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## FISICA E APPLICAZIONI DI FISICA

9 CFU - 2° Semester

### Teaching Staff

#### ELENA BRUNO

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**Office Hours:** Lunedì dalle 09:30 alle 11:30 e Mercoledì dalle 14:30 alle 15:30. Si consiglia di contattare il docente in anticipo (entro la mattina del giorno prima). Impegni istituzionali o personali possono far slittare il ricevimento

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### LEARNING OBJECTIVES

#### ▪ Physics

The course has the stated goal of providing adequate knowledge and understanding of fundamental physical laws that govern geological processes, and skills in applying knowledge

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### DETAILED COURSE CONTENT

#### ▪ Physics

1. Introduction Introduction. Description of a physical phenomenon.Units and dimensional equations. Quantify a physical quantity. The concept of error. The International System (SI): time, mass, length. The prefixes. Derived units. Vector and scalar quantities. Representation of the vectors into components with respect to a reference system. Vector sum. Scalar and vector product of vectors.2. MechanicsThe concept of force. Forces and motion. Newton's first law. Inertial reference systems. Vector nature of forces. Newton's second law. Weight of a body. Some special forces: friction, reaction force to weight. Action and reaction. Newton's third law.One-dimensional motion. Definition of displacement, average velocity, instantaneous velocity. Average and instantaneous acceleration.Rectilinear motion with constant acceleration. Motion in multiple dimensions. Decomposition of motions along the axes of a reference system. Projectile motion.Elements of uniform circular motion. Position and displacement and angular velocity. Centripetal acceleration. Period and frequency. Angular velocity of the Earth.Work and energy.

Definition of mechanical work. Theorem of kinetic energy. Work force and weight. Spring force and work of the elastic force (spring). Definition of power. Potential energy. Definition of conservative forces and not. Work and potential energy. Conservation of mechanical energy. Relationship between force and potential energy. Extension of conservation of mechanical energy. Particle systems. The center of mass. Extension of the concept for a rigid system. The concept of equilibrium. Internal and external forces. Momentum. Momentum for a system of points. Conservation of momentum. Center of gravity and center of gravity. Definition of angular momentum. Conservation of angular momentum. Gravitation. Newton's law. Gravitational potential energy. The force of Newton is conservative. Escape velocity.

3. Fluids Definition of fluid. Pressure. Pressure variation of a fluid at rest in a gravitational field. Pascal's principle. Bernoulli equation of energy conservation in the case of fluids. Archimedes' principle. Real fluids: viscosity and surface tension. The lava.

4. Heat and thermodynamics Definition of temperature. Triple point of water. Perfect gas thermometer. Thermal expansion. Heat and temperature. Heat capacity and specific heat. Phase transitions. Latent heat. Example about the latent heat. Thermodynamic state (equilibrium). State functions. Heat transfer: conduction, convection and radiation. The problem of global warming. First law of thermodynamics. Reversible and irreversible transformations. Second law of thermodynamics. Reversible and irreversible processes. Entropy. Third law of thermodynamics.

5. Electricity e magnetism Electric charges. Quantization of the electric charge. Conductors and insulators. Coulomb's law. Definition of electric field. Field lines. Gauss' law for the electric field. Electric potential. Potential difference. Work. Equipotential surfaces. Potential of a charged sphere. Capacitors and capacity. Ideal capacitors. Electric currents. Current density. Resistance. Joule's law. Resistors in series and parallel. Generators of electromotive forces. Examples of circuits and Kirchoff's laws. The permanent magnets. Earth's magnetic field. Effect of the magnetic field on the motion of electric charges. Lorentz's force. Other sources of magnetic field. The Biot-Savart's law. Work on Gauss' law for the magnetic field. Ampere's law. The magnetic field flux. Faraday's law. Induced electromotive force. Mention of Maxwell's equations in vacuum.

6. Elasticity, oscillations and waves Elastic deformation in solids. Hooke's law for tensile and compressive forces. Simple harmonic motion. Mention of on the damped harmonic motion. Mention of forced oscillations and resonance. What is a wave. Transverse and longitudinal waves. Wavelength and frequency. Mechanical and electromagnetic waves. Phenomena of reflection, refraction and interference. Mechanical waves and transport of energy. Earthquakes. Waves. Sound waves. Doppler effect and applications. Electromagnetic waves. Electromagnetic spectrum. Plane and transverse waves. Velocity in vacuum and in a medium. Index of refraction. Energy of the electromagnetic wave. Huygens' principle. Interference and diffraction. Resolving power: Reyleigh criterion. Spectrometers and spectroscopy and their applications. Polarization: circular, linear. Polaroids. Geometrical optics: light spectrum. Index of refraction. Reflection and refraction. Total internal reflection and critical angle. Chromatic dispersion. Mirrors, lenses and their applications.

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## TEXTBOOK INFORMATION

### ▪ Physics

1. "Fisica generale - Principi e applicazioni", A. Giambattista, B. McCarthy Richardson, R. C. Richardson, Casa Ed. Graw Hill, (4 edizione)

2. "Fisica con fisica moderna" II edizione, Giancoli, Casa Editrice Ambrosiana (edizione 2006 o 2007)
3. "Principi di fisica", J. Serway, Casa ed. EdiSES
4. "Fondamenti di fisica", D. Halliday, R. Resnik, J. Walker, Casa Editrice Ambrosiana (sesta edizione 2006)

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