TITOLO DEL CORSO ELECTROMAGNETIC METHODS OF GEOPHYSICAL EXPLORATION			
Settore Scientifico - Disciplinare: GEO/11		**CFU: 6** (5 LF + 1 LAB)	**Ore: 52**
Ore di studio per attività:	**Lezioni frontali:** 2	**Laboratorio:** 1	**Attività di campo:** 0
Tipologia di attività formativa: caratterizzante			

SYLLABUS

Prerequisiti: Basic knowledge of Mathematics, Physics and Applied Geophysics.

Lezioni frontali	
numero di ore 4	Argomento: *Electromagnetic wave propagation inside matter*: Maxwell's equations and preliminary assumptions. Energy loss and penetration depth.
numero di ore 4	Argomento: *Measuring earth material properties with electromagnetic waves*: electrical conductivity, dielectric permittivity, magnetic permeability.
numero di ore 6	Argomento: *Review of electrostatic methods:* Maxwell's equations for static fields. Electrostatic techniques (direct current resistivity, time-domain induced polarization, self-potential): measurement principle; measurement system; data collection; data processing algorithms; forward modeling; inversion algorithms. Case studies in civil engineering; cultural heritage; natural or anthropic risks; mining exploration.
numero di ore 14	Argomento: *Low and high frequency electromagnetic prospecting methods using controlled sources (FDEM, GPR):* measurement principle; measurement system; data collection; data processing algorithms; forward modeling; inversion algorithms. Case studies in civil engineering; cultural heritage; natural or anthropic risks.
numero di ore 6	Argomento: *Time-domain electromagnetic prospecting methods using controlled sources (TDEM)*: measurement principle; measurement system; data collection; data processing algorithms; forward modeling; inversion algorithms. Case studies in natural or anthropic risks; mining, petroleum and geothermal exploration.
numero di ore 6	Argomento: *Electromagnetic prospecting methods using natural sources:* the diffusion of natural EM fields in a layered Earth model; impedance tensor. Magnetotelluric method: measurement principle; measurement system; data collection; data processing algorithms; forward modeling; inversion algorithms. Case studies in natural risks; mining, petroleum and geothermal exploration.
Laboratorio	
numero di ore 12	Attività: Practical use of electromagnetic geophysical instrumentation. Acquisition, analysis and interpretation of electromagnetic field data through the following software: **MATLAB**, **Res2D/3DInv**, **Reflexw 7.0**, **TOUGH2**, **Surfer**, **Voxler**.

Risultati di apprendimento attesi
Knowledge and understanding: The student must demonstrate knowledge and understanding of the interactions between natural/artificial electromagnetic fields and earth materials. He must also show to be able to select the most suitable electromagnetic methodologies to solve complex problems within different research fields of the Earth Sciences.
Applying knowledge and understanding: The student must be able to apply the acquired knowledge and understanding of the geophysical electromagnetic methodologies to correctly planning large- and small-scale surveys aimed to solve problems within broader (or multidisciplinary) contexts related to: natural or anthropic risks (seismic, volcanic, hydrogeological, environmental pollution); mining, petroleum and geothermal exploration; archaeological and engineering studies.
Making judgements: The student must be able to independently evaluate the physical processes that can occur in the subsoil with reference to the research objective and to indicate the most suitable electromagnetic methodologies for the study of these processes. He must also be able to propose solutions to improve the quality of the acquired geophysical data and/or their effectiveness. Moreover, he must have the ability to evaluate the consistency of the interpretative hypotheses based on the collected data and data of different nature (e.g., geological, geochemical, etc.) available for the study area.
Communication: The student must be able to explain to a non-expert audience the basic principles of the main electromagnetic geophysical methodologies. He must be able to discuss a report summarizing exhaustively and concisely the acquisition and processing of data coming from an electromagnetic method chosen among those illustrated during the course. He must also be able to correctly use the scientific language and to demonstrate that he understood limits and possible applications of the performed study.
Learning skills: The student must be able to broaden his knowledge by independently drawing on texts, scientific articles and websites. He must gradually acquire the ability to attend specialist seminars, conferences and masters, in the field of electromagnetic exploration methods.
Modalità di verifica dell'apprendimento
Esame finale: Oral examination. The grading scale is from 1/30 to a maximum of 30/30 cum laude. The minimum passing grade is 18/30.