



## INTRODUCTION TO POWER SYSTEMS AND ELECTRICAL MACHINES

Enrollment year	2017/2018
Academic year	2017/2018
Regulations	DM270
Academic discipline	
Department	DEPARTMENT OF ELECTRICAL, COMPUTER AND BIOMEDICAL ENGINEERING
Course	INDUSTRIAL ENGINEERING
Curriculum	PERCORSO COMUNE
Year of study	1°
Period	2nd semester (05/03/2018 - 15/06/2018)
ECTS	12
Lesson hours	104 lesson hours
Language	Italian
Activity type	WRITTEN AND ORAL TEST
Teacher	BENZI FRANCESCO (titolare) - 6 ECTS MONTAGNA MARIO - 6 ECTS
Prerequisites	Basics of Electrotechnics and Circuit Theory.
Learning outcomes	<p>The course is intended to provide the basic elements of electrical systems, transformer and machines in industry and power systems. As for electrical systems the course will teach basic techniques for the analysis and design of electrical distribution and user systems, and in particular: lines sizing (both overhead lines and cables) at medium and low voltage; Protection against overload and short circuit.</p> <p>As for the electrical machines an introduction to thermal features and service types according to international regulation is provided. Role and use of transformers and industrial electric motors. For both the student will learn elementary knowledge of their principles of operation and their sizing with respect to given electrical or mechanical loads.</p>



- Medium and low voltage distribution systems; network structure; electrical calculation of lines; approximate formulas of voltage drop for short lines; project and verification calculations according to the maximum voltage drop criterion.
- Thermal phenomena in electrical lines; heat transfer equations; current flow rate of overhead lines; Conduction capacity of cables; line sizing according to the thermal criterion; classification and structure of electric cables; low-voltage cables in air-laying or in underground installation according to CEI-UNEL standards; overload and short circuit behaviour.
- Switching apparatuses; characteristics of switches, disconnectors and contactors, circuit breakers and differential switches.
- Low-voltage circuit protection; overcurrent protection; thermal relay; magnetic relay; magnetothermal protection; fuses. Protection against overloads and short circuits.
- Electrical machines for industrial applications. Role and characteristics of electrical machines in industry and power systems. Materials, losses in the materials, thermal problems. Service types and rated value definition.
- Power transformers. Transformer operating principle. Ideal and real transformer. Three-phase transformers. Transformer equivalent circuit. Transformer efficiency.
- The asynchronous machine. The rotating magnetic field. Induction machine operating principle. Engine operation. Equivalent circuit of the asynchronous machine. Torque and current characteristics. Starting techniques. Single-phase asynchronous machine.
- Speed control. Operation at variable frequency. Speed and torque regulation.



Two thirds of the course are taught as lectures; one third is about numerical modelling and exercise.

**Reccomended or required  
readings**

The lectures notes are made available to the students through the Kiro platform. Also a number of numerical resolved exercise are available.

G. P. Granelli. Dispense di Impianti Elettrici.

G.P. Granelli, M. Montagna. Fondamenti di Impianti Elettrici vol. I. Cisalpino - Istituto Editoriale Universitario.

Comitato Elettrotecnico Italiano. Norme CEI 64-8 e CEI-UNEL.





The exam is written, and consists of a reasoned numerical resolution of one or more problems. It is possible to have an oral integration at the student's request.



