Academic subject: General Physics 2				
Degree Class: L-35 – Scienze Matematiche		**Degree Course:** Mathematics	**Academic Year:** 2017/2018	
		Kind of class: mandatory	**Year:** 2	**Period:** 1
			ECTS: 9 divided into **ECTS lessons: 9** **ECTS** **exe/lab/tutor:**	

Time management, hours, in–class study hours, out–of–class study hours
        lesson: 72   exe/lab/tutor: in–class study: 72   out–of–class study:

Language: Italian	**Compulsory Attendance:** no		
Subject Teacher: Antonio Marrone	**Tel**: 0805443463 **e–mail:** antonio.marrone@uniba.it	**Office:** Department of Physics Room 148, Floor 1	**Office days and hours:** Mon 11-12.30 Thu 8.30-10.00

Prerequisites:
Basic Physics knowledge (mechanical, thermodynamic). Basics of Vector and Differential Calculus

Educational objectives:
Acquisition of basic concepts of classical electromagnetism, with particular reference to electrostatics, currents, circuits, and magnetostatics

Expected learning outcomes (according to Dublin Descriptors)	**Knowledge and understanding:** Acquisition of fundamental concepts of classical electromagnetism. Acquisition of the corresponding calculation techniques. **Applying knowledge and understanding:** The theoretical knowledge acquired is used in the study of phenomena connected to electric and magnetic fields **Making judgements:** Ability to assess the consistency of logical reasoning used in demonstrations. Ability to identify the right mathematical tools and the right physical knowledge to deal with electromagnetic phenomena **Communication:** Acquiring the language and the formalism of classical physics, necessary for the consultation and understanding of the texts, the expose the acquired knowledge, the description, analysis and troubleshooting. **Lifelong learning skills:** Obtaining an appropriate study method, supported by the consultation of texts and from the resolution of exercises and questions periodically suggested during the course

Course program

GENERAL INFORMATION ON ELECTRIC SHOCK: electric power; positive and negative electricity; definition of electric charge; Coulomb's law; superposition principle.

ELECTRIC CHARGE AND MATERIAL

ELECTROSTATIC FIELD: operational definition of the electric field; measuring unit for the electric field; electric field produced by more point-like charges; electric field produced by continuous distributions; representation of the electrostatic field E by force lines; force pipe; electrostatic field flow; Gauss theorem; Gauss's theorem and force lines; Deriving the electric field from the Gauss theorem in symmetry situations; E discontinuity through a charged surface.

ELECTRIC POTENTIAL: displacement of a charge in an electrostatic field; conservative electrostatic forces; electrostatic potential energy; electrostatic potential; equipotential surfaces; Deriving the electric field from the potential; gradient properties (intrinsic definition); approximate potential evaluation.

DIFFERENTIAL ELECTROSTATIC FORMULATION: integral properties of the field electrostatic; Gauss's theorem in differential form; divergence of a vector field; transformation of a surface integral (flow) into a volume integral: theorem of divergence; evaluation of the divergence in Cartesian coordinates; properties of the electrostatic field circuitry in differential terms; rotational of a vector field; transformation of the integrating circuit into a flow integral: Stokes theorem; calculation of Cartesian components of rotational; formal use of differential operators; differential properties of the electrostatic field; Poisson and Laplace equations for electrostatic potential; some properties of harmonic functions; balance in the electrostatic field.

ELECTRIC CONDUCTOR CORPS: conductors in equilibrium in an electrostatic field; the potential of the conductors in equilibrium: charge density on the surface of a conductor; force on surface charges to a conductor: electrostatic pressure; effect of the tips; fundamental problem of electrostatic; electrostatic screen: electrostatic field and potential inside a cavity in a conductor; charges introduced into the cavity of a conductor; the "earth" as potential zero conductor; Image method: Point-to-point h charging from an unlimited plan.

ELECTROSTATIC CAPACITY: electrostatic capacity of an isolated conductor; capacity unit; capacitance and induction coefficients for a conductor system; capacitors; relative capacity; calculation of the capacity of condensers with particular symmetry; connection of multiple capacitors in series or in parallel.

ENERGY IN THE ELECTROSTATIC FIELD: potential energy of a charge system; energy of a balanced load conductor system; energy stored in a condenser; localization of energy in the electrical field; energy of a point load, classic electron beam.

POTENTIAL FROM LOAD DISTRIBUTIONS: MULTIPLE DEVELOPMENT: insulating bodies in an electric field; electric dipole; potential of a dipole; field generated by a dipole; actions of a uniform electrostatic field on a dipole; the energy of a dipole in an electrostatic field; drag on a dipole; multipole potential development (outlines); dipole equivalent to a zero charge distribution.

DIELETRIC: insulating bodies in the electric field; polarization density; field and potential produced by polarization; uniform polarization; polarized dielectric plate; outdoor field; equivalent supercharged charges; electric field within the dielectric; uneven polarization; polarization induced by the electric field; apolar molecules; atomic polarizability; polarization with polar molecules; relationship between the E0 field that induces the equivalent dipole time and the average internal dielectric field (EINT); dielectric susceptibility; linear dielectrics; fundamental equations of electrostatics in the presence of dielectrics; Maxwell shift vector; field D in linear and homogeneous dielectrics; refraction of E and D lines; non-homogeneous dielectric; capacity of dielectric capacitors; energy density in a dielectric; forces between the armor of a flat condenser; force acting on the dielectric.

ELECTRICAL CURRENT

ELECTRICAL CURRENCIES: intensity and current density; storage of electric charge; continuity equation; dependence of current density on electric field; Ohm Law; ohm law in integral form; connection of multiple resistances in series and in parallel; current distribution in extended media: current line geometry; resistance between two electrodes in an extended conductor; Extended conductor resistance (notes); relaxation time of a homogeneous conductor (notes); charge and discharge of a capacitor; energy dissipated in the passage of electric current: Joule effect; energy balance in the charging and discharge processes of a condenser.

GENERATORS AND ELECTROMOTRIC FORCE: energy balance in a stationary current path circuit; electric generators; General Ohm Law; measurement of f.e.m. of a generator; generators in circuits;

stationary circuit analysis; Kirchhoff's laws.

MAGNETOSTATICS

MAGNETIC FIELD: action of magnets on electric charges in motion: magnetic field; Lorentz's strength; relativistic invariance of the electric charge; motion of electrical charges in a uniform magnetic field; cyclotron (notes); helical motion in a magnetic field.

MAGNETIC FIELD AND STATIONARY CURRENCIES: Hall effect; magnetic forces on electric current; strength between parallel currents; Absolute Ampere; magnetic field produced by straight and parallel currents; Ampère theorem; differential equations of the magnetic field; field of a solenoid; field of a toroidal solenoid; law of Laplace Ampère (notes); field produced by a flat circular loop at a point on its axis; Equivalence principle of Ampère; action of a field B on an elementary thread

Teaching methods:

Auxiliary teaching:

Assessment methods:
written and oral test

Bibliography:

M.T. Chiaradia−L. Guerriero−G. Selvaggi   FISICA II ELETTROSTATICA E CORRENTI

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