Content

Course Code	Course Name	Semester	Theory	Practice	Lab	Credit	ECTS
ING229-A	Analogical Electronics	3	3	0	2	4	5

Prerequisites	
Admission Requirements	

Language of Instruction	French
Course Type	Compulsory
Course Level	Bachelor Degree
Objective	The primary objective of this course is to provide students with a comprehensive engineering vision that extends from basic circuit theory to the physics of semiconductor devices and the design of modern analog electronic systems. Starting with the analysis of the behavior of circuits composed of passive elements (resistors, capacitors, inductors) in the time and frequency domains (transient regimes, sinusoidal analysis, filters), the course aims for an in-depth understanding of the operating principles of active semiconductor components such as diodes, transistors, and operational amplifiers (Op-Amps). The goal is for students to achieve the competence to model, analyze, and design rectifier, amplifier, active/passive filter, and regulator circuits with a mathematical approach in order to process real-world continuous (analog) signals.

Content	1. Review: Electric Circuits: Direct Current (DC) Circuits • Current, current density, and resistance (Ohm's Law) • Electromotive force (emf) and voltage • Kirchhoff's Laws (Junction and Loop rules) • Thevenin and Norton theorems 2. Transient Response • First and second-order circuits (RC, RL, and RLC) • Charge/discharge curves and time constant concept • Step and pulse responses of circuits 3. Alternating Current and Sinusoidal Steady-State • Complex numbers and phasor concept • Impedance and admittance • AC Power (Active, reactive, apparent power, and power factor) • Series and parallel resonance in RLC circuits 4. Frequency Response and Filters • Transfer function concept • Bode plots (Drawing and reading magnitude and phase curves) • Passive filter topologies: Low-pass, high-pass, band-pass, and band-stop filters • Cutoff frequency and bandwidth calculations 5. Fundamentals of Semiconductor Physics • Energy band structures of conductors, insulators, and semiconductors • Intrinsic semiconductors and electron-hole concept • P-type and N-type doping • P-N junction and depletion region formation 6. Diodes and Applications • Ideal and real diode characteristics (Current-Voltage, I-V curve) • Rectifier circuits: Half-wave and full-wave (bridge) rectifiers • Ripple voltage reduction with filter capacitor • Zener diodes and voltage regulation • Clipper, clamper circuits, and LEDs 7. Transistors • Bipolar Junction Transistors (BJT): NPN and PNP structures • BJT operating regions (Cutoff, Saturation, Active region) • BJT biasing circuits and DC load line • Transistor logic as a switch and amplifier • Introduction to Field Effect Transistors (FET/MOSFET) 8. Operational Amplifiers (Op-Amps) • Ideal Op-Amp characteristics and equivalent circuit • Negative feedback principle and virtual short circuit • Basic Op-Amp configurations: Inverting and non-inverting amplifiers • Adder, subtractor, and voltage follower (buffer) circuits • Integrator and differentiator circuits (Electronic equivalent of mathematical operations)
References	Lecture Notes and Exercises Moodle / Teams Learning Management Systems - LMS

Theory Topics

Week	Weekly Contents