Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

Syllabus
Course description

Course title	Physics II
Course code	42129
Scientific sector	FIS/01
Degree	Bachelor in Industrial and Mechanical Engineering
Semester	I
Year	II
Academic Year	2019-2020
Credits	6
Modular	no

Total lecturing hours	36
Total lab hours	
Total exercise hours	24
Attendance	
Prerequisites	Concepts of mechanics, familiarity with single-variable and many-variable calculus.
Course page	https://www.unibz.it/en/faculties/sciencetechnology/bachelor-industrial-mechanical-engineering/course-offering/?academicYear=2019

Specific educational objectives	The course aims to give to the attendants both scientific basis on electricity and magnetism and practical methods to solve problems related to the same topics.

Lecturer	Leonardo Colletti
Scientific sector of the lecturer	FIS/08
Teaching language	English
Office hours	see Timetable
Teaching assistant (if any)	
Office hours	
List of topics covered	Electrostatics: experimental results; the electric charge and its characteristics; the electrometer; Bohr's model of the atom; quantization and conservation of the charge; Coulomb's law; operational definition of the Coulomb; stability of a system of charges; energy of a system of charges; definition of the electric field; the principle of superposition; the electrostatic potential; the electric dipole; flux of a vector field; Gauss's law; the equations for electrostatics. Field and potential for various distributions of charge. Electrostatics and conductors: Capacity and associated

	energy; capacitors in series and parallel. The electric field in matter: Experimental aspects; molecular polarization; polar and non-polar dielectrics; polarization density vector; surface and volumetric polarization charge density; electric displacement field vector; divergence of the electric displacement vector; electric susceptibility and dielectric constant; electric potential in dielectric media; continuity conditions of the electric and electric displacement vectors at the interface of two isotropic and homogeneous dielectrics; force on a dielectric in a capacitor; dielectric strength. Electric current: Electromotive force; current density and current intensity; principle of conservation of electric charge; Ohm's laws; Joule's law; resistances in series and parallel. Kirchhoff's laws. Magnetostatics: The sources of the magnetic field and experimental facts; the law of Biot-Savart; magnetic dipole of a current loop; line integrals on closed loops and Ampere's Law; integral and differential forms for the equations of magnetostatics. Electromagnetic induction: The Lorentz force; Faraday's law of induction and Lenz's law; rotor of the electric field; inductance and associated energy. Alternating currents. RLC circuit. Magnetic field in matter: Orbital and spin magnetic moments in atoms; diamagnetism and paramagnetism; magnetization intensity; surface and volumetric magnetization currents; Electromagnetism. Stationary and time-dependent Maxwell's equations. Electromagnetic waves. Poynting's vector. Potentials of the electromagnetic field.
Teaching format	Frontal lectures and exercises.

Learning outcomes (ILOs)	<u>Knowledge and understanding</u> Description of electric phenomena in vacuum and in the matter, and interpretation of these phenomena through the concept of electric field and electric potential. Description of magnetic phenomena in vacuum and in the matter, and interpretation of these phenomena through the concept of magnetic field and interaction between magnetic field and magnetic momentum of atoms.

	Description of Maxwell's equations, their theoretical justifications and physical consequences. <u>Applying knowledge and understanding</u> Ability to analyse and to solve problems about electric and magnetic phenomena such as electrical conduction, calculation of electric and magnetic field in the space and calculation of interaction forces between electric charges or between wires bringing current and external magnetic fields. <u>Making judgements</u> Students are expected to develop the ability to give explanations of physical phenomena, systems or devices basing their explanation on the concepts learned in the course. <u>Communication skills</u> Further development of a rigorous scientific language to express ideas and opinions about natural phenomena. <u>Ability to learn</u> Development of an analytic attitude leading the student to decompose a problem in sub-tasks which can be solved with the knowledge already acquired.

Assessment	**Summative assessment**
Assessment language	English
Evaluation criteria and criteria for awarding marks	The purpose of the exam is to verify the level of mastery of the teaching objectives listed above. The level of preparation is verified at the end of the course by means of a written exam divided into 2 exercises and 2 questions on the theory.

Form	**%**	**Length /duration**	**ILOs assessed**
Written Exam (2 theory questions, 8 points each; 2 exercises, 8 points each)	100%	2 hours	Electrostatic, electrical conduction, capacitors and resistors, magnetostatics and magnetodynamics; Maxwell's equations. Theory and exercises.

	Every exercise and question have the same score of 8 points. The score is based on the degree of completeness, clarity and correctness of the answer. The final score is the sum of the scores associated to each exercise and question of theory. To pass the exam the final score has to be greater or equal to 18. If mark>30 then a “with honors” is awarded. The student can have access to the exam with pen, pencil and portable calculator. Values of constants are provided to the students along with the text of the exam.

Required readings	None.
Supplementary readings	Lecture notes. Various textbooks can be used as a reference, for example: E.M. Purcell, Electricity and Magnetism M. Alonso, E.J. Finn, Physics C. Mencuccini, V. Silvestrini, Fisica II R. Feynman, The Feynman Lectures on Physics