

## 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	<p>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.</p>

Content	<p>-1. Electrostatics</p> <p>Concept of charge (Point, linear, surface, and volume charge distributions)</p> <p>Coulomb's Law</p> <p>Electric Field and electric field lines</p> <p>Electric Potential and potential energy</p> <p>Gauss's Law and applications to symmetric charge distributions</p> <p>Capacitance, Capacitors, and Dielectric materials</p> <p>2. Magnetostatics</p> <p>Concept of magnetic field and magnetic force (Lorentz Force)</p> <p>Magnetic effect of current (Magnetic field of moving charges)</p> <p>Biot-Savart Law</p> <p>Ampere's Law and applications</p> <p>3. Electrodynamics: Induction</p> <p>Concept of magnetic flux</p> <p>Faraday's Law of Induction</p> <p>Lenz's Law (Direction of induced current and conservation of energy)</p> <p>Motional emf</p> <p>Self-inductance and Mutual inductance</p> <p>Magnetic field energy</p> <p>4. Electric Circuits: Direct Current (DC) Circuits</p> <p>Current, current density, and resistance (Ohm's Law)</p> <p>Electromotive force (emf) and voltage</p> <p>Kirchhoff's Laws (Junction and Loop rules)</p> <p>Thevenin and Norton theorems</p> <p>5. Maxwell's Equations</p> <p>Displacement current and Ampere-Maxwell Law (Creation of magnetic field by a time-varying electric field)</p> <p>Integral and differential forms of Maxwell's equations:</p> <p>Gauss's Law for electricity</p> <p>Gauss's Law for magnetism (Absence of magnetic monopoles)</p> <p>Faraday's Law</p> <p>Ampere-Maxwell Law</p> <p>6. Electromagnetic Waves</p> <p>Derivation of the electromagnetic wave equation from Maxwell's equations</p> <p>Properties of plane electromagnetic waves (Orthogonality of E and B fields to each other and to the direction of propagation)</p> <p>Relationship between the speed of light (c), electric permittivity (<math>\epsilon_0</math>), and magnetic permeability (<math>\mu_0</math>) of free space</p> <p>Poynting Vector: Energy transport and momentum in electromagnetic waves</p> <p>Electromagnetic spectrum</p>
References	<p>Lecture Notes and Exercises</p> <p>Moodle / Teams Learning Management Systems - LMS</p>

**Theory Topics**

Week	Weekly Contents
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