Analog Electronics

1. **Course number and name:** 020ELAES1 Analog Electronics

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

3. **Name(s) of instructor(s) or course coordinator(s):** Rayan MINA

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

5. **Specific course information**
   a. **Catalog description:**
      This course covers the main low-power electronic components: 1) P-type and N-type semiconductors – P-N junction; 2) diodes: characteristics and application circuits (clipping, rectification…), Zener diode (regulation), Light-emitting diode. 3) Bipolar transistor: DC operation (I-V characteristics, Biasing, Load line), AC operation (amplifier circuits), synthesis of amplifier circuits, Bipolar transistor as switches. 4) MOSFET transistors: I-V characteristics, resistive operation and amplification. 5) Operational amplifier (OA): behavioral model and imperfections, application circuits (Inverting/Non-inverting amplifiers, Integrators, Voltage Follower, Active filters). 6) Comparator: characteristics, performance & limitations, applications.

   b. **Prerequisites** 020SRLNI4 Linear Electrical Systems and Networks or 020SRLCI4 Linear Electrical Systems and Networks

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

6. **Educational objectives for the course**
   a. **Specific outcomes of instruction:**
      - Model and analyze the behavior of basic electronic components: diodes, BJT transistors, and MOSFET transistors.
      - Evaluate the performances and limitations of electronic components.
      - Identify the most common diode-based circuit applications.
      - Design, simulate on Proteus and perform electrical calculations on the performance of single-stage and multiple-stage transistor-based amplifier circuits.
      - Extract relevant parameters from data sheets of electronic components.
      - Design and analyze operational amplifier circuits to perform target functions in several applications: programmable amplification, Filtering, Analog comparison.

b. PI addressed by the course:

PI	1.3	2.2	2.3	6.1	6.2	6.3	6.4
Covered	x	x	x	x	x	x	x
Assessed				x	x		

7. Brief list of topics to be covered:

- Identify Semiconductors and doping, P-N junction, Biasing of a PN junction. Recognize and identify Diodes: Definition, I-V characteristics, linear model and parameters.
- Applications of diodes: Analyze and design rectifier circuits, Clipper.
- Recognize Zener diode and design regulation circuits.
- Evaluate and design regulated power supply.
    - ✓ Lab1: Diodes DC operation measurement and I-V characteristics
- Identify bipolar junction transistor: analyze DC operation and quiescent point.
- Analyze and recognize different biasing circuits.
    - ✓ Lab2: Diode application circuits (Rectifiers, voltage regulators), Bipolar transistor DC operation
- Bipolar transistor: analyze AC operation and identify small-signal equivalent model.
- Evaluate, analyze and design BJT One-stage amplifiers: CE and CC
- Evaluate, analyze and design BJT Multi-stage amplifiers.
    - ✓ Lab3: Design of BJT amplifier circuits (CE) and measurement
    - ✓ Lab4: Simulation and Design of diode circuits and BJT amplifiers in Proteus
- Identify MOSFET transistors: analyze and evaluate DC and AC operation, equivalent models.
- Design FET one-stage amplifiers
- Analyze Operational Amplifier: Basics, theory, models, and operation.
- Application circuits: Design Inverting/Non-inverting amplifiers, integrator amplifier, active filters
    - ✓ Lab5: Operational amplifier basic circuits and integrator measurement
- Evaluate Operational Amplifier Imperfections
    - ✓ Lab6: Operational amplifier base Active filters measurement
- Design and analyze Analog Comparators and applications.