Sensors and Instrumentation

1. **Course number and name:** 020CEIES3 – Sensors and Instrumentation

2. **Credits and contact hours:** 4 ECTS credits, (2 lectures per week) x 1:15 contact hours

3. **Instructor's or course coordinator's name:** Elie AOUAD

4. **Instructional materials:**
   a. **Textbooks:** Georges ASCH et collaborateurs, *Les Capteurs en Instrumentation Industrielle*, 5ème édition, Dunod, 1999

   b. **Other supplemental materials:** Notes, exercises, Lab assignments

5. **Specific course information**
   a. **Catalog description:**
   A sensor is, by definition, a system that converts a signal that is generally non-electric in nature (temperature, luminous flux, velocity, position, displacement, force, weight, torque, etc.) into an electrical signal that is easily processed. Sensors are generally used in monitoring, measurement or control systems. The course begins with a general review of the main characteristics of a sensor (sensitivity, time response delay, measurement errors). Then, several types of sensors, such as optical sensors, temperature sensors, tachometric sensors, position and displacement sensors, and force, weight and torque sensors, are described and studied individually in detail.

   b. **prerequisites or co-requisites:** 020ELNES2 – Digital Electronics

   c. **Required** for EE students.

6. **Educational objectives for the course**
   a. **Specific outcomes of instruction:**
   The students will be able to:
   - ✓ Select and use a sensor according to its features and the considered application
   - ✓ Analyze, design and implement analog or digital measurement systems consisting of analog or discrete electronic components, specific electronic circuits, and measuring instruments.

   b. **PI addressed by the course:**

PI	1.1	1.2	1.3	6.1	6.2	6.3	6.4
Covered	x	x	x	x	x	x	x
Assessed	x	x	x	x	x	x	x

7. Brief list of topics to be covered:

- ✓ Introduction to sensors, measurement process, conditioning circuits, signal processing circuits (6.25 hours)
- ✓ Sensors general characteristics: measurement errors, sensitivity, time delay (2.5 hours)
- ✓ Exercices (2.5 hours)
- ✓ Optical sensors: photoelectric effect, photoconductivity, photodiode, phototransistor (2.5 hours)
- ✓ Temperature sensors: resistive sensors, temperature sensing using diodes or paired transistors, thermocouple (3.75 hours)
- ✓ Tachometers: electromagnetic tachometers, optical tachometers (2.5 hours)
- ✓ Position and displacement sensors: resistive, inductive and capacitive sensors, digital sensors, optical sensors (6.75 hours)
- ✓ Force, weight and torque sensors: piezoelectric sensors, magnetic sensors (5 hours)
- ✓ Lab demonstrations and assignments (3.75 hours)