

# Syllabus

## *Course Description*

<b>Course Title</b>	Electrical Systems Engineering
<b>Course Code</b>	45500
<b>Course Title Additional</b>	
<b>Scientific-Disciplinary Sector</b>	IIND-08/B
<b>Language</b>	English
<b>Degree Course</b>	Master in Energy Engineering
<b>Other Degree Courses (Loaned)</b>	
<b>Lecturers</b>	Dr. Vincenzo Trovato, Vincenzo.Trovato@unibz.it <a href="https://www.unibz.it/en/faculties/engineering/academic-staff/person/46153">https://www.unibz.it/en/faculties/engineering/academic-staff/person/46153</a>
<b>Teaching Assistant</b>	
<b>Semester</b>	First semester
<b>Course Year/s</b>	1
<b>CP</b>	6
<b>Teaching Hours</b>	60
<b>Lab Hours</b>	2
<b>Individual Study Hours</b>	88
<b>Planned Office Hours</b>	
<b>Contents Summary</b>	<p>Initially the course refers to elements of general electrotechnics. Then the symbolic notation is introduced for the study of sinusoidal networks: complex operators; behaviour of the bipoles in sinusoidal and three-phase systems.</p> <p>The emphasis is put on electrical installations (structure of the Italian electricity system; structure of electrical networks; generation, transmission, distribution and final use of electricity). Furthermore, the criteria for the design of DC power lines is examined (cantilevered power lines; sizing of lines with constant section or constant current density).</p> <p>The main constructive characteristics of single-phase and three-</p>

	<p>phase transformers are also examined (magnetic cores and electric coils; real transformer; losses due to the Joule effect and iron losses due to hysteresis and eddy currents).</p> <p>The theory of symmetrical components for the understanding and analysis of non-symmetrical three-phase electrical faults is addressed.</p> <p>Finally, the effects of electricity on the human body are examined, the components of a grounding system and protection against indirect electrical contacts.</p>
<b>Course Topics</b>	<ol style="list-style-type: none"> <li>1. Definitions and generality</li> <li>2. Sinusoidal quantities</li> <li>3. Three-phase systems</li> <li>4. Networks structure</li> <li>5. Sizing of continuous and alternating power lines</li> <li>6. Transformers</li> <li>7. Non-symmetrical electrical networks</li> <li>8. Fault analysis</li> <li>9. Electrical safety</li> </ol>
<b>Keywords</b>	Three-phase systems; Continuous and alternating power lines; Transformers; Fault analysis; Electrical safety
<b>Recommended Prerequisites</b>	Mathematical analysis, Physics 2, Electrotechnics.
<b>Propaedeutic Courses</b>	
<b>Teaching Format</b>	Class lectures.
<b>Mandatory Attendance</b>	Not mandatory.
<b>Specific Educational Objectives and Learning Outcomes</b>	<ul style="list-style-type: none"> <li>• Obtain working knowledge in electrical systems</li> <li>• Understand the current and future electricity scenarios</li> <li>• Learn how to make comparisons among different technologies and solutions based on multiple aspects</li> <li>• Master the main theoretical background in power systems design</li> </ul> <p>The learning outcomes need to refer to the Dublin Descriptors:</p> <p>Knowledge and understanding</p> <ol style="list-style-type: none"> <li>1. Knowledge of the basics related to the transmission and distribution of electricity and the main criteria to design electric lines, basics on transformers, line faults and electric safety.</li> </ol>

	<p>Applying knowledge and understanding</p> <p>2. Students will be able to approach the design of direct current and alternating current lines, with a basic understanding on how to select the proper circuit protection. Recognize the different voltage level associated with electricity transmission and evaluate the main issues related to the distribution of electricity. A basic knowledge of CEI regulations is also provided.</p> <p>Making judgements</p> <p>3. Students will be able to interpret design choices on existing systems, and to identify and investigate critical aspects related with them.</p> <p>Communication skills</p> <p>4. Students will learn the main technical terms related to the topic.</p> <p>Ability to learn</p> <p>5. The variety of topics of the course allow the students to have basic knowledge of many subjects, giving them the opportunity to easily deepen specific topics.</p>
<b>Specific Educational Objectives and Learning Outcomes (additional info.)</b>	
<b>Assessment</b>	- Summative assessment: 100% oral examination with two or three questions: about ½ hour; ILOs assessed: all.
<b>Evaluation Criteria</b>	A single final mark will be calculated averaging the marks of two/three questions. All marks must be at least 18. Evaluation based on knowledge of the subject and ability to do connections between the various course topics.
<b>Required Readings</b>	Lessons and slides of the course.
<b>Supplementary Readings</b>	<p><b>Italian books</b></p> <ul style="list-style-type: none"> <li>· R. Benato, L. Fellin – Impianti Elettrici – Wolters Kluwer (2014)</li> <li>· N. Falettim P. Chizzolini – Trasmissione e Distribuzione dell’Energia Elettrica Vol. I e II – Patron Editore (2004)</li> </ul>

	<ul style="list-style-type: none"> <li>· G. Conte – Manuale di Impianti Elettrici – biblioteca tecnica Hoepli (2014)</li> <li>· M. Fauri – Fondamenti di Elettrotecnica – Esculapio (2020)</li> <li>· V. Cataliotti – Impianti Elettrici – Dario Flaccovio Editore (2004)</li> <li>· V. Carrescia – Fondamenti di Sicurezza Elettrica – TNE (2008)</li> </ul> <p><b>English books</b></p> <ul style="list-style-type: none"> <li>· R. Dorf, J. Svoboda – Introduction to electric circuits – Wiley (2018)</li> <li>· W. Grainger, J. Stevenson – Power System Analysis – McGraw-Hill (1994)</li> </ul> <p>J. Glover, T. Overbye, M. Sarma – Power System Analysis and Design – Cengage Learning (2016)</p>
<p><b>Further Information</b></p>	<p>Connections with other courses:</p> <ul style="list-style-type: none"> <li>• Hydropower and wind power Systems: on hydro and wind power generation and their role in modern low-carbon power systems</li> <li>• Electrochemical energy storage and conversion: on the role of energy storage in power residential and bulk power systems</li> <li>• Smart Grids: the continuation of the topics presented in the Electrical Systems Engineering</li> </ul> <p>Professional applications of the covered topics:</p> <p>An Energy Engineer with solid knowledge in power system could join companies such as:</p> <ul style="list-style-type: none"> <li>• Enel, Terna, Eni, Edison etc. to carry out technoeconomic analysis of power systems focusing on different sectors of the electricity systems.</li> <li>• Arera, ACER, Enel etc. to carry out activities in the context of energy policy</li> <li>• RSE, EURAC etc. to carry out techno-scientific research activities in the wide context of smart grids</li> <li>• Several consultancy firms which are being expanding their energy practices</li> <li>• Power system professional design offices to design the specifications of MV/LV power systems for domestic and industrial</li> </ul>

	applications • Any university to continue education path with a PhD focused on smart grids etc.
<b>Sustainable Development Goals (SDGs)</b>	Affordable and clean energy, Climate action, Sustainable cities and communities