Freie Universität Bozen
Libera Università di Bolzano
Università Liedia de Bulsan

# Syllabus
# Course description

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| **Course title** | Physics 2 |
| **Course code** | 42129 |
| **Scientific sector** | FIS/01 |
| **Degree** | Bachelor in Industrial and Mechanical Engineering |
| **Semester** | I |
| **Year** | II |
| **Academic Year** | 2017-2018 |
| **Credits** | 6 |
| **Modular** | no |

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| **Total lecturing hours** | 36 |
| **Total lab hours** | |
| **Total exercise hours** | 24 |
| **Attendance** | |
| **Prerequisites** | Attendance of the Physics 1 course. Students should be familiar with basic concepts of mechanics and differential calculus. |
| **Course page** | |

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| **Specific educational objectives** | The course belongs to the class "caratterizzanti" in the curriculum "Bachelor in Industrial and Mechanical Engineering ". It aims to give to the attendants both scientific basis on electricity and magnetism phenomena and practical methods to solve problems related to the same topics. |

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| **Lecturer** | Prof. Donato Vincenzi, office C4.02, donato.vincenzi@unibz.it |
| **Scientific sector of the lecturer** | FIS/01 |
| **Teaching language** | English |
| **Office hours** | See timetable |
| **Teaching assistant (if any )** | Dr. Claudia Notarnicola Claudia.Notarnicola1@unibz.it |
| **Office hours** | |
| **List of topics covered** | Electrostatics: Experimental results; the electric charge; Coulomb's law and 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.<br><br>Electrostatics and conductors: Capacity and associated energy; capacitors in series and parallel.<br><br>The electric field in matter: Experimental aspects; |

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| | 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.<br><br>Electric current: Electromotive force; current density and current intensity; principle of conservation of electric charge; Ohm's law; Joule's law; resistances in series and parallel. Kirchhoff's laws.<br><br>Magnetostatics: The sources of the magnetic field and experimental facts; the law of Biot-Savart; I and II laws of Laplace; definition of the Ampere; magnetic dipole of a current loop; line integrals on closed loops and Ampere's Law; integral and differential forms for the equations of magnetostatics;<br><br>Electromagnetic induction: The Lorentz force; Faraday's law of induction and Lenz's law; Foucault currents; rotor of the electric field; inductance and associated energy.<br><br>Magnetic field in matter: Orbital and spin magnetic moments in atoms; diamagnetism and paramagnetism; magnetization intensity; surface and volumetric magnetization currents; |
| **Teaching format** | Frontal lectures and exercises. Home assignments |

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| **Learning outcomes (ILOs)** | The learning outcomes need to refer to the Dublin Descriptors:<br><br><u>Knowledge and understanding</u><br><br>1. Description of electric phenomena in vacuum and in the matter, and interpretation of these phenomena through the concept of electric field and electric potential.<br>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.<br><br><u>Applying knowledge and understanding</u><br><br>2. Ability to analyse and to solve simple 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.

Making judgements

3. In the home assignments, students are asked to give their personal explanation of physical phenomena or devices basing their explanation on the concepts learned in the course.

Communication skills

4. The home assignments and the written question in the final exam require the students to explain with their words and in a rigorous way the explanation of a physical phenomenon. Examples of simple and rigorous explanations are given to the students during the course as a reference.

Ability to learn

5. 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**

**Formative assessment**

| Form | Length /duration | ILOs assessed |
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**Summative assessment**

| Form | % | Length /duration | ILOs assessed |
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| Written Exam | 92% | 3 hours | Electrostatic, electrical conduction, capacitors and resistors, magnetostatics and magneto dynamics |
| Home Assignments (3) | 8% | | Communication skills and capacity to analyse a complex problem and divide it into simpler phenomena. |

**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.

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| | The level of preparation is verified at the end of the course by means of a written exam divided into 3 exercises and a general question of the theory introduced during the course.<br><br>Every exercise and the question have the same score of 8.5. Every exercise is furtherly divided into 3 or more questions representing a fraction of the total exercise score.<br><br>For every exercise the score is proportional to the number of questions correctly addressed up to a maximum of 8.5. For the theory question 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 to the question of theory. To pass the exam the final score has to be greater or equal to 18.<br><br>Students can choose the oral exam as an option: during this exam the students will be asked to solve an exercise at the blackboard and to answer to question about the comprehension of the theory of electricity and magnetism introduced during this course. The exercise has a maximum score of 12 and the 3 questions of theory have a maximum total score of 22.<br><br>The student can have access to the exam with pen, pencil and portable calculator. A short list of formulae is provided to the students along with the text of the exam. A single reference book is also available on the teacher desk. |

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| **Required readings** | Authors: David Halliday, Robert Resnick, Jearl Walker<br>Title: Fondamenti di fisica. Vol. 2: Elettrologia, magnetismo, ottica, Settima edizione<br>Editor: Casa Editrice Ambrosiana.<br>ISBN: 9788808183118 |
| **Supplementary readings** | Authors: R. A. Serway, J. W. Jewett Jr.<br>Title: Fisica per Scienze ed Ingegneria - Volume secondo<br>Editor: Edises<br>ISBN: 9788879598248<br><br>Authors: Mazzoldi, Nigro, Voci.<br>Title: Elementi di Fisica II: Elettromagnetismo - Onde.<br>Editor: Casa editrice: EdiSES.<br>ISBN: 978-8879591522 |