Course title: Physics I (code 03295)
Professor: Marco Barbera (marco.barbera@unipa.it)
Credits (CFU): 5 + 2 (lectures + exercises)
Classroom: Room “Ruccia” – Building 17 – Viale delle Scienze

COURSE PROGRAM

1. INTRODUCTION

- The scientific method; Physics in the context of experimental science;
- Physical quantities and the International System of Units;
- Measurement of physical quantities and uncertainties;
- Scalars and vectors; vector’s sum and components.

2. SOME IDEAS OF MODERN PHYSICS

3. MECHANICS

3. Kinematics

- Position, displacement, velocity, acceleration;
- Motion in one dimension: uniform motion, uniformly accelerated motion;
- Motion in two dimensions: projectile motion.

3.2 Dynamics of a particle

- The force;
- The first Newton’s law and inertial systems;
- The second and third Newton’s law, the frictional force;
- Uniform circular motion, acceleration and centripetal force.

3.3 Work and Energy

- Work done by a constant force, the scalar product of vectors;
- Work done by a variable force, elastic force of a spring;
- Kinetic Energy theorem and kinetic energy;
- Conservative and non-conservative forces, potential energy;
- Conservation of mechanical energy;
- Conservation of energy;
- Power.

3.4 Dynamics of multi-body systems

- The center of mass, Newton's second law for a system of particles;
- Linear momentum;
- Conservation of linear momentum;
- Collisions.

3.5 Rotational motion

- The rotational variables;
- Rotational kinetic energy, rotational inertia;
- Torque, Newton's second law for rotation;
- The vector product;
- Angular momentum and its conservation.

3.6 Equilibrium and Elasticity

3.7 Gravitation

- Newton’s law of gravitation;
- Gravitation near the Earth's surface;
- Gravitational potential energy;
- Kepler's laws;
- Satellites: orbits and Energy.

4. FLUIDS

4.1. Fluids at rest

- Density, pressure;

- Stevino’s law;
- Pascal’s principle;
- Archimedes’ principle.

4.2 Fluid Dynamics

- Ideal fluids, equation of continuity, Bernoulli's equation;
- Viscosity, Poiseuille's Law.

4.3 Surface tension and capillarity

5. OSCILLATIONS and MECHANICAL WAVES

5.1 Oscillations

- Simple harmonic motion, the pendulum;
- Forced Oscillatotions and resonance;
- Damped oscillations.

5.2 Transverse mechanical waves

- Wave Speed on a Stretched String;
- Energy and Power of a Wave Traveling Along a String;
- Superposition of waves: interference, standing waves, resonance.

5.3 Acoustic waves

- The speed of sound;
- Intensity and sound level;
- interference of sound waves, beats;
- The Doppler effect.

6 THERMODINAMICS

6.1 Temperature and heat

- Thermodynamic systems,. thermal equilibrium. temperature, heat;
- Thermal expansion, heat capacity and specific heat;
- Heat transfer: conduction, convection and radiation;
- The first law of Thermodynamics.

6.2 Kinetic theory of gases

- Avogadro's number;
- Equation of state of an ideal gas, work done by an ideal gas;
- temperature and mean translational kinetic energy;
- mean free path, distribution of molecular velocities;
- Degrees of freedom and the molar specific heat.

6.3 The second law of Thermodynamics

- Reversible and irreversible processes;
- Entropy and the second Law of Thermodynamics;
- Heat engines, the Carnot cycle, thermal efficiency;
- Entropy and statistics.

Suggested Text Books

1. D. Halliday, R. Resnick, J.l Walker,"Fondamenti di Fisica”, Casa Editrice Ambrosiana
2. D. C. Giancoli, "Fisica con Fisica Moderna”, Casa Editrice Ambrosiana