### Syllabus

#### Course title
Electrical Systems Engineering

#### Course code
45500

#### Scientific sector
ING-IND/33

#### Degree
Master Energy Engineering

#### Semester
1st

#### Year
1st

#### Academic year
2017-2018

#### Credits
6

#### Modular

<table>
<thead>
<tr>
<th>Total lecturing hours</th>
<th>60</th>
</tr>
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<tbody>
<tr>
<td>Total lab hours</td>
<td>0</td>
</tr>
<tr>
<td>Total exercise hours</td>
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#### Attendance
Not mandatory

#### Prerequisites
Students attending this course should have already passed the exam of Physics II and Electrotechnics

#### Course page

#### Specific educational objectives
The course will cover the following topics:
1. Structure of electrical networks
2. DC and AC electrical power lines;
3. Transformers
4. Non-symmetrical networks
5. Grid failure
6. Electrical safety
7. LV distribution systems

#### Module 1

<table>
<thead>
<tr>
<th>Lecturer</th>
<th>Maurizio Fauri</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific sector of the lecturer</td>
<td>ING-IND/33</td>
</tr>
<tr>
<td>Teaching language</td>
<td>English</td>
</tr>
<tr>
<td>Office hours</td>
<td>Appointment by email</td>
</tr>
<tr>
<td>Teaching assistant (if any)</td>
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#### List of topics covered
(1) Electrotechnic and Electromagnetism:
- definition of resistor, capacitor, inductor;
- characteristic equation of ports;
- Rms value of a sinusoidal magnitude;
- behaviour of dipoles in sinusoidal condition.
- magnetic properties of materials;
- magnetic circuits.
(2) Sinusoidal networks:
- symbolic notation;
- complex operators;
- behaviour of dipoles in sinusoidal condition and three-phase systems.

(3) Electrical installations:
- structure of the Italian electricity system;
- structure of power networks;
- generation;
- transmission;
- distribution;
- final use of electrical energy.

(4) Criteria to design power lines:
- designing criteria;
- DC and AC cantilever lines;
- dimensioning in constant section or at direct current density.

(5) Transformers:
- main construction characteristics of single and three-phase transformers;
- magnetic cores and electrical coils;
- real transformer;
- losses due to the Joule effect and iron losses due to hysteresis and eddy currents.

(6) Transient and sequence analysis:
- short circuit faults;
- not symmetrical three phase system;
- single and multi-phase electrical faults;
- open circuit faults;
- overcurrent protection system.

(7) Effects of electricity on the human body:
- components of a grounded system;
- LV distribution systems;
- protection from indirect electrical contacts.

Teaching format
Frontal lectures.
Class lectures (blackboard and slides).
Some of the lecture material (slides) will be available for download by the students.

Learning outcomes
The learning outcomes need to refer to the Dublin Descriptors.

Knowledge and understanding
1. Knowledge of sinusoidal and three-phase network; design an electrical DC and AC power lines; identify
### Applying knowledge and understanding

2. Capability of defining the requirements for design an electrical DC and AC power lines, calculate faults conditions and design the protection systems. Furthermore, students will be able to understand the effects of electricity on the human body and technical solutions to realize safety operating condition.

### Making judgements

3. The student will be able to assess the quality of existing electrical power network, identify critical aspects and suggest redesign solutions in case of short circuit faults.

### Communication skills

4. The student will be able to discuss the learned knowledge with vocabulary and technical terms of the discipline, describing efficiently the outcome of the design activity and the features of different technical solutions.

### Ability to learn

5. Lifelong learning capability through the acquisition of critical tools and critical evaluation of electrical power network and electrical device specifications.

### Assessment

Oral examination with questions aimed at verifying the knowledge and the capability to understand the topics of the course and the mastery of the technical language. The capability to transfer these competences to applicative cases and the developed autonomy of judgment will be evaluated.

### Assessment language

English

### Evaluation criteria and criteria for awarding marks

Students will be evaluated on the basis of their preparation about course lessons. A single final vote will take into account of knowledge of the topics presented during the course, ability to synthesize information, correctness of the technical terms and clarity (50 %). With reference to the capability to analyse the proposed problem and to formulate a technically advantageous solution will be taken into account (50 %).

### Required readings

Lessons and slides of the course
## Supplementary readings

### Books
- L. Fellin, R. Benato, *Impianti elettrici*, Utet Scienze Tecniche

### Documents
- Power Point presentations will be available in the course reserve collection database of the Faculty.
- Additional material will be provided by the Professor.