Digital Electronics

1. **Course number and name:** 020ELNES2/020DELES2 Digital Electronics

2. **Credits and contact hours:** 6 ECTS credits, (2 lectures per week) x 1:15 + (1 lab project session per week) x 1:15 contact hours.

3. **Name of course coordinator:** Rayan Mina

4. **Instructional materials:** Instructor's PowerPoint slides

5. **Specific course information**
   a. **Catalog description:**
   Introduction to digital integrated circuit technology. Digital integrated circuits using MOS transistors, CMOS characteristics, fundamental building blocks, transistor level design of CMOS logic gates circuits, interfacing digital integrated circuits. Data converters basics: sampling, quantification, coding, analog switches, Overview of Analog to digital converter (ADC) and Digital to analog converter (DAC) circuits (Resistive Weights, R/2R, SAR, Flash). Introduction to Memory Devices: terminology, architecture, ROM, SRAM, DRAM, Memory assembly.

   b. **Prerequisites:** 020ELAES1/020AELES1 Analog Electronics

   c. **Required** for CCE and EE students

6. **Educational objectives for the course**
   a. **Specific outcomes of instruction:**
      – Identify the fundamental characteristics of CMOS digital logic ICs logic.
      – Analyze and design all types of CMOS gate circuits and logic functions.
      – Identify and analyze the transfer function (I/O signals) of different types of ADC and DAC converters at both Circuit and System levels.
      – Identify the role, functionality, and types of memory circuits.
      – Analyze and implement a memory circuit and assemble several memory chips
      – Design and realize an electronic circuit that meet a set of desired needs and perform specific functions (Project)

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

PI	1.3	2.1	2.2	2.4	3.1	3.2	5.1	5.2	6.1	6.2	6.3	6.4
Covered	x	x	x	x	x	x	x	x	x	x	x	x
Assessed		x	x	x					x	x	x	x

7. **Brief list of topics to be covered:**
   – Models and equations of MOS Transistors in Triode/cut-off regions
   – Introduction to digital integrated circuit technology

- Design of Logic gates using NMOS and PMOS transistors
- Interfacing digital integrated circuits
- Analog systems vs digital systems
- Analog switches: functionality, equivalent models, configuration, circuit-level design, applications
- Digital to analog converter
- Analog to digital converter
- Introduction to Computer Architecture
- Memory circuits: bloc diagram, I/O ports, types
- ROM Memory circuits
- RAM Memory circuits