Content

Course Code	Course Name	Semester	Theory	Practice	Lab	Credit	ECTS
ING117-A	Physics II	2	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 understanding of the universal laws of electromagnetic theory, through a holistic approach ranging from static charges to the dynamics of moving charges, and ultimately to electromagnetic waves. Building upon the modeling of electrostatic and magnetostatic principles with a solid mathematical foundation (vector analysis, surface and volume integrals), the course aims for an in-depth understanding of Maxwell's Equations, which summarize the dynamic interaction of electric and magnetic fields. This process, supported by interactive in-class problem-solving and the active learning (flipped classroom) methodology, aims to equip students with the competence (problem-solving formation) to apply abstract electromagnetic concepts to concrete engineering problems such as electric circuits, induction systems, and wave propagation.

Content	-1. Electrostatics Concept of charge (Point, linear, surface, and volume charge distributions) Coulomb's Law Electric Field and electric field lines Electric Potential and potential energy Gauss's Law and applications to symmetric charge distributions Capacitance, Capacitors, and Dielectric materials 2. Magnetostatics Concept of magnetic field and magnetic force (Lorentz Force) Magnetic effect of current (Magnetic field of moving charges) Biot-Savart Law Ampere's Law and applications 3. Electrodynamics: Induction Concept of magnetic flux Faraday's Law of Induction Lenz's Law (Direction of induced current and conservation of energy) Motional emf Self-inductance and Mutual inductance Magnetic field energy 4. 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 5. Maxwell's Equations Displacement current and Ampere-Maxwell Law (Creation of magnetic field by a time-varying electric field) Integral and differential forms of Maxwell's equations: Gauss's Law for electricity Gauss's Law for magnetism (Absence of magnetic monopoles) Faraday's Law Ampere-Maxwell Law 6. Electromagnetic Waves Derivation of the electromagnetic wave equation from Maxwell's equations Properties of plane electromagnetic waves (Orthogonality of E and B fields to each other and to the direction of propagation) Relationship between the speed of light (c), electric permittivity (?_0), and magnetic permeability (µ_0) of free space Poynting Vector: Energy transport and momentum in electromagnetic waves Electromagnetic spectrum
References	Lecture Notes and Exercises Moodle / Teams Learning Management Systems - LMS

Theory Topics

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