Course Syllabus

1. Course number and name: **020ELIES2 – Industrial electronics**

2. Credits and contact hours: **3 credits, 45 contact hours + 18 lab hours**

3. Instructor's or course coordinator's name: **Flavia KHATOUNIAN**

4. Text book
    a. Hervé LABORNE, "Convertisseurs assistés par un réseau alternatif", Tome 1, Editions Eyrolles, 1992.
    b. Hervé LABORNE, "Convertisseurs assistés par un réseau alternatif", Tome 2, Editions Eyrolles, 1992.
    c. other supplemental materials: PowerPoint presentation, Mini-project instructions, Lab experiments instructions

5. Specific course information
    a. brief description of the content of the course (catalog description)
    This course introduces students to the expanding field of power electronics in the domain of industrial applications. It is articulated around three main topics: first, the characteristics of power semiconductor devices (ideal vs practical), which are used as switches to perform the power conversions from ac-dc, dc-dc, dc-ac and ac-ac, then an in-depth study of the operation, analysis, and design of single-phase and three-phase thyristor-based power rectifiers. This main part is validated by workshops using Matlab/Simulink, as well as a set of lab experiments. Finally, an application related to variable speed systems, and based on power-rectifiers is developed.

    b. prerequisites or co-requisites: **None**

    c. Required/Elective/Selected Elective: **Required**

6. Specific goals for the course
    a. specific outcomes of instruction

- Classify power semiconductor devices based on their static and dynamic switching characteristics.
- Explain the switch mode in a group of semiconductor devices and calculate snubber circuits to protect a thyristor from a large *di/dt* during turn-on and a large *dv/dt* during turn off.
- Describe and analyze the operation of single-phase and three-phase thyristor-based power rectifiers.
- Design a simple system based on power conversion from ac-dc.
- Use Matlab and Matlab/Simulink to simulate the studied thyristor-based power rectifiers.

b. KPIs addressed by the course

KPI	**a1**	**a2**	**b1**	**b2**	**b3**	**c1**	**c2**	**k3**
Covered	x	x	x	x	x	x	x	x
Assessed	x	x		x	x			
Give Feedback								

7. Brief list of topics to be covered and approximate lecture hours:

- Course introduction (2.5 hours)
- Characteristics of ideal versus practical power switches (1.25 hours)
- The power diode (1.25 hours)
- Thyristors (1.25 hours)
- Thyristors natural and forced commutation techniques (2.5 hours)
- Fully-controlled power switches: power bipolar transistors, GTO, MOSFET, IGBT (2.5 hours)
- Switch mode and snubber circuits (6.25 hours)
- Single-phase thyristor-based power rectifiers (6.25 hours)
- Three-phase thyristor-based power rectifiers (8.75 hours)
- Power factor improvement: Mixed topologies (6.25 hours)
- Case study: Design of a simple system based on power conversion from ac-dc (6.25 hours)
- Workshops using Matlab/Simulink (9 lab hours)
- Laboratory experimental validation of the main rectifiers topologies (9 lab hours)