



FISICA A - L

FIS/07 - 6 CFU - 2° Semester

Teaching Staff

FRANCESCO RUFFINO

Email: francesco.ruffino@ct.infn.it

Office: Dipartimento di Fisica ed Astronomia, Studio 262A

Phone: 0953785461

Office Hours: Lunedì 15:00-17:00, Mercoledì 15:00-17:00, Altri giorni ed orari possono essere resi disponibili contattando direttamente il docente

LEARNING OBJECTIVES

Basic principles and concepts about particle, particles system, rigid body and fluids kinematic and dynamic. Basic principles and concepts about elastic and non-elastic waves. Basic principles and concepts about thermodynamics. Basic principles and concepts about electrostatic, magnetism, electromagnetism and electromagnetic waves. Basic principles and concepts about optics.

COURSE STRUCTURE

Classroom lectures

DETAILED COURSE CONTENT

1) Measurements and uncertainties

Models, theories, laws-Measurements and uncertainties-Units of measurements, samples and the International systems of measures-Conversions of the measurement units-Dimensionality calculus

2) Motion description: kinematics in one dimension

Systems of reference and displacement-Mean velocity-Instantaneous velocity-Acceleration-Motion with constant acceleration-Falling objects-Graphical analyses of the linear motion

3) Kinematics in two dimensions; Vectors

Vectors and scalars-Sum of vectors: graphic method-Subtraction of vectors and multiplication of vector with a scalar-Sum of vectors by components-Bullet motion-Relative velocity

4) Motion and forces: dynamics

Force-Newton's first law-Mass-Newton's second law-Newton's third law-Weight: the gravitational force and the normal force-Applications involving friction: inclined planes

5) Circular motion; Gravitation

Kinematics of the uniform circular motion-Dynamics of the uniform circular motion-Newton's law of the gravitation-Gravitation near the Earth surface-Kepler's laws

6) Work and energy

Work by a constant force-Work by a non-constant force-Kinetic energy and the work principle-Potential energy-Conservative and non-conservative forces-Conservation of the mechanical energy-Other types of energy: energy transformation and the energy conservation principle-Energy conservation principle involving friction

7) Impulse

Relation impulse-force-Impulse conservation-Collisions and impulse-energy and impulse conservation in collisions-Elastic collisions in one dimension-Inelastic collisions-Collisions in two and three dimensions-Center of mass

8) Rotatory motion

Angular quantities-Kinematic equations for the uniform accelerated rotatory motion-Rolling motion-Torque-Rotational dynamics: torque and inertial moment-Rotational kinetic energy-Conservation of the angular momentum-Vectorial nature of the angular quantities

9) Static; Elasticity

Static: equilibrium between forces-Equilibrium conditions-Elasticity: Hooke's law

10) Fluids

Density-Pressure-Atmospheric and relative pressure-Pascal principle-Pressure measurements: manometer and barometer-Archimede's principle-Motion of fluids: flow and continuity equation- Bernoulli equation-Application of the Bernoulli principle

11) Vibrations and waves

Armonic motion-Energy in the armonic oscillator-Period and sinusoidal nature of the armonic motion-Pendulum-Damped armonic motion-Forced vibrations; resonance-Undulatory motion-Transversal and longitudinal waves-Energy carried by waves-Waves reflection and interference-Stationary waves; resonance

12) Sound

Properties of the sound-Sound intensity: decibel-Sound sources: vibrating strings and air columns- Sound waves interference-Doppler effect

13) Temperature and kinetic theory

Atomic theory of matter-Temperature and thermometers-Thermic equilibrium and zero principle of the thermodynamic-Thermic dilatation-Anomalous water behaviour under 4 °C-Gases laws and absolute temperature-Ideal gas law-Ideal gas law and the molecules: the Avogadro number-Kinetic theory and the

molecular interpretation of the temperature-Distribution of the molecular velocities-Real gases and phase transformation-Vapour tension

14) Heat

Heat and energy transfer-Distinction between temperature, heat, and internal energy-Internal energy of an ideal gas-Specific heat and calorimetry-latent heat-Heat transmission: conduction, convection, irradiation

15) Principles of the thermodynamics

Thermodynamic's first principle-Applications of the first principle-Thermodynamic's second principle-Thermic machines-Entropy and the second principle-From order to disorder;unavailable energy-Statistic interpretation of the entropy

16) Electric charge and field

Static electricity; conservation of the electric charge-The electric charge in the atom-Dielectrics and conductors-The induced charge; the electroscope-Coulomb law-electric field-Field lines-Electric fields and conductors

17) Electrical potential and energy; capacitance

Electric potential and differences of potential-Relation between electrical potential and field-equipotential lines-Electronvolt as measurement unit for the energy-Electrical potential due to puntiform charges-Electrical dipoles-Capacitance-Dielectrics-Charge storage

18) Electrical currents

The battery-The current-Ohm's law: the resistance-Resistivity-Electrical power-AC current- Microscopic aspects of the electrical current

19) DC circuits

Parallels and series of resistances-Electromotive force-Kirchhoff's laws-Parallels and series of Electromotive; Charging a battery-Circuits with parallels or series of capacitances-Circuits with a resistance and a capacitance-DC Ammeters and Amperometri e voltmeters

20) Magnetism

Magnets and magnetic fields-electric currents as sources of magnetic fields-Force applied by a magnetic field on an electric current; Definition of B-Force applied by a magnetic field on a electric charge in motion-Magnetic field by a linear thread-Force between parallel threads-Ampere and Coulomb unity measurements definitions-Ampere's law-Torque on a coil travelled by a current; magnetic torque-Applications: galvanometers, motors-Mass spectrometer-Ferromagnetism-Elettromagnets e solenoids-magnetic fields in matter; hysteresis

21) Electromagnetic induction and the Faraday's law; AC circuits

Inducted electromotive force-Faraday's law;Lenz's law- Inducted electromotive force in a conductor in motion-Relation between the variation of the magnetic flux and the electrical field-Electric generators-Parasitical currents-Transformators; electric energy transfer-Inductance-Energy in a magnetic field-LR circuits-AC circuits; impedance-AC RLC circuits-Resonance in AC circuits; oscillators

22) Electromagnetic waves

Relation between variable electric fields and magnetic fields: Maxwell equations- Fourth Maxwell's equation; the displacement current-Electromagnetic waves production-Calculus of the velocity of the electromagnetic waves-Light as an electromagnetic wave; the electromagnetic spectrum-Measurement of the light velocity-Electromagnetic waves energy

23) The light: geometric optics

The light modeled as beams-Reflection; images formation on a plane mirror-Images formation on spherical mirrors-Refractive index-Refraction: Snell's law-Internal total reflection-Thin lens; rays diagrams-The lens equation

24) Waves nature of the light

Huygens principle and diffraction-Huygens principle and refraction; Interference; Young experiments-Visible spectrum and dispersion-Diffraction from a split-Diffractive grating-The spectrometer and the spectroscopy-Polarization

25) Optical instruments

The human eyes-Magnifying lens-Telescope-Microscope-Lens and mirrors aberrations-Resolution limits: Rayleigh criterion-Telescope and microscope resolution-Diffraction of X rays

TEXTBOOK INFORMATION

Theory:

- 1) Raymond A. Serway, John W. Jewett, "Principi di Fisica (quinta edizione)", EDISES
- 2) Douglas C. Giancoli, "Fisica-Principi e Applicazioni" (Edizione italiana a cura di Paolo Cavatorta e Lanfranco Cicala), edizioni "Casa Editrice Ambrosiana"
- 3) F. Borsa, A. Lascialfari, "Principi di Fisica-per indirizzo biomedico e farmaceutico", EDISES

Exercises:

- 1) John R. Gordon, Ralph W. McGrew, Raymond R. Serway, John W. Jewett, "Esercizi di Fisica-guida ragionata alla soluzione", EDISES
 - 2) http://upload.wikimedia.org/wikibooks/it/4/4b/Esercizi_di_fisica_con_soluzioni.pdf;
<http://www60.jimdo.com/app/s80e7ac8b55e77c3c/p6a5b5a2aca6b274c/>
-