General information		
Academic subject	GEOPHYSICS	
Degree course	Scienze Ambientali (L32) - **Environmental Sciences**	
Academic Year	*2021/2022*	
European Credit Transfer and Accumulation System (ECTS)		9
Language	*Italian*	
Academic calendar (starting and ending date)	*01/03/2022 – 31/05/2022*	
Attendance	Strongly recommended	

Professor/ Lecturer	
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Virtual headquarters	*Miscrosoft Teams*
Tutoring (time and day)	Tuesday from 12:00 am to 1:00 pm with prenotation

Syllabus	
Learning Objectives	*Earth interior by using physical parameters*
Course prerequisites	Knowledge of Mathematics, Physics, Earth Science.
Contents	The course consists of 7 credits of lectures and 2 of exercises with classroom exe with notes on some programs). The topics covered during the lectures can be grouped into 3 main parts, the first seismology, the second to gravimetry and the third to geomagnetism. Attendance to the course is strongly recommended. **SEISMOLOGY** ELASTICITY THEORY. Elastic, anelastic and plastic characteristics of materials. Stress The elastic constants: Hooke's law. The solution of the seismic wave equation. PROPAGATION OF SEISMIC WAVES INSIDE THE EARTH. Longitudinal (P) and transv SH) waves. Propagation velocity of body waves and their relationship with dens waves of Rayleigh and Love, dispersion. Location of an earthquake. Seismog seismograms. Intensity scales. Magnitude and energy. Origin of earthquakes. Fo mechanism. Asperities and barriers. Solution of the fault plan. Attenuation of seis Quality Factor Q. Huyghens principle. Fermat principle. Reflection and refraction waves. Conical waves. Dromochronous of direct waves. Reflection seismology: or interface. Refraction seismology: two-layer model; multi layer model. Earth with spherical layers: radius parameter. Travel time as a function of speed distribu dromochronous for a spherical earth in the case of nearby earthquakes. Inversio Application of the inversion equation: special cases (decrease in speed with d increase in speed with depth). SEISMICITY AND STRUCTURE OF THE INTERIOR OF THE EARTH. Earth seismicity tectonics theory. Lithosphere, Astenosphere. Seismic waves and structure of the the Earth. Crust, mantle, core. Variation of seismic wave velocity and elastic parar depth. Difference of continental / oceanic structures, lateral variations. Adams- equation: variation of density and gravity with depth. Latest global models of the s

	the interior of the Earth. Changes to the mantle / core passage, laboratory indicatic forecast and prevention; seismic precursors. Notes on seismic risk, seismic haza classification, seismic rules. Seismic microzonation. GRAVIMETRY THE GRAVITY OF THE EARTH. Newton's law of universal gravitation. Earth rotation. N systems. Centrifugal force. Force of gravity. Field and gravity potential. EARTH SHAPE AND DIMENSIONS. Real shape of the Earth. Geoid, spheroid, ellipsoi equation. Crushing of the spheroid. Moment of inertia with respect to the pol variation of density with depth. Dynamic ellipticity and flattening of the spheroid. the spheroid. Clairaut's theorem. Reference ellipsoid. Normal gravity. Internationa Formula of gravity. REDUCTION AND INTERPRETATION OF GRAVITY OBSERVATIONS. Free air reduction. of Bouguer. Topographical correction. Bouguer anomalies: definition and physica Gravimetric anomalies separation. Qualitative and quantitative interpretation anomalies. THEORY OF ISOSTASY. The discovery of isostasia. Airy hypothesis and Pratt Isostatic anomalies. Isostatic compensation and vertical crustal movements. Tests Isostasia and crustal structure. TERRESTRIAL TIDES. Tidal force. Tidal friction and its effects. GEOMAGNETISM THE TERRESTRIAL MAGNETIC FIELD. Generality. Elements of the Earth's magnetic f and non-dipolar fields. Secular variation and drift to the west. Temporal variations o magnetic field. Origin of the Earth's magnetic field. The magnetic properties of roc PALEOMAGNETISM. Rock magnetization: thermoremanent, depositional, magnetization. Archeomagnetism and secular variation. Paleomagnetic poles and of the axial dipole. Inversions of the Earth's magnetic field. Poles migration and cor Magnetic marine anomalies and expansion of ocean bottoms: the Vine-Matthews
Books and bibliography	LOWRIE W.: Fundamentals of Geophysics. Cambridge University Press. Seconda E 2007. FOWLER C.M.R.: The solid Earth. Cambridge University Press. Seconda Edizione, 20 GASPARINI P, MANTOVANI M.S.M: Fisica della Terra solida, 1984
Additional materials	The texts must be integrated with the lecture notes and the web pages suggested b the teacher during the lessons.

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	*6*	*3*	

Teaching strategy	
	Frontal lessons supported by PowerPoint presentations, classroom exercises with problem solving and data interpretation also using computer tools implemented on a laptop. Students will be encouraged to actively discuss with each other and with the teacher the problems encountered in completing the

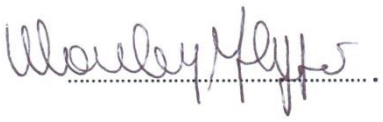
	exercises and the reasons for any failures in their completion, so as to identify the main possible causes of errors.
Expected learning outcomes	
Knowledge and understanding on:	Knowledge of the main geophysical characteristics of the Earth (seismic wave density, gravity, gravimetric field, magnetic field); acquisition of the basic notio the location of earthquakes and the determination of their magnitude. This knowl be acquired through theoretical lessons. ○
Applying knowledge and understanding on:	Ability to apply the knowledge acquired during the course necessary for the desc the main seismological, gravimetric and magnetic characteristics of the Ea verification of the acquired skills will be carried out through exercises and problem out during practical exercises in the classroom. ○
Soft skills	• *Making informed judgments and choices* Acquisition of the ability to: locate the sources of earthquakes, to determ magnitude and their focal mechanism; to know the difference between predic prevention, with the ability to read seismic hazard and seismic risk maps; to Bouguer anomalies, and to be able to read gravimetric and magnetic m achievement of these objectives will be verified on the basis of the results achiev exercises carried out during the classroom exercises. • *Communicating knowledge and understanding* Ability to exhibit the fundamental concepts of the study themes and ability to des main geophysical methodologies; ability to process and interpret data with cl language properties; ability to work independently and / or in a team. The verifi these skills will be assessed on the basis of how to relate to others in group wo the exercises and participation in the discussion of particular cases. • *Capacities to continue learning* Acquisition of the ability to grasp the links between the various teaching topics a of other subjects of the course of study. For this purpose, during lectures and e the student will be asked to resume the contents of previous courses that have an essential starting point for mastering the conceptual developments covered d course. The acquisition of adequate learning ability is also stimulated by partici seminars and traineeships.

Assessment and feedback	
Methods of assessment	
Evaluation criteria	• *Knowledge and understanding* The student will have to demonstrate his knowledge of the fundamental concept Physics by proving that he has understood the main seismological, gravime magnetic notions of the Earth. The level of knowledge achieved, and the maste fundamental concepts will be verified through the discussion of the topics studi an oral exam. Evidence of a lack of understanding of the fundamental concepts the interruption of the exam and the referral of the student to a subsequent app • *Applying knowledge and understanding* The student must be able to use the basic acquired knowledge to deal with a seismological problem (e.g. locating an earthquake), gravimetric (e.g. obtaining gravimetric measurements) and magnetic (e.g. determining the position of a magnetic paleo-pole); he must also be able to follow the

	correct procedures in the acquisition, processing and interpretation of geophysical data. The verification of the skills acquired will be conducted through practical tests performed during the exercises, also assessing the ability of a dialectical interaction with the course colleagues. The ability to succeed in completing the aforementioned tests will be one of the elements that will contribute to defining the overall assessment of the student and the final grade. If the student, at the end of his / her training course, does not demonstrate that he / she has acquired the necessary skills, this gap may result in the failure to pass the exam and the need for the student to return to a subsequent appeal. • *Autonomy of judgment* The student must be able to solve a geophysical question relating to the cours making the most suitable methodological choices for solving the probl achievement of this objective will be verified on the basis of the results achiev tests conducted during the exercises and through the proposition, during examination, of seismological, gravimetric and geomagnetic problems, with re which the student will have to be able to identify the best procedures to deal w Failure to acquire an adequate propositional capacity with respect to the metho used in specific problems implies a significant penalty in the final vote. • *Communicating knowledge and understanding* The student must be able to describe clearly and with language properties all t covered during the course, which do not give rise to ambiguity or misunderstan must also be able to dialogue and relate to other students. The verification of th will be assessed on the basis of the language property shown in the discussion of proposed during the application tests and the display methods shown during the o The insufficient mastery of language ownership will be reflected in a penalty of vote, with foreclosure of the possibility of achieving the maximum mark. • *Communication skills* • *Capacities to continue learning* The student must be able to independently acquire further knowledge starting from the basis of the contents transmitted during the course and making connections with other subjects of the course of study.
Criteria for assessment and attribution of the final mark	The level reached in this capacity will be verified through the discussion of the exam topics. The demonstration of an acquired ability to broaden one's knowledge with an autonomous learning path can have recognition through the attribution of a maximum mark with honors.
Additional information	

Bari,
14/09/2021

Firma



(Prof.)

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