

Electrical Engineering Field		Actuators, Control, and Power	Total of teaching hours : 92 hrs		
			Course	Supervised work	Lab work
GE I3.6	3 ECTS credits		24 hrs		24 hrs
			4 hrs evaluation - 4 hrs individual work 24 hrs + 12 hrs Workshop project		

<p>Objectives</p> <ul style="list-style-type: none"> • Explain the operation of the electromechanical energy converters • Characterise and implement electrical machinery • Explain the operation of the main static converters • Choose the electric motors and their control devices best suited to the applications given <p>(taxonomic level : application and analysis)</p>
<p>Pre-requisites</p> <ul style="list-style-type: none"> ◦ Electromagnetic induction and applications ◦ Mathematical tools (Fourier, Laplace series, differential equations, ...) <p>Links to other modules GE 13-5 Electronic components</p>

Part 1 : Electrical Engineering and Power Electronics

Chapter 1 Foundations	<ul style="list-style-type: none"> ◦ Sources ◦ Power Components ◦ Basic structure of static converters ◦ The four operating quadrants ◦ Speed variators
Chapter 2 Three-phase electrical networks	<ul style="list-style-type: none"> ◦ Three-phase production and distribution ◦ Three-phase transformers ◦ Adjustment and safety: main rules
Chapter 3 DC motor and its power supply	<ul style="list-style-type: none"> ◦ Operating principle ◦ Operation with variable speed ◦ Three phase rectifiers not-controlled and controlled ◦ Choppers
Chapter 4 Three-phase asynchronous motor and its power supply	<ul style="list-style-type: none"> ◦ Operation principle ◦ Operation with variable speed ◦ Inverters
Chapter 5 Synchronous motors	<ul style="list-style-type: none"> ◦ Synchronous motors: torque, V-curves ◦ Autopiloted motor ◦ Brushless motors
Chapter 6 Electromagnetic compatibility	<ul style="list-style-type: none"> ◦ Causes, remedies, regulations
Lab work	<p>For example :</p> <ul style="list-style-type: none"> • Three-phase transformer • DC motor permanently powered • Three-phase asynchronous powered and with constant frequency • Synchronous motor: synchronisation, control of the power factor • Variation in the speed of a DC motor by controlled rectifier or by chopper • Variation in speed of an A/C motor by voltage inverter

Part 2 : Sequential Design

Course	<p>Methodological approach to design</p> <ul style="list-style-type: none"> - Methodology of sequential design management. - Study of task synchronisations. - Optimisation of the 'Cycle Time'. - Control and its environment. <p>Programming techniques</p> <p>Universal method of programming of Sequential Designs : digital method.</p>
Lab work	<p>3 TP</p> <p>Industrial case study ; Implementation on API ; Simulation, validation of the solution</p>



Educational approaches and assessment methods

Evaluation of course. Personal evaluation of Lab work.

Bibliography

- A. Fouille. Electrotechnique à l'usage des ingénieurs, tomes 1 et 2. Paris: Dunod, 1996
- T. Wildi. Electrotechnique. 4th ed. Paris : De Boeck University, 2005
- G. Séguier, F. Notelet. Electrotechnique industrielle. 3rd ed. Paris : Tec&Doc Lavoisier, 2006
- G. Séguier, R. Bausière, F. Labrique. Les convertisseurs de puissance, tome 1 à 4. Paris : Tec&Doc
- M. Rashid, T. Swanston. Power Electronics, 3e ed. London : Prentice Hall International, 2003