



UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Geophysics

1920-3-E3401Q051

Aims

The student should acquire a knowledge of the geophysical phenomena that are most relevant for environmental applications, with a specific emphasis on the shallow Earth's subsurface.

Contents

Earth rotation and its variations. Earth shape. Gravitational field of the Earth. Geoid. Tides. Gravimetric surveys. Magnetic field of the Earth and its temporal variations. Solar wind. Elettro-magnetic induction. Geomagnetic surveys. Electric resistivity and conductivity. Fundamentals of geoelectric prospects. Seismic surveys. Equations of the elastic waves (1D). Thermal properties of rocks. Thermal energy transfer in the soil. Geothermic surveys. Rock radioactivity. Equation of radioactive decay. Radioactive surveys. Seismology. Mechanisms for generation of earthquakes. Problem solving with practical applications in relation to the theoretical part of the course.

Detailed program

Gravity and rotational motion: Universal gravitational law. Gravitational force and acceleration between bodies. Gravitational potential energy and work. Centripetal acceleration. Geopotential. Geoid. Satellite measurements of Earth gravity. Tides. Inertial moment. Angular momentum rotational energy conservation. Changes in the Earth rotation period. Chandler's oscillation. Gravimetric analysis. Absolute gravity measurements: pendulum, free fall method, push and free fall method. Relative gravity measurements: Gravimeter. Corrections to gravity measurements: latitudinal, tidal, free air correction, Bouguer plate correction, topographic correction. Gravity

anomaly interpretation.

Magnetism: Magnetic force. Magnetic potential. Magnetic dipole field. Gauss method. Magnetic moment. Magnetization. Magnetic susceptibility. Lorentz force. Magnetic properties of materials. Diamagnetism. Paramagnetism. Ferromagnetism. Magnetic anisotropies. Single and multiple domains. Rock magnetization: induced and permanent (sedimentary and thermopermanent) magnetization. Geomagnetism. Inclination and declination. International geomagnetic reference field. Temporal variations of the magnetic field: secular variations, field inversions, diurnal variations. Models. Magnetic dynamo. Magnetic analysis. Magnetometer. Measurement corrections: temporal, latitudinal, altitudinal. Magnetic anomaly interpretation. Königsberger ratio.

Geothermy: Thermal gradient. Adiabatic gradient, melting temperature gradient. Heat transport. Thermal conductivity. Heat flux equation. Heat fluxes into the soil. Convection. Basics of geodynamical modelling (continuity equation, Navier-Stokes equation, convection-diffusion heat equation). Geothermal measurements. Thermistors: thermocouples, thermistors. Transient regimes for the estimation of thermal conductivity.

Electricity: Coulomb force. Electric potential. Electric tension. Electric resistance. Electrical properties of materials. Geoelectricity. Electric analysis. Four electrode method.

Radioactivity: Atomic structure. Isotopes. Radioactive decay: alpha and beta. Decay constant. Half-life time. Radioactive dating: radiocarbon, rubidium-strontium, potassium-argon, lead-uranium. Mass spectrometer.

Seismicity: Elasticity. Hooke law. Stress tensor. Deformation matrix: longitudinal deformation and distortion. Young modulus. Rigidity modulus. Seismic waves. Pressure waves (P waves). One dimensional wave equation. Propagation velocity. Wave energy and damping. Shear waves (S waves). Surface waves (Love and Rayleigh waves). Wave propagation: refraction and reflection. Critical angle. Seismometer and seismogram. Measurement errors. Fundamentals of passive seismic analysis and internal structure of the Earth. Earthquakes. Intensity and magnitude. Parameter determination: direct and inverse method.

Prerequisites

Physics

Teaching form

Frontal lectures (6 credits)

Laboratory (2 credits)

- esame orale e scritto (con risoluzione di problemi)

Valutazione dell'esame:

- Voto in trentesimi

Textbook and teaching resource

William Lowrie *Fundamental of Geophysics*, Cambridge University Press, 2007.

Semester

Second

Assessment method**Examination type:**

- Written (problem solving) and oral (discussion on topics covered during class) examination.

Office hours

Contact the instructor via email at claudia.pasquero@unimib.it
