the national grid high voltage. After outlining the international framework of regulatory boards (CEN, CENELEC, ETSI, IEC, UCTE, etc ...), it introduces the equations of three-phase lines with the propagation constant and the characteristic impedance. It will explain then technological innovation on electric transmission and distribution, as well as the control system in real time. It will be explained the mechanisms to control voltage and frequency according to the request of reactive and active power. It will also expose the criteria for the protection of the transmission lines and moreover the problem of power quality and the characteristics of the free market.

Lecturer	Prof. Vincenzo Trovato
Scientific sector of the lecturer	ING-IND/33
Teaching language	Italian
Office hours	On appointment

Teaching assistant *(if any)*	-
Office hours	-
List of topics covered	The course will cover the following topics: 1. Energy situation 2. Electrical circuit representation of transmission networks 3. Sinusoidal transmission lines 4. Management of networks and interconnection 5. Voltage control 6. Frequency control 7. Stability of the network 8. Overvoltage of internal origin and protection networks 9. Power quality 10. Free market energy
Professional applications of the covered topics	The training of students allows them to find professional applications in: • public and private companies that manage electricity distribution and transmission networks. • industries that produce electrical equipment for medium voltage and high voltage. • engineering companies for consulting and design in the field of electrical energy power plants
Teaching format	Frontal lectures and seminars.

Learning outcomes	At the end of the course, students will have the following skills: 1. Knowledge and understanding: understand the operation and design MV and HV AC power supply lines. 2. Applying knowledge and understanding: being able to participate in the management of an electrical transmission network for controlling the frequency and voltage of the network; 3. Making judgements: knowing how to judge, identify and resolve anomalies and failure conditions of the electricity transmission grids; 4. Communication skills: interact with other operators and technicians to operate in the free energy market 5. Ability to learn: learn and develop new high voltage line protection systems.
Assessment	The evaluation of students' training will take place with an oral test as summative assessment, during which the degree of learning (ILO 1) and the ability to manage a transmission network (ILOs 2 and 3) will be assessed, together with their communication skills (ILO 4).
Assessment language	Italian

Evaluation criteria and criteria for awarding marks	The preparation of the students will be assessed based on the degree of: • technical preparation of the topics covered; • learning of the operating and management methods of the electricity distribution and transmission networks; • ability to evaluate fault conditions and recovery methods.

Required readings	PowerPoint presentations will be available in the course reserve collection database.
Supplementary readings	• M. Fauri, F. Gnesotto, G. Marchesi, A. Maschio, Lezioni di Elettrotecnica (vol. 2 Applicazioni Elettriche), Esculapio Editore, Bologna, 2002 • L. Fellin, R. Benato, Impianti elettrici, Utet Scienze Tecniche • A. Paolucci, Trasmissione dell'energia elettrica, Padova • F. M. Gatta, Impianti elettrici, Esculapio Editore, Bologna, 2018 Additional material will be provided by the Professor.