General information		
Academic subject	Applied Geophysics	
Degree course	Environmental Sciences (L32)	
Academic Year	*2021-2022*	
European Credit Transfer and Accumulation System (ECTS)		9
Language	Italian	
Academic calendar (starting and ending date)	I semester	
Attendance	Strongly recommended	

Professor/ Lecturer	
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Virtual headquarters	TEAMS code: 84pnfil
Tutoring (time and day)	It is possible to take a tutoring appointment both on site and online by sending an email to the teacher.

Syllabus	
Learning Objectives	Provide basic theoretical and applied knowledge of geophysics by promoting the understanding of multidisciplinary applications that involve biotic and abiotic components in relation to environmental parameters that change by man and nature itself.
Course prerequisites	Basic knowledge of Mathematics and Physics
Contents	*The course consists of 7 credits of lectures and 2 of exercises which include numerical exercises in the classroom, field experience with processing and interpretation of the collected data. The topics covered during the lectures are organized as follows:* *PART I: Introduction to applied geophysics* *Physical properties of the Earth and rocks and geophysical investigation methods; active and passive methods; noise; surveys, profiles and maps; resolution; planning a geophysical survey. The geophysical signal: Fourier transform; sampling theorem, spatial and temporal aliasing. Filters. Forward and Inverse Problem in geophysics.* *PART II: Seismic methods* *Elastic properties of rocks, propagation of elastic waves, reflection and refraction, energy loss, equipment and acquisition techniques.* *Seismic refraction method. Principles of the seismic refraction method. Geometry of refracted raypaths. Travel time equation for stratified soils. Time-distance graphs for planar and dipping layers. Hidden-layer problem. Down-Hole and Cross-Hole investigations. Execution and interpretation of seismic tomographies. Examples of applications.* *Seismic reflection method. General principles. Travel time equation and time-distance graphs. Normal Move Out (NMO). Common Mid Point (CMP) technique.*

	Processing and velocity analysis. Stacked sections and migration. Examples of applications. *PART III: Marine Geophysical investigations* *Definition of the physical-chemical characteristics of the marine environment. Instrumental equipment for marine exploration. Examples of applications.* *PART IV: Electrical methods* *Geoelectric method. Theoretical principles; electrical conduction in rocks and minerals; Archie's law; electrode configurations. Measurement equipment and acquisition techniques. Vertical electrical sounding; horizontal electrical sounding; electrical tomography (ERT). Execution and interpretation of electrical tomographies. Application examples.* *Outline of induced polarization and self potential methods.* *PART V: Potential methods* *Gravity method. Physical basis, Newton's lows. Gravitational field and gravitational potential; Geoid and approximate models. Normal gravity and international formula of gravity. Densities of rocks. Instruments and acquisition techniques. Correction of gravity measurements, Bouguer anomalies, regional and residual anomalies. Gravity anomalies produced by bodies caused by simple shaped bodies. Examples of applications.*
Books and bibliography	*J.M. Reynolds, An introduction to applied and environmental geophysics. John Wiley and Sons.* *Carrara E., Rapolla A., Roberti N., I metodi geoelettrico e sismico per le indagini superficiali del sottosuolo, LIGUORI EDITORE.* *Santarato G., Nasser A.Z., Bignardi S., Lezioni di geofisica Applicata. libreriauniversitaria.it*
Additional materials	*The reference texts will be integrated with the lecture notes.*

Work schedule			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
Hours			
225	*63*	*30*	*132*
ECTS			
9	*7*	*2*	

Teaching strategy	*Lessons supported by Power Point presentations. Practical experiences with instrumental measurements on field, processing and interpretation of data with IT tools.*
Expected learning outcomes	
Knowledge and understanding on:	Students will develop knowledge and understanding of the physical principles related to seismic, electrical and potential methods and parameters. Students will obtain a knowledge of survey methods with reference to data acquisition and processing techniques aimed at defining the physical-geometric characteristics of geological bodies, natural resources and / or artificial structures, in the framework

	of environmental study. Such knowledge and skills will be acquired through theoretical lessons.
Applying knowledge and understanding on:	Students will develop knowledge and understanding on the planning, the acquisition and the analysis of data relating to the geophysical methods covered by the course. Students will be able to correctly display data and results and interpret the results in different application areas. Such knowledge and skills will be developed through data processing exercises and practical experiences.
Soft skills	• *Making informed judgments and choices* Students will acquire the ability to identify the most suitable survey techniques for the study of specific environmental problems. This objective will be achieved in the context of theoretical lessons and discussions related to case studies reported in the scientific literature. • *Communicating knowledge and understanding* Students will develop abilities to report and show the studied principles and concepts; they will develop the ability to describe the techniques and procedures for acquiring, processing, representing and interpreting data with clarity and appropriate language. • *Capacities to continue learning* Students will acquire the ability to deepen and integrate the knowledge acquired in the field of geophysical techniques covered by the course, to develop autonomous ability and reasoning aimed at updating topics and identifying the multidisciplinary aspects.

Assessment and feedback	
Methods of assessment	*Oral. The activity carried out during the exercises, as well as the assiduity of the attendance of lessons and exercises will also contribute to the final evaluation.*
Evaluation criteria	• *Knowledge and understanding* The student will have to demonstrate the knowledge of the fundamental characteristics of the geophysical prospections' methods covered by the course and of the investigated geophysical parameters. The oral exam is aimed at ascertaining the level of knowledge achieved. Mastery of the fundamental concepts outlined above is an indispensable requirement for passing the exam. • *Applying knowledge and understanding* The student will have to be able to use the acquired knowledge to plan a geophysical investigation and to identify the correct data acquisition, processing and interpretation procedures. The verification of the skills acquired will be conducted during the oral exam and during the exercise and practical activities. • *Autonomy of judgment* The student will have to be able to identify and argue, for a specific problem, the most suitable methodological choices for solving the problem. The achievement of this objective will be verified with a discussion of specific problems during the oral exam, but also during the exercise and practical activities. • *Communicating knowledge and understanding* The student will have to be able to communicate the concepts learned with clarity and appropriate language, which do not give rise to ambiguity or misunderstandings and to present data effectively. These skills will be verified both during the exercises and the oral exam. • *Communication skills*

	The student will have to be able transfer the acquired know-how to environmental issues, and effectively communicate through written and oral presentations. • *Capacities to continue learning* ○ The student will have to be able to deepen the topics covered through individual activity that show the ability to make connections with the other subject areas and, in perspective, to update topics and knowledge.
Criteria for assessment and attribution of the final mark	*The final grade is on a 18-30 scale. The exam is passed when the grade is greater than or equal to 18*
Additional information	

Bari, 17/09/2021

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