Internet of Things Technologies

1. **Course number and name:** 020IDOES5/020ITTES5 Internet of Things Technologies

2. **Credits and contact hours:** 4 ECTS credits, 2x1:15 contact hours

3. **Name of course coordinator:** Melhem El Helou

4. **Instructional materials:** Course handouts and tutorials, lab experiments, standards and white papers

5. **Specific course information**
   a. **Catalog description:**
      IoT reference model – End-to-end IoT chain – Constraints and challenges of connected devices – Hardware architecture of connected devices – Wireless LAN (IEEE 802.11, IEEE 802.15.4, BLE, ZigBee) – Low power long range networks (LoRa, Sigfox, NB-IoT) – Application layer (MQTT, XMPP, COAP) – IoT network design – hands-on and deployment of end-to-end IoT chain

   b. **Prerequisites:** 020INRES1/020IDNES1 Introduction to Data Networks

   c. **Selected Elective** for CCE students

6. **Specific goals for the course**
   a. **Specific outcomes of instruction:**
      Analyze the constraints of connected objects in terms of energy, computation capability, transmission, and security.
      Compare medium access control protocols in IoT.
      Design IoT networks.
      Design and deploy a real prototype of an end-to-end IoT chain.
      Analyze and compare the performance of an IoT network using a simulation tool.

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

PI	1.1	1.2	1.3	2.1	2.2	2.3	2.5	3.2	4.2	5.1	6.1	6.2	6.3	6.4	7.1
Covered	x	x	x	x	x	x	x		x		x	x			
Assessed	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

7. **Topics and approximate lecture hours:**
   – Introduction to the Internet of Things (1 lecture)
   – Hardware architecture of connected objects (1 lecture)
   – Challenges of connected objects (energy, security, computation capability, transmission interface) (1 lecture)
   – Wireless LAN (IEEE 802.11, IEEE 802.15.4, BLE, ZigBee) (3 lectures)
   – Low power long range networks LPWAN (LoRa, Sigfox, NB-IoT) (6 lectures)

- Activity on LoRa performance evaluation (1 lecture)
- Group activity on LoRaWAN performance evaluation (2 lectures)
- Application layer (MQTT, XMPP, COAP) (1 lecture)
- IoT network design: coverage planning and capacity planning (2 lectures)
- Design and deployment of end-to-end IoT chain (3 lectures)
- Performance evaluation of the deployed network (3 lectures)