



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

REGULATION OF STUDIES OF THE PROGRAMME

LM-74 GEOLOGIA PER LO SVILUPPO SOSTENIBILE
GEOLOGY FOR SUSTAINABLE DEVELOPMENT – Curriculum RAW MATERIALS EXPLORATION AND SUSTAINABILITY

Bologna Campus

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ART. 1 ADMISSION REQUIREMENTS

a. Knowledge required for admission

Admission to the 2nd cycle degree program is subject to the possession of a three-year university degree or other suitable qualification obtained abroad. Moreover, candidates must meet the curricular requirements and their personal competences and skills deemed satisfactory for admission to the course.

Curricular requirements

Curricular requirements are met through one of the two options provided:

1. having obtained a first cycle degree in one of the following classes ex. Italian Ministerial Decree no. 270:

- Geological Sciences (L-34)
- Natural Sciences (L-32)
- Civil and environmental engineering (L-7)

or an academic qualification obtained abroad deemed equivalent to those listed above.

2. being a holder of a first cycle degree programme and having acquired at least 30 CFU/ECTS distributed in the geological (GEO) discipline subject area.

The English language proficiency at CEFR B2 level is required for the admission.

Admission to the degree programme is also subject to the passing of a test to assess the candidates' personal competences and skills, as detailed in the dedicated section.

b. Assessment of personal competences and skills

The assessment of the personal preparation of the candidate is carried out by the Admission Commission through the evaluation of the documents submitted by the candidate. The personal competences and skills of the candidate are deemed satisfactory in case they are a holder of degree in Geological Sciences (L-34) or equivalent academic qualification obtained abroad. In all other cases, the candidate is required to take part in an interview, which can be carried out in person or online.

In order to pass the assessment, the candidates need to have basic knowledge of math, chemistry, physics and geology, with particular focus on:

- competences in chemistry, physics, math and informatics which represent a solid scientific cultural background and specifically the ability to describe and interpret geological processes;
- competences in Earth Sciences necessary to understand the theory and practical outcomes of the evolution of the planet;
- knowledge of methods and practices necessary for outdoor, laboratory and on the field training activities aimed at geological analysis.

Candidates will also be evaluated on the overall motivation, innovation and entrepreneurial potential related to the themes covered by the EIT KIC on Raw Materials.

ART. 2 MOBILITY RULES BETWEEN DEGREE PROGRAMME CURRICULA

The programme is structured in curricula (one in Italian and one in English).

Students may choose from the courses available in the course structure diagram, following the methods indicated in the structure itself and in the terms indicated annually the School and published on the University website.

According to the same criteria, the Degree Programme Board also assesses the applications to transfer between curricula.

ART. 3 INDIVIDUAL STUDY PLANS

Individual study plans may be presented in the terms laid down annually by the Department and published on the University website.

The Degree Programme Board assesses the study plans presented on the basis of their coherence with the Degree Programme Teaching regulations and the coherence with the learning outcomes of the degree programme.

ART. 4 IMPLEMENTATION OF LEARNING ACTIVITIES AND TYPES OF TEACHING ACTIVITIES

The enclosed teaching plan indicates all the learning activities and their division into hours of classroom teaching, practical exercises or internship, as well as the type of teaching methods. Any further information will be published annually on the University website.

ART. 5 PART-TIME STUDENT STATUS

The student can choose to enroll as a part-time student that allows to complete the course of study in a time longer or shorter to the normal duration (2 years for the Second Cycle degree programmes) according to the procedures laid down in the University Teaching Regulation.

The teaching activities foreseen by the course of study, in case of necessary disablement, can be replaced, to guarantee the quality and sustainability of the educational offer.

ART. 6 ASSESSMENT OF LEARNING ACTIVITIES

The attached teaching plan indicates all cases in which the learning activities end with an exam, marked with a score out of 30 or by simple "pass" in the case of having acquired the relative competencies.

The assessment methods (oral, written or practical exam or any combination thereof; individual or group exams) are laid down annually by the Degree Programme during the presentation of the teaching plan and notified to the students via the University website prior to start of the programme.

ART. 7 ELECTIVE LEARNING ACTIVITIES

Students may select one or more learning activities autonomously from among those identified by the Degree Programme Board and listed in the enclosed Course Structure Diagram.

If students intend to sit exams concerning an activity that is not included among those available through the online procedure, they should apply to the Degree Programme Board in the terms laid down annually and published on the University website. The Board will assess the coherence of the choice with the student's study programme.

ART. 8 CRITERIA FOR THE RECOGNITION OF CREDITS ACQUIRED IN DEGREE PROGRAMMES IN THE SAME CLASS

The acquired university credits are recognised up to the number of credits indicated for the same subject area.

If having recognised the credits according to the provisions of this regulation, there are unused residual credits, the Degree Programme Board may recognise them by assessing the specific case in coherence with the teaching and cultural affinities.

Referring to degree programmes delivered in a language other than Italian, recognition refers to course units delivered or learning activities undertaken in that language.

ART. 9 CRITERIA FOR THE RECOGNITION OF CREDITS ACQUIRED WITHIN DEGREE PROGRAMMES IN DIFFERENT CLASSES, FROM TELEMATIC UNIVERSITIES OR INTERNATIONAL DEGREE PROGRAMMES

The acquired credits are recognised by the Degree Programme Board according to the following criteria:

- analysis of the course contents
- assessment of the coherence of the scientific-disciplinary fields and the contents of the learning activities in which the student has acquired the credits with the specific learning outcomes of the study programme and the individual learning activities to be recognised, in any case pursuing the aim of promoting student mobility.

The credits are recognised up to the maximum number of university credits provided for in the programme.

If having recognised the credits according to the provisions of this regulation, there are unused residual credits, the Degree Programme Board may recognise them by assessing the specific case in coherence with the teaching and cultural affinities.

Referring to degree programmes delivered in a language other than Italian, recognition refers to course units delivered or learning activities undertaken in that language.

ART. 10 CRITERIA FOR THE RECOGNITION OF EXTRA-UNIVERSITY COMPETENCIES AND SKILLS

Competences acquired outside of the university may be recognised in the following cases:

- professional knowledge and skills certified under the terms of the applicable laws;
- competences and skills acquired in post-graduate learning activities run or planned by the University.

The request for recognition shall be assessed by the Degree Programme Board considering the indications of the academic bodies and the maximum number of recognisable credits laid down in the Degree Programme Teaching Regulations.

This recognition is subject to the activities being coherent with the specific learning outcomes of the degree programme and the learning activities which are recognised, also in consideration of the contents and duration in hours of the implemented activity.

ART. 11 CURRICULAR INTERNSHIP

The Degree Programme includes two mandatory internships of respectively 9 and 15 CFU/ECTS. The latter must be dedicated to the preparation of the final examination (thesis project).

ART. 12 FINAL EXAMINATION

a. Characteristics of the final examination

The Final Examination for obtaining the Master's degree consists in a thesis that has to be written and elaborated in an original fashion by the student, and in its discussion in front of a Degree Commission. The thesis deals with and tackles a scientific problem on a topic compatible with the objectives of the curriculum and is devoted to the recognition, evaluation and management of primary and secondary raw materials within a broader circular economy framework, eventually in combination with a strong entrepreneurial orientation. The thesis, carried out under the guidance of a supervisor, has to contain a section dealing with the phase of analysis and interpretation of the gathered data, possibly of an experimental nature, which may also include the collection of data in the field and/or in the laboratory. By the end of the Final Examination the students are expected to demonstrate that they have the ability to operate autonomously and with critical ability, and to present and discuss the results of their dissertation with clarity and full mastery. The Final Examination can be linked to a project or an internship activity.

b. Modalities of the final examination

The thesis is discussed publicly during a specific final examination session in front of a Board with the support of slides. The Board is composed by at least three members. The student illustrates the thesis project and its results in 15 minutes, followed by a Q&A session with the Board.

The thesis is evaluated by the supervisor and the opponent who submit a written grade to the degree programme director. The evaluation of the supervisor (expressed in points out of 10) assesses the autonomy, accuracy and results. The evaluation of the opponent (expressed in point out of 10) assesses the consistency, editorial accuracy and overall methodology.

The final grade is the sum of the following evaluations:

- a) grade out of one hundred and ten (/110) determined by the weighted average of the candidate;
- b) +1 point if the student is completing the course during its regular duration (2 academic years);
- c) average of the evaluations of the supervisor and opponent;
- d) evaluation of the Board awarding from -2 to +2 points, based on the quality of the discussion and the effectiveness and accuracy of the answers of the Q&A session.

The sum of the evaluations c) and d) is rounded to the nearest whole number, expressed as out of 10. The honours (lode) is automatically granted by the Board if the sum is equal or above 113. If the sum is a grade between 110 and 113 the supervisor, the opponent or one of the members of the Board can propose the awarding of the honours, which can only be granted by unanimous decision.

The Joint Teacher-Student Committee expressed its favourable opinion under the terms of article 12 para. 3 of Ministerial Decree no. 270/04.

Anno Accademico 2024/2025
Scuola Scienze
Classe LM-74-SCIENZE E TECNOLOGIE GEOLOGICHE
Corso 6050-GEOLOGIA PER LO SVILUPPO SOSTENIBILE
Curriculum: RAW MATERIALS EXPLORATION AND SUSTAINABILITY (B60)

Primo Anno di Corso

Gruppo: 1) Compulsory Learning Activities

TAF: Ambito:

Cfu min: Cfu max:

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
6050 000 000 91560 - 0 - APPLIED PETROLOGY	CON	GEO/07		8	16/20/48/0	No	Voto
Ambito: 470 - Discipline mineralogiche, petrografiche e geochimiche Obiettivi: This course covers the quantitative methods used to infer the evolution of igneous and metamorphic rocks from their mineral assemblages and textures. Students will learn a variety of approaches, from field study to thermodynamic calculations, all of which help to draw conclusions on multi-scale observations of real rocks. Applied petrology includes the understanding of how predictive models for rocks under different pressures, temperatures and fluid compositions are carried out, with a special emphasis on raw materials in general. This unit comprises the study of published work showing the application of petrological methods to ore geology. Knowing basic petrologic concepts and how to perform a microstructural study on thin sections using optical and electronic microscopies are a prerequisite. Obiettivi inglese: This course covers the quantitative methods used to infer the evolution of igneous and metamorphic rocks from their mineral assemblages and textures. Students will learn a variety of approaches, from field study to thermodynamic calculations, all of which help to draw conclusions on multi-scale observations of real rocks. Applied petrology includes the understanding of how predictive models for rocks under different pressures, temperatures and fluid compositions are carried out, with a special emphasis on raw materials in general. This unit comprises the study of published work showing the application of petrological methods to ore geology. Knowing basic petrologic concepts and how to perform a microstructural study on thin sections using optical and electronic microscopies are a prerequisite.			B				
6050 000 000 88387 - 0 - ENVIRONMENTAL IMPACT, LCA AND URBAN MINING	CON	CHIM/12		6	47/14/6/0	No	Voto
Ambito: 1144 - Attività formative affini o integrative Obiettivi: The aim of the course is to learn, understand and employ assessment tools with regard to the cycles of chemical substances and material (MFA, Material Flow Analysis) in the ecosphere and technosphere; to interpret and use sustainability indicators; to know methodologies for the evaluation of the territorial environmental impacts generated by industrial plants, from preliminary study to monitoring; to learn and apply LCA (Life Cycle Assessment) methodology to estimate the environmental effects associated to products, manufacturing systems and services, with a specific focus on chemical processes; to be acquainted with the technologies for the recovery of inorganic and metallic resources and secondary raw materials, and with systems and processes for the optimization of critical raw-materials cycle closure. Obiettivi inglese: The aim of the course is to learn, understand and employ assessment tools with regard to the cycles of chemical substances and material (MFA, Material Flow Analysis) in the ecosphere and technosphere; to interpret and use sustainability indicators; to know methodologies for the evaluation of the territorial environmental impacts generated by industrial plants, from preliminary study to monitoring; to learn and apply LCA (Life Cycle Assessment) methodology to estimate the environmental effects associated to products, manufacturing systems and services, with a specific focus on chemical processes; to be acquainted with the technologies for the recovery of inorganic and metallic resources and secondary raw materials, and with systems and processes for the optimization of critical raw-materials cycle closure.			C				

6050 000 000 B2107 - 0 - GEOCHEMISTRY OF RAW MATERIALS AND THEIR ENVIRONMENTAL APPLICATIONS	CON	GEO/05	8	64/0/0/0	No	Voto
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Ambito: 437 - Discipline geomorfologiche e geologiche applicative

B

Obiettivi: This course aims at providing integrated and quantitative geochemical tools that can be used for modelling the genesis of primary mineral deposits and evaluate the environmental impact of exploited mine sites. The course is divided in two modules and combines the use of theoretical models of fluid-mineral equilibria with practical aspects of the analysis of fluids and gases in natural environments.

Our aim is providing the students with specific competence on fluid-rock interaction modelling that can be applied for the studies of primary and secondary raw materials, and competence on the practical aspects of fluid-gas analysis and their interpretation using case studies.

Obiettivi inglese: This course aims at providing integrated and quantitative geochemical tools that can be used for modelling the genesis of primary mineral deposits and evaluate the environmental impact of exploited mine sites. The course is divided in two modules and combines the use of theoretical models of fluid-mineral equilibria with practical aspects of the analysis of fluids and gases in natural environments.

Our aim is providing the students with specific competence on fluid-rock interaction modelling that can be applied for the studies of primary and secondary raw materials, and competence on the practical aspects of fluid-gas analysis and their interpretation using case studies.

6050 000 000 96018 - 0 - GEOPHYSICAL EXPLORATION	CON	GEO/10	6	48/0/0/0	No	Voto
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Ambito: 429 - Discipline geofisiche

B

Obiettivi: At the end of the course, the student:

- knows the basic principles of the main geophysical exploration techniques (seismic, electric, magnetic, electromagnetic and gravimetric methods);

- the application fields and limitations of each technique

in respect to different environmental, geotechnical, subsoil exploitation and protection problems, at small and large scale.

Obiettivi inglese: At the end of the course, the student:

- knows the basic principles of the main geophysical exploration techniques (seismic, electric, magnetic, electromagnetic and gravimetric methods);

- the application fields and limitations of each technique

in respect to different environmental, geotechnical, subsoil exploitation and protection problems, at small and large scale.

6050 000 000 91585 - 0 - MINERAL DEPOSITS IN THE FIELD	CON	GEO/03	8	32/0/48/0	No	Voto
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Ambito: 436 - Discipline geologiche e paleontologiche

B

Obiettivi: The rationale of this course is to illustrate and provide an overview of the role deformation plays in both the genesis and spatial distribution of ore deposits. This will be done by combining traditional class lectures and lab style exercises with seminar-style classes based on reading and student presentations and a few days directly at the outcrop. This combined approach will allow students to develop theoretical and practical skills related to asking and assessing scientific questions as well as summarizing and presenting the results of scientific studies dealing with the role exerted by rock deformation and fluid/rock interaction in deformed contexts. The course will review the concepts, theoretical knowledge and techniques of Structural Geology that are relevant to understanding ore genesis and exploration of ore deposits. It will also provide hands-on field work to help strengthen the theoretical knowledge and provide the students with a solid understanding of the involved mechanisms and processes. Students will thereby learn the simple principles of "Structural Control" and how to elaborate the best practices for structural data collection and analysis in mineral exploration and mining.

Obiettivi inglese: The rationale of this course is to illustrate and provide an overview of the role deformation plays in both the genesis and spatial distribution of ore deposits. This will be done by combining traditional class lectures and lab style exercises with seminar-style classes based on reading and student presentations and a few days directly at the outcrop. This combined approach will allow students to develop theoretical and practical skills related to asking and assessing scientific questions as well as summarizing and presenting the results of scientific studies dealing with the role exerted by rock deformation and fluid/rock interaction in deformed contexts. The course will review the concepts, theoretical knowledge and techniques of Structural Geology that are relevant to understanding ore genesis and exploration of ore deposits. It will also provide hands-on field work to help strengthen the theoretical knowledge and provide the students with a solid understanding of the involved mechanisms and processes. Students will thereby learn the simple principles of "Structural Control" and how to elaborate the best practices for structural data collection and analysis in mineral exploration and mining.

6050 000 000 91556 - 0 - MINERAL SCIENCE	CON	GEO/06	9	48/0/36/0	No	Voto
Ambito:	470 - Discipline mineralogiche, petrografiche e geochimiche					
Obiettivi:	The aim of this course is to provide detailed knowledge on physical, chemical, mechanical properties and characterization of mineral raw materials. The course examines in-depth aspects of mineralogy, crystal-chemistry, crystallography, advanced thermodynamics, and solid state physics related to minerals of primary and secondary sources. The course also deals with classical characterization methods to understand the basics of physical-chemical, thermodynamic, reaction kinetics and mechanical properties of mineral raw materials. The aim of this course is to provide detailed knowledge on physical, chemical, mechanical properties and characterization of mineral raw materials. This module will also provide classical laboratory sessions that through captivating specific discussions, fostered by updated literature review on selected papers, will provide the students practical and critical knowledge, analysis and review of mineral raw materials. Finally, student working groups on specific experimental laboratory sessions on themes related to mineral raw materials will offer the students mutual interaction, knowledge share and cross-thinking.					
Obiettivi inglese:	The aim of this course is to provide detailed knowledge on physical, chemical, mechanical properties and characterization of mineral raw materials. The course examines in-depth aspects of mineralogy, crystal-chemistry, crystallography, advanced thermodynamics, and solid state physics related to minerals of primary and secondary sources. The course also deals with classical characterization methods to understand the basics of physical-chemical, thermodynamic, reaction kinetics and mechanical properties of mineral raw materials. The aim of this course is to provide detailed knowledge on physical, chemical, mechanical properties and characterization of mineral raw materials. This module will also provide classical laboratory sessions that through captivating specific discussions, fostered by updated literature review on selected papers, will provide the students practical and critical knowledge, analysis and review of mineral raw materials. Finally, student working groups on specific experimental laboratory sessions on themes related to mineral raw materials will offer the students mutual interaction, knowledge share and cross-thinking.					

6050 000 000 95940 - 0 - POLITICAL ECONOMY OF INDUSTRY AND DEVELOPMENT	CON	SECS-P/06	6	48/0/0/0	No	Voto
Ambito:	1144 - Attivita' formative affini o integrative					
Obiettivi:	Through this course the student acquires knowledge in the field of political economy of industry and territorial economic development with particular reference both to company strategy and government policy perspectives. The evolution of the debate and the main theoretical contributors in this field will be analysed and discussed. Relevant case studies will be studied and offered to the classroom as material for the understanding of "real world" issues with reference to Italy, Europe, highly industrialised and the so called emerging countries. The course is structured in three modules: a) introduction to the main concepts and tools in political economy, economics, economic policy; b) industry, company strategy and government policy; c) structural change, development and sustainability. Teaching consists of formal lectures and classes that require the active participation of students.					
Obiettivi inglese:	Through this course the student acquires knowledge in the field of political economy of industry and territorial economic development with particular reference both to company strategy and government policy perspectives. The evolution of the debate and the main theoretical contributors in this field will be analysed and discussed. Relevant case studies will be studied and offered to the classroom as material for the understanding of "real world" issues with reference to Italy, Europe, highly industrialised and the so called emerging countries. The course is structured in three modules: a) introduction to the main concepts and tools in political economy, economics, economic policy; b) industry, company strategy and government policy; c) structural change, development and sustainability. Teaching consists of formal lectures and classes that require the active participation of students.					

6050 000 000 91558 - 0 - PRIMARY MINERAL DEPOSITS	CON	GEO/09	9	48/0/36/0	No	Voto
Ambito:	470 - Discipline mineralogiche, petrografiche e geochimiche					
Obiettivi:	The objective of this course is giving a system and integrated view of the geological processes that lead to the genesis of the main primary raw materials using a combination of field, laboratory, and numerical methods. The fundamental subjects of this course will be the geological characteristics of the most important classes of ore deposits, which include the magmatic, magmatic-hydrothermal, hydrothermal exhalative, orogenic-Au, Mississippi valley type, banded iron formations (BIF), and placer deposits. The geothermal fields will be considered as proxies of currently forming ore deposits. The scientific methods used in the course will be field mapping of ore bodies and wallrock alteration, the petrographic, mineralogical, and geochemical study of ore bodies and wallrock alteration; the fluid inclusion studies; stable isotope studies; fluid-rock equilibria. At the end of the course, the students will learn how to distinguish and identify with various techniques samples from different deposit types.					
Obiettivi inglese:	The objective of this course is giving a system and integrated view of the geological processes that lead to the genesis of the main primary raw materials using a combination of field, laboratory, and numerical methods. The fundamental subjects of this course will be the geological characteristics of the most important classes of ore deposits, which include the magmatic, magmatic-hydrothermal, hydrothermal exhalative, orogenic-Au, Mississippi valley type, banded iron formations (BIF), and placer deposits. The geothermal fields will be considered as proxies of currently forming ore deposits. The scientific methods used in the course will be field mapping of ore bodies and wallrock alteration, the petrographic, mineralogical, and geochemical study of ore bodies and wallrock alteration; the fluid inclusion studies; stable isotope studies; fluid-rock equilibria. At the end of the course, the students will learn how to distinguish and identify with various techniques samples from different deposit types.					

Secondo Anno di Corso

Gruppo: 1) Compulsory Learning ActivitiesTAF: **Ambito:**

Cfu min: Cfu max:

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
6050 000 000 60750 - 0 - FINAL EXAMINATION	CON			15	0/0/0/0	No	
<p>Ambito: 1018 - Per la prova finale</p> <p>Obiettivi: The Final Examination for obtaining the Master's degree consists in a thesis that has to be written and elaborated in an original fashion by the student, and in its discussion in front of a Degree Commission. The thesis deals with and tackles a scientific problem on a topic compatible with the objectives of the curriculum and is devoted to the recognition, evaluation and management of primary and secondary raw materials within a broader circular economy framework, eventually in combination with a strong entrepreneurial orientation. The thesis, carried out under the guidance of a supervisor, has to contain a section dealing with the phase of analysis and interpretation of the gathered data, possibly of an experimental nature, which may also include the collection of data in the field and/or in the laboratory. By the end of the Final Examination the students are expected to demonstrate that they have the ability to operate autonomously and with critical ability, and to present and discuss the results of their dissertation with clarity and full mastery. The Final Examination can be linked to a project or an internship activity.</p> <p>Obiettivi inglese: The Final Examination for obtaining the Master's degree consists in a thesis that has to be written and elaborated in an original fashion by the student, and in its discussion in front of a Degree Commission. The thesis deals with and tackles a scientific problem on a topic compatible with the objectives of the curriculum and is devoted to the recognition, evaluation and management of primary and secondary raw materials within a broader circular economy framework, eventually in combination with a strong entrepreneurial orientation. The thesis, carried out under the guidance of a supervisor, has to contain a section dealing with the phase of analysis and interpretation of the gathered data, possibly of an experimental nature, which may also include the collection of data in the field and/or in the laboratory. By the end of the Final Examination the students are expected to demonstrate that they have the ability to operate autonomously and with critical ability, and to present and discuss the results of their dissertation with clarity and full mastery. The Final Examination can be linked to a project or an internship activity.</p> <p>Note: The activity does not imply your continuous presence in Unibo premises nor at external companies/institutions.</p>							
6050 000 000 90029 - 0 - GEOSTATISTICS AND ENVIRONMENTAL MODELLING	CON	ING-IND/28		6	0/0/0/0	No	Voto
<p>Ambito: 1276 - Discipline ingegneristiche, giuridiche, economiche e agrarie</p> <p>Obiettivi: The course aims at providing the elements needed to characterize and model geo-resources for exploitation and environmental rehabilitation projects.</p> <p>Obiettivi inglese: The course aims at providing the elements needed to characterize and model geo-resources for exploitation and environmental rehabilitation projects.</p>							
6050 000 000 85201 - 0 - INTERNSHIP				6	0/0/150/0	No	Giudizio
<p>Ambito: 1146 - Tirocini formativi e di orientamento</p> <p>Obiettivi: At the end of the internship, the student has scientific, technical-professional and/or management skills in different sectors of Earth Sciences which can contribute to his/her entry into the work and/or research. In particular, the student is able to carry out one or more of the following activities: select, analyze and interpret field and/or laboratory data, including experimental data; evaluate and interpret data for the planning and design of geological interventions; work independently, demonstrating the ability to adapt to new situations; interact with technicians and experts from other specializations and disciplines.</p> <p>Obiettivi inglese: At the end of the internship, the student has scientific, technical-professional and/or management skills in different sectors of Earth Sciences which can contribute to his/her entry into the work and/or research. In particular, the student is able to carry out one or more of the following activities: select, analyze and interpret field and/or laboratory data, including experimental data; evaluate and interpret data for the planning and design of geological interventions; work independently, demonstrating the ability to adapt to new situations; interact with technicians and experts from other specializations and disciplines.</p>							

6050 000 000 70040 - 0 - RESOURCES AND RECYCLING CON ING-IND/29 6 48/0/0/0 No Voto

Ambito: 1144 - Attivita' formative affini o integrative C

Obiettivi: The aim of this course is to develop cultural, scientific and technical aspects for the enhancement and sustainable use and recycling of both raw materials and primary-secondary resources. Moreover, they will be developed the design aspects and feasibility of Appropriate Technologies for the developing countries, particularly with regard to water supply, wastewater treatment and solid waste management. The course is deeped on principles of Circular Economy (dry waste for recycling and organic waste for composting), on the circularity as tool for saving raw material, water and natural resources and to reduce waste production.

Obiettivi inglese: The aim of this course is to develop cultural, scientific and technical aspects for the enhancement and sustainable use and recycling of both raw materials and primary-secondary resources. Moreover, they will be developed the design aspects and feasibility of Appropriate Technologies for the developing countries, particularly with regard to water supply, wastewater treatment and solid waste management. The course is deeped on principles of Circular Economy (dry waste for recycling and organic waste for composting), on the circularity as tool for saving raw material, water and natural resources and to reduce waste production.

Gruppo: 2) Elective Learning Activities - regolamento

TAF: D Ambito: 1008 - A scelta dello studente

Cfu min: 12 Cfu max: 12 Num. Esami: 1 Num. Idoneità: 0

La Scuola garantisce che, ai fini del rispetto del limite massimo di 12 esami/5 idoneità i CFU a scelta saranno acquisibili con 1 esami e 0 idoneità

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
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Gruppo: 3) Internship in Preparation of the Final Examination

TAF: E Ambito: 1018 - Per la prova finale

Cfu min: 15 Cfu max: 15

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
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6050 000 000 91232 - 0 - INTERNSHIP ABROAD FOR THE PREPARATION OF THE FINAL EXAMINATION 15 0/0/375/0 No Giudizio

Ambito: E

Obiettivi: By the end of the internship, the student has acquired scientific, technical-professional and/or management skills in one or more sectors in the field of the recognition, evaluation and management of primary and secondary raw materials, as part of a joint training project between the University of Bologna and a host institution represented by a foreign university, company, research institution, public or private structure and/or laboratory. This internship is specifically aimed at the collection, analysis and interpretation of data, possibly of an experimental nature, in the field and/or in the laboratory and/or from in situ investigation, that are useful for tackling and solving a scientific problem defined in the context of the Final Examination. The deliverables of the internship for the Preparation of the Final Examination should be a type of preliminary work that is functional to tackle and solve the scientific problem defined in the context of the degree thesis for the Final Examination.

Obiettivi inglese: By the end of the internship, the student has acquired scientific, technical-professional and/or management skills in one or more sectors in the field of the recognition, evaluation and management of primary and secondary raw materials, as part of a joint training project between the University of Bologna and a host institution represented by a foreign university, company, research institution, public or private structure and/or laboratory. This internship is specifically aimed at the collection, analysis and interpretation of data, possibly of an experimental nature, in the field and/or in the laboratory and/or from in situ investigation, that are useful for tackling and solving a scientific problem defined in the context of the Final Examination. The deliverables of the internship for the Preparation of the Final Examination should be a type of preliminary work that is functional to tackle and solve the scientific problem defined in the context of the degree thesis for the Final Examination.

Note: If you select this activity, you intend to enter a competition for international mobility (e.g. Thesis Abroad, Erasmus+, etc.) or to start an internship by applying on SOL – Internship (to know more go on your degree course's website > homepage > studying>internship for the preparation of the final thesis.

Ambito:

E

Obiettivi: By the end of the internship, the student has acquired scientific, technical-professional and/or management skills in one or more sectors in the field of the recognition, evaluation and management of primary and secondary raw materials, as part of a joint training project between the University of Bologna and a host institution represented by a foreign university, company, research institution, public or private structure and/or laboratory. This internship is specifically aimed at the collection, analysis and interpretation of data, possibly of an experimental nature, in the field and/or in the laboratory and/or from in situ investigation, that are useful for tackling and solving a scientific problem defined in the context of the Final Examination. The deliverables of the internship for the Preparation of the Final Examination should be a type of preliminary work that is functional to tackle and solve the scientific problem defined in the context of the degree thesis for the Final Examination.

Obiettivi inglese: By the end of the internship, the student has acquired scientific, technical-professional and/or management skills in one or more sectors in the field of the recognition, evaluation and management of primary and secondary raw materials, as part of a joint training project between the University of Bologna and a host institution represented by a foreign university, company, research institution, public or private structure and/or laboratory. This internship is specifically aimed at the collection, analysis and interpretation of data, possibly of an experimental nature, in the field and/or in the laboratory and/or from in situ investigation, that are useful for tackling and solving a scientific problem defined in the context of the Final Examination. The deliverables of the internship for the Preparation of the Final Examination should be a type of preliminary work that is functional to tackle and solve the scientific problem defined in the context of the degree thesis for the Final Examination.

Note: If you select this activity, you intend to start an internship by applying on SOL – Internship (to know more go on your degree course's website > homepage > studying>internship for the preparation of the final thesis

Anno Accademico 2024/2025
Scuola Scienze
Classe LM-74-SCIENZE E TECNOLOGIE GEOLOGICHE
Corso 6050-GEOLOGIA PER LO SVILUPPO SOSTENIBILE
PROCESSI GEOLOGICI, RISCHI E RISORSE (C82)

Primo Anno di Corso

Gruppo: 1) Attività formative obbligatorie

TAF: Ambito:

Cfu min: Cfu max:

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
6050 000 000 B4788 - 0 - ANALISI DATI E STATISTICA PER LA GEOLOGIA	CON	MAT/08		8	32/0/48/0	No	Voto
Ambito: 1144 - Attivita' formative affini o integrative Obiettivi: Il corso fornisce una introduzione alle tecniche di base per l'analisi statistica dei dati geologici e all'uso di strumenti software per l'analisi statistica maggiormente diffusi in ambito geologico. Al termine del corso lo studente padroneggia le principali tecniche di statistica descrittiva per distribuzioni univariate, conosce gli elementi di base dell'inferenza statistica, comprende le metodologie di base per l'analisi statistica multivariata e per l'interpretazione dei risultati dei corrispondenti modelli. Inoltre, lo studente è in grado di applicare le tecniche teoriche apprese all'analisi dei dati geologici, utilizzando software dedicato all'analisi statistica dei dati sperimentali e sa commentare e valutare criticamente i risultati di tale analisi. Obiettivi inglese: The course provides an introduction to basic techniques for the statistical analysis of geological data and an introduction to the use of software tools for statistical analysis most widespread in the geological field. At the end of the course the student knows the main techniques of descriptive statistics for univariate distributions, knows the basic elements of statistical inference, understands the basic methodologies for multivariate statistical analysis and for the interpretation of the results of the corresponding models. Moreover, the student is able to apply the learned theoretical techniques to geological data by using software dedicated to the statistical analysis of experimental data and the student knows how to comment and critically evaluate the results of this analysis.			C				
6050 000 000 99887 - 0 - ESPLORAZIONE GEOFISICA	CON	GEO/10		8	48/10/12/0	No	Voto
Ambito: 429 - Discipline geofisiche Obiettivi: Al termine del corso lo studente conosce i principi alla base dei più recenti metodi sperimentali di prospezione geofisica e dei metodi numerici di modellazione di alcuni comportamenti fisici del sottosuolo. Lo studente conosce i fondamenti de: <ul style="list-style-type: none"> • l'analisi dei segnali analogici e digitali nel dominio del tempo e della frequenza; • i metodi di prospezione sismica basati sulle onde di superficie; • i principi e i metodi della caratterizzazione dinamica dei terreni; • i metodi elettrici ed elettromagnetici. Lo studente è in grado di applicare i metodi appresi ai problemi di indagine stratigrafica dei terreni a diverse scale ed alla definizione dei comportamenti dinamici (es. sismici) dei terreni. Lo studente è in grado pianificare campagne di indagine multi-metodo in funzione dei diversi obiettivi dell'esplorazione geofisica. Obiettivi inglese: At the end of the course the student knows the principles at the basis of the most recent geophysical exploration techniques and of the numerical methods to model some physical behaviors of the subsoil. The student knows the fundamentals of: - analog and digital signal processing in the time and frequency domain,			B				

- seismic surface wave-based methods
- methods based on the dynamic characterization of the subsoil
- electrical and electromagnetic methods.

The student is capable to apply these methods to stratigraphic exploration at different scales and to characterize the dynamic behavior (e.g. seismic response) of the subsoil. The student is capable to design multi-method surveys as a function of the different goals of the geophysical exploration.

6050 000 000 B4789 - 0 - GEOSCIENZE PER LA TRANSIZIONE ENERGETICA	CON	GEO/07	8	64/0/0/0	No	Voto
Ambito:	470 - Discipline mineralogiche, petrografiche e geochemiche		B			
<p>Obiettivi: Al termine del corso gli studenti e le studentesse avranno acquisito una gamma di conoscenze trasversali sul ruolo chiave che le Geoscienze ricoprono nel percorso di decarbonizzazione che le società moderne sono tenute a percorrere. Avranno compreso e sapranno trasmettere l'importanza della loro figura professionale per la sostenibilità e sicurezza di tutte le attività delle moderne filiere energetiche. In quest'ottica, il corso riassumerà e sottolineerà l'importanza delle Geoscienze nel processo di transizione energetica e progressiva decarbonizzazione, dall'analisi di alcuni dei grandi cicli elementari sulla Terra alle tecniche di esplorazione, modellazione, estrazione, sviluppo e stoccaggio fino al monitoraggio delle georisorse energetiche al fine di garantire la sostenibilità del loro utilizzo, inclusa la mitigazione del loro impatto ambientale e sociale. L'esplorazione e la pianificazione dell'utilizzo ragionato delle georisorse strategiche come le materie prime critiche e la ricerca di idrogeno naturale saranno alcuni dei temi di approfondimento assieme allo studio di tecniche per la riduzione delle emissioni globali tramite processi di cattura, utilizzo e stoccaggio di CO₂, lo stoccaggio di scorie nucleari e di idrogeno nel sottosuolo. Il corso consisterà di lezioni frontali, esercitazioni ed una serie di seminari (1 CFU) tenuti da geologi e geologhe di ditte, enti di ricerca ed aziende attivamente impegnate in vari settori delle filiere energetiche alternative al mondo delle risorse</p> <p>Obiettivi inglese: The course is designed to provide students with transferable knowledge about the key role that the Geosciences play in the decarbonization path that modern society is required to undertake. They will learn and be able to convey the importance of their professional figure for the sustainability and safety of all activities in modern energy supply chains. The course will summarize and emphasize the importance of the Geosciences for the energy transition and progressive decarbonization: from the analysis of some of the great elemental cycles on Earth to the techniques of exploration, modeling, extraction, development, and storage, to the monitoring of energy georesources to ensure the sustainability of their use, including the mitigation of their environmental and social impacts. Exploration and planning for the sustainable use of strategic geo-resources such as critical raw materials and natural hydrogen exploration will be some of the topics dealt with along with the study of techniques for reducing global emissions through CO₂ capture, utilization, and storage processes, nuclear waste storage, and underground hydrogen storage.</p> <p>The course will consist of lectures, practical exercises, and seminars (1 CFU) taught by geologists from companies and research institutes actively engaged in various sectors of unconventional energy supply chains.</p>						

6050 000 000 B4787 - 0 - GIS E REMOTE SENSING	CON	GEO/04	8	40/0/36/0	No	Voto
Ambito:	437 - Discipline geomorfologiche e geologiche applicative		B			
<p>Obiettivi: Partendo dai fondamenti di geomatca e dalle basi teoriche relative alle caratteristiche e al funzionamento dei Sistemi Informativi Geografici e dei plugin più utili/utilizzati nell'ambito delle geoscienze, il corso fornisce gli strumenti di base per effettuare delle elaborazioni di dati in ambiente GIS (utilizzando il software open-source QGIS). Le conoscenze acquisite in ambito GIS verranno integrate con conoscenze di base di Remote Sensing, per permettere allo studente di padroneggiare l'utilizzo di dati vettoriali e dati raster provenienti da diverse fonti e piattaforme, con applicazioni pratiche tipiche della geomorfologia. I principali obiettivi formativi includono: 1) comprensione ed analisi di dati vettoriali e raster; 2) (foto)interpretazione di immagini e dati telerilevati (ed es. foto aeree, dati multispettrali, ecc.); 3) acquisizione di competenze di base nell'elaborazione delle immagini e nell'analisi dei dati telerilevati da satellite e da drone (inclusi dati iperspettrali, LiDAR e radar); 4) conoscenza delle principali banche dati vettoriali e raster a scala regionale, nazionale ed europea e utilizzo dei dati in esse contenuti per effettuare diversi tipi di elaborazioni, con particolare riferimento alle analisi spaziali e alla produzione di cartografia tematica; 5) costruzioni di file vettoriali e dei loro attributi, utilizzando anche misure rilevate direttamente sul campo; 6) integrazione dei dati e delle informazioni preesistenti con elaborazioni specifiche per la produzione di una cartografia originale.</p> <p>Le competenze teoriche acquisite durante le lezioni frontali sono accompagnate da una parte pratica nella quale vengono presentati diversi tipi di elaborazioni quali-quantitative, con sessioni guidate di "hands on". Lo studente può quindi cimentarsi in esercizi via via più complessi fino al raggiungimento di un grado di competenza che consenta di utilizzare gli strumenti messi a disposizione dal GIS in diversi ambiti delle geoscienze. Alla fine del corso, gli studenti svilupperanno un progetto che consentirà loro di applicare le competenze acquisite durante il corso.</p> <p>Obiettivi inglese: Starting from the fundamentals of geomatics and the theoretical bases relating to the main characteristics and functioning of Geographic Information Systems and the most useful/used plugins in the field of geosciences, the course provides the basic tools for carrying out data processing in a GIS environment (using the open-source software QGIS). The knowledge acquired in the GIS field will be integrated with basic knowledge of Remote Sensing, to allow the student to master the use of vector data and raster data from different sources and platforms, with practical applications typical of geomorphology. The main learning objectives include: 1) understanding and analysis of vector and raster data; 2) (photo)interpretation of remotely sensed images and data (e.g. aerial photos, multispectral data, etc.); 3) acquisition of basic skills in image processing and analysis of remote sensing data from satellites and drones (including hyperspectral, LiDAR and radar data); 4) knowledge of the main vector and raster databases at regional, national and European scale and use of the data contained therein to carry out different types of processing, with particular reference to spatial analyses and the production of thematic cartography; 5) construction of vector files and their attributes, also using measurements taken directly in the field; 6) integration of pre-existing data and information with newly developed datasets for the production of an original cartography. The theoretical skills acquired during the lectures are accompanied by a practical part in which different types of qualitative-quantitative elaborations are presented, with guided "hands on" sessions. The student can then test his/her competences through increasingly more complex exercises to reach a level of competence that allows him/her to use the tools made available by GIS in various areas of geosciences. At the end of the course, students will develop a project that will allow them to apply the skills acquired during the course.</p>						

Gruppo: 2) Gruppo di scelta - ambito discipline geologiche e paleontologiche**TAF: B Ambito: 436 - Discipline geologiche e****Cfu min: 6 Cfu max: 6**

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
6050 000 000 91445 - 0 - GEOLOGIA MARINA (6 CFU)	CON	GEO/02	B	6	64/10/36/0	No	Voto
<p>Ambito: 436 - Discipline geologiche e paleontologiche</p> <p>Obiettivi: Al termine del corso, lo studente possiede le conoscenze di base sui principali processi geologici responsabili della formazione e dell'evoluzione dei margini continentali dai sistemi costieri ai bacini oceanici. Sarà in grado di inquadrare l'assetto geologico delle aree marine italiane, con particolare riguardo all'evoluzione tardo-quadernaria e recente. Conosce le principali tecniche di rilievo, campionamento, monitoraggio e mappatura di aree marine e costiere, finalizzate anche alla valutazione dei principali elementi di pericolosità e alla pianificazione dello spazio marittimo, nell'ottica di una corretta "blue growth".</p> <p>Obiettivi inglese: The course provides the basic knowledge on the main geological processes involved in the formation and evolution of continental margins from the coast to oceans. A focus is given on the geological setting of Italian Seas, with particular regard to their late-Quaternary evolution. Students will acquire competencies on the main techniques of surveying, sampling, mapping and monitoring of marine and coastal areas, also in the light of geological hazard assessment and of marine spatial planning issues.</p>							

6050 000 000 B4792 - 0 - PROCESSI DEFORMATIVI E STRUTTURE FRAGILI	CON	GEO/03	B	6	48/0/0/0	No	Voto
<p>Ambito: 436 - Discipline geologiche e paleontologiche</p> <p>Obiettivi: L'insegnamento si propone di fornire metodi e strumenti per la descrizione, l'analisi e l'interpretazione delle strutture tettoniche che si sviluppano in condizioni alto-crosta (regime reologico fragile), nonché per l'identificazione dei processi che ne governano l'evoluzione nello spazio e nel tempo. Gli studenti acquisiranno le conoscenze della moderna Geologia Strutturale teorica e sperimentale rilevanti per la comprensione dei fattori che controllano la localizzazione e la storia di attivazione-deattivazione delle zone di faglia. Gli aspetti della ricerca saranno combinati con aspetti applicativi della Geologia Strutturale (ad esempio: mitigazione dei rischi geologici, valutazione delle georisorse, relazione tra tettonica e modellazione del paesaggio), contribuendo al raggiungimento degli obiettivi formativi della Laurea Magistrale. L'insegnamento combinerà lezioni tradizionali in classe con la lettura ed analisi di articoli scientifici.</p> <p>Obiettivi inglese: The course aims to provide students with methods and tools to describe, analyse, and interpret tectonic structures that develop in high-crustal conditions (brittle rheologic regime). Students will learn about the processes that govern the evolution of these structures in both space and time. They will acquire the knowledge of modern theoretical and experimental Structural Geology relevant to the understanding of factors controlling the localisation and the activation-deactivation of fault zones. Research aspects will be combined with applied aspects of Structural Geology (e.g., mitigation of geological risks, assessment of georesources, relationship between tectonics and landscape evolution), contributing to the achievement of the learning outcomes of the Master's Degree. The course will combine traditional in-class lectures with the reading and analysis of scientific articles.</p>							

Gruppo: 3) Gruppo di scelta - ambito discipline geomorfologiche e geologico-applicative**TAF: B Ambito: 437 - Discipline geomorfologiche e****Cfu min: 6 Cfu max: 6**

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
6050 000 000 B4793 - 0 - ANALISI E PREVISIONE DEI FENOMENI FRANOSI	CON	GEO/05	B	6	48/0/0/0	No	Voto
<p>Ambito: 437 - Discipline geomorfologiche e geologiche applicative</p> <p>Obiettivi: Il principale obiettivo formativo del corso è quello di fornire gli strumenti per la identificazione, caratterizzazione e gestione dei fenomeni di instabilità di versante. Al termine del corso, lo studente sarà in grado: riconoscere frane in campagna e da foto aerea; pianificare una campagna geognostica in situ e in laboratorio; progettare un sistema di monitoraggio del versante; ricostruire il modello geologico-tecnico del versante; analizzare la stabilità del versante. Le attività di campo saranno parte integrante del corso e hanno l'obiettivo di verificare direttamente sul campo i concetti appresi in aula.</p> <p>Obiettivi inglese: The primary educational objective of the course is to provide the tools for the identification, characterization, and management of slope instability phenomena. By the end of the course, the student will be able to: recognize landslides in the field and from aerial photos; plan an in-situ and laboratory geotechnical campaign; design a slope monitoring system; reconstruct the geological-technical model of the slope; analyze the slope's stability. Field activities will be an integral part of the course and aim to directly verify the concepts learned in the classroom.</p>							

6050 000 000 B4796 - 0 - IDROGEOLOGIA APPLICATA E INQUINAMENTO DEGLI ACQUIFERI CON GEO/05 6 32/10/12/0 No Voto

Ambito: 437 - Discipline geomorfologiche e geologiche applicative

B

Obiettivi: Al termine dell'insegnamento lo studente è in grado di comprendere i principi ed i concetti sul ruolo delle acque sotterranee nell'ambito del ciclo idrologico di bacino, sulla parametrizzazione delle unità idrogeologiche e sugli strumenti di caratterizzazione dei sistemi di circolazione idrica sotterranea. Lo studente è in grado anche di comprendere i processi di contaminazione di origine antropica delle acque sotterranee, le modalità di migrazione dei contaminanti nel mezzo poroso e gli approcci di tipo idrogeologico per la protezione, caratterizzazione, analisi di rischio e bonifica degli acquiferi contaminati

Lo studente è in grado di:

-apprendere le implicazioni applicative per la progettazione degli interventi di sfruttamento sostenibile, protezione e bonifica delle risorse idriche sotterranee con esempi ed applicazioni relativi al contesto idrogeologico locale (Bacino Padano ed Appennino Settentrionale);

-applicare prospezioni idrogeologiche e tecniche di campionamento e monitoraggio di acque sotterranee in condizioni di pieno campo, sia in siti naturali che in siti contaminati. Viene previsto 1 CFU di laboratorio sul campo in siti di esercitazione con valenza didattica.

Obiettivi inglese: At the end of the course the student is able to comprehend the principles and concepts about: the role of groundwater inside the framework of hydrologic cycle at the watershed scale; the parameterization of hydrogeological units; the tools of characterization of groundwater flow systems. The student is also able to comprehend the processes of man derived contamination of groundwater, the mechanisms of migration of contaminants through the porous medium and hydrogeological approaches for the protection, characterization, risk assessment and remediation of contaminated aquifers.

The student is able to:

-learn the implications for the design of groundwater sustainable exploitation measures, protection and remediation of the aquifers with application case studies relative to local settings (Po plain, Northern Apennine);

-apply hydrogeological prospecting tools and techniques of field groundwater sampling and monitoring, either for natural or contaminated settings. One credit will be devoted to field laboratory activity with practical training.

Gruppo: 4) Gruppo di scelta - ambito discipline mineralogiche, petrografiche e geochimiche

TAF: B Ambito: 470 - Discipline mineralogiche, petrografiche

Cfu min: 6 Cfu max: 6

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
6050 000 000 44960 - 0 - GEOCHIMICA AMBIENTALE	CON	GEO/09		6	32/0/24/0	No	Voto
Ambito: 470 - Discipline mineralogiche, petrografiche e geochimiche			B				
Obiettivi: Il corso è finalizzato a fornire le conoscenze di base ed alcuni approfondimenti specifici al fine di mettere in grado lo studente di comprendere concetti e metodi propri della geochimica ambientale ed utilizzare con sufficiente cognizione di causa testi scientifici e tecnici.							
6050 000 000 28026 - 0 - RISCHIO VULCANICO	CON	GEO/08		6	32/0/24/0	No	Voto
Ambito: 470 - Discipline mineralogiche, petrografiche e geochimiche			B				
Obiettivi: Al termine del corso, lo studente ha appreso i concetti di base sulla valutazione della mitigazione del rischio vulcanico in relazione alla pericolosità per i differenti fenomeni eruttivi primari (processi di caduta, correnti piroclastiche, colate laviche) e secondari (collassi, lahar, tsunami, frane), ed i sistemi di monitoraggio dell'attività eruttiva. In particolare lo studente è in grado di leggere ed utilizzare carte di pericolosità e conoscere le implicazioni vulcanologiche della pianificazione del territorio in funzione del rischio vulcanico.							
Obiettivi inglese: At the end of the course, the student learned the basic concepts on the evaluation of volcanic risk mitigation in relation to the hazards for different primary eruptive phenomena (fall processes, pyroclastic currents, lava flows) and secondary (collapses, lahars, tsunamis, landslides), and monitoring systems of the eruptive activity. In particular, the student is able to read and use hazard maps and know the volcanological implications of land planning based on volcanic risk.							

Gruppo: 5) Attività formative a scelta - ordinamento**TAF: D Ambito: 1008 - A scelta dello studente****Cfu min: 12 Cfu max: 12** Num. Esami: 1 Num. Idoneità: 0

La Scuola garantisce che, ai fini del rispetto del limite massimo di 12 esami/5 idoneità i CFU a scelta saranno acquisibili con 1 esami e 0 idoneità

Note: Scegli 12 CFU fra tutte le attività formative attivate dall'Ateneo.

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
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Qualsiasi attività dell'Ateneo (010)

Ambito:

Secondo Anno di Corso**Gruppo: 1) Gruppo di scelta - ambito discipline geologiche e paleontologiche****TAF: B Ambito: 436 - Discipline geologiche e****Cfu min: 6 Cfu max: 6**

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
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6050 000 000 75558 - 0 - ANALISI DEI BACINI SEDIMENTARI

CON

GEO/02

6

40/0/12/0

No

Voto

Ambito: 436 - Discipline geologiche e paleontologiche

Obiettivi: Al termine del corso lo studente avrà appreso i concetti di base sulla formazione dei bacini sedimentari nel contesto della tettonica delle placche nonché su aspetti quali erosione, denudamento, flusso di sedimento e tassi di sedimentazione oltre che su subsidenza, geotermocronologia ed evoluzione diagenetica. Lo studente sarà in grado di: interpretare dati su stratigrafia, stili deposizionali, geometrie e proprietà petrofisiche dei riempimenti dei bacini sedimentari; effettuare correlazioni stratigrafiche ed analisi di facies ed impiegare metodi cartografici; comprendere l'andamento generale del flusso dei fluidi nei bacini sedimentari.

Obiettivi inglese: The course focuses on the understanding of sedimentary basins within the framework of plate tectonics and integrates aspects of stratigraphy, sedimentology, geophysics, geodynamics, sedimentary petrology, and low-temperature thermochronology. Specific topics include: lithospheric stretching and flexure, strike-slip tectonics and basin formation, dynamic topography, sediment generation/transport/deposition, diagenesis and petrophysical properties, applications to hydrocarbon prospecting and the evaluation of water resources.

6050 000 000 B4829 - 0 - STRATIGRAFIA APPLICATA

CON

GEO/02

6

40/0/12/0

No

Voto

Ambito: 436 - Discipline geologiche e paleontologiche

Obiettivi: Al termine del corso, lo studente è in grado di:

- (i) impiegare tecniche avanzate di correlazione stratigrafica in affioramento e nel sottosuolo
- (ii) descrivere e interpretare carote di sedimento
- (iii) interpretare prove penetrometriche in chiave stratigrafica
- (iv) sviluppare modelli stratigrafici finalizzati alla caratterizzazione geometrica e petrofisica di potenziali serbatoi e acquiferi
- (v) applicare concetti base di stratigrafia sequenziale alla soluzione di problemi ingegneristici, applicativi e ambientali.

Obiettivi inglese: The aim of the course is to improve students' ability to:

- (i) develop advanced techniques of stratigraphic correlation in outcrop and subsurface
- (ii) describe and interpret sediment cores
- (iii) perform stratigraphic interpretation of cone penetration tests
- (iv) use geometric and sedimentological features of sediment bodies as tools for reservoir/aquifer characterization
- (v) apply basic concepts of sequence stratigraphy to solve engineering and environmental problems.

Gruppo: 2) Gruppo di scelta - ambito discipline geomorfologiche e geologico-applicative**TAF: B Ambito: 437 - Discipline geomorfologiche e****Cfu min: 6 Cfu max: 6**

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
6050 000 000 B4854 - 0 - DINAMICHE FLUVIALI E GESTIONE DEL SEDIMENTO	CON	GEO/04		6	24/10/24/0	No	Voto

Ambito: 437 - Discipline geomorfologiche e geologiche applicative

Obiettivi: L'insegnamento mira a fornire conoscenza sulle dinamiche attuali che caratterizzano i sistemi fluviali dell'Antropocene, in cui il principale agente di cambiamento è rappresentato dal disturbo antropico storico e/o contingente. L'insegnamento integra lezioni frontali a sessioni di laboratorio ed attività di campo. Le lezioni trattano aspetti inerenti l'apporto e il trasferimento di sedimento, incluse le interazioni tra versanti e aste fluviali, il ruolo della forzante idro-meteorologica sull'intensità e la tipologia dei processi di trasporto di sedimento. Allo stesso tempo, viene affrontato il tema della gestione del sedimento a scala di bacino, con riferimento agli impatti associati ai cambiamenti di uso del suolo, estrazioni di ghiaie in alveo e alla costruzione di opere di captazione idrica e di difesa spondale. Argomenti specifici includono: (i) i meccanismi principali di trasporto solido fluviale; (ii) la morfologia e la tipologia degli alvei come risultato del (dis)equilibrio tra apporto e trasporto di sedimento; (iii) il bilancio di sedimento come chiave per l'identificazione di situazioni di disequilibrio e la redazione di strategie di gestione sostenibile; (iv) lo stato dei fiumi dell'Appennino Settentrionale e le recenti dinamiche di incisione generalizzata. La discussione in classe viene stimolata mediante una rassegna bibliografica su temi selezionati, la cui enfasi varia di anno in anno e viene arricchita da seminari ad invito tenuti da portatori di interessi pubblici. La componente di laboratorio, condotta per lo più in ambiente GIS, introduce gli studenti alla mappatura di forme naturali e antropiche chiave, quali ad esempio le sorgenti di sedimento sui versanti, il canale attivo, i terrazzi fluviali, i conoidi alluvionali e le opere di difesa. Una seconda parte più quantitativa, si occupa della valutazione del cambiamento topografico mediante sottrazione di Modelli Digitali del Terreno (DTM) ad alta risoluzione (DoD) e valutazione delle relative incertezze. La componente di campo illustra il rilevamento topografico di sezioni trasversali, la caratterizzazione granulometrica del letto, nonché il funzionamento di stazioni di monitoraggio idrologiche e del trasporto solido. Infine, l'analisi dei dati raccolti in campo viene condotta da gruppi di studenti e si conclude con la redazione di una breve relazione tecnica.

Obiettivi inglese: This course aims to provide knowledge on the contemporary dynamics that characterize fluvial systems, with a focus on rivers of the Anthropocene, in which the main driver of change is inherited (or contingent) anthropogenic disturbance. It integrates lectures with lab- and field-based components. Lectures examine aspects of sediment supply and sediment transfer, including hillslope-channel interactions, the role of hydro-meteorological forcing on the intensity and typology of geomorphic transport processes. It also deals with sediment management at the watershed scale, addressing the impacts of land cover alteration, in-channel gravel mining, and the construction of engineering structures for water diversion and flood protection. Specific topics of interests include: (i) the main mechanisms of fluvial sediment transport; (ii) channel morphology and typology as a result of the (im)balance between sediment supply and transport capacity; (iii) the sediment budget approach as a key for identifying sedimentary disequilibrium and guide sustainable sediment management; and (iv) the state of rivers in the Northern Apennines and relevant issues of channel incision into bedrock. The discussion in class is fostered by a literature review on selected topics. The emphasis will vary from year to year and will be enriched with invited talks given by public stakeholders. The lab-based component, largely conducted in GIS environment, introduces students to expert-based mapping of key natural and anthropogenic features, such as hillslope sediment sources, the active channel bed, fluvial terraces, alluvial fans, check dams and lateral levees. On a more quantitative level, GIS-based activities include application of geomorphic change detection techniques through differencing of sequential, high-resolution, Digital Elevation Models (DoDs) and evaluation of the relevant uncertainty. The field-based component illustrates the topographic surveying of channel cross sections, the characterization of channel bed texture (i.e., grain size distribution), as well as the at-a-station monitoring of water and sediment fluxes. Finally, analysis of data collected in the field is performed by groups of students, in preparation of a short technical report.

6050 000 000 91442 - 0 - PROGETTAZIONE GEOLOGICO-TECNICA	CON	GEO/05		6	32/20/0/0	No	Voto
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Ambito: 437 - Discipline geomorfologiche e geologiche applicative

Obiettivi: Al termine del corso, lo studente apprende concetti relativi a: attribuzione parametri fisico-meccanici ai mezzi geologici; calcolo del carico limite, carico ammissibile e cedimenti di fondazioni superficiali e profonde; progettazione di rilevati, strutture arginali e dighe in terra; stati limite di spinta attiva e passiva per opere di sostegno; opere di scavo in sotterraneo (caverne, miniere e gallerie) ed in superficie (cave in terreni sciolti e lapidei). Lo studente è in grado di: progettare una campagna di indagine e sintetizzarne i risultati in un modello geologico tecnico; è inoltre in grado di verificare le più comuni opere in materiali sciolti e i fronti di scavo.

Obiettivi inglese: Students learn to solve main engineering geology problems which can be encountered in professional practice. The course emphasizes the importance of the geological and geotechnical model and parameter selection in calculations of ultimate and serviceability limit state calculations for both shallow and deep foundations and discusses methods of embankment construction, including soil improvement. Earth retaining structures considers systems ranging from gravity walls to composite construction (reinforced earth) and flexible structures. Underground excavation, earth dams and artificial slope design are also treated with respect to possible geological problems.

Gruppo: 3) Gruppo di scelta - ambito discipline affini e integrative**TAF: C Ambito: 1144 - Attività formative affini o integrative****Cfu min: 12 Cfu max: 12**

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
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6050 000 000 B4863 - 0 - IDROLOGIA E RISCHIO ALLUVIONALE	CON	ICAR/02	6	32/0/24/0	No	Voto
Ambito: 1144 - Attivita' formative affini o integrative						C
Obiettivi: Al termine del corso, lo studente apprende i concetti di base sulle tecniche di misura delle principali variabili idrologiche, sulla valutazione dei termini del bilancio idrologico a scala di bacino e sulla stima e gestione del rischio alluvionale. Lo studente conosce i modelli afflussi-deflussi più diffusi, le problematiche principali della modellazione idrologica nei problemi di protezione idraulica del territorio, ed acquisisce i concetti di pericolosità idraulica, vulnerabilità ed esposizione del territorio al rischio alluvionale, nel contesto generale dei cambiamenti climatico-ambientali.						
Obiettivi inglese: The course aims at dealing quantitatively with the basic components of the hydrological cycle: e.g. measurement and modelling of the main hydrological variables. The main objective of the course is illustrating the most popular rainfall-runoff models and providing students with tools for understanding the problems of hydrological modeling and the fundamental concepts and methods for flood hazard and risk assessment and modelling in the context of climate and environmental change.						
6050 000 000 B4865 - 0 - MODELLAZIONE DELLE ACQUE SOTTERRANEE	CON	GEO/05	6	24/0/36/0	No	Voto
Ambito: 1144 - Attivita' formative affini o integrative						C
Obiettivi: Al termine dell'insegnamento lo studente conosce: i principali modelli analitici idrogeologici per l'elaborazione di dati raccolti tramite prove idrodinamiche in campo (prove di pompaggio, slug test) e per l'analisi di idrogrammi sorgivi; i principi della modellazione numerica di flusso e trasporto con metodi alle differenze finite; i concetti di modello concettuale, implementazione, parametrizzazione, calibrazione e validazione di un modello numerico.						
Lo studente è in grado di: applicare modelli analitici per ricavare parametri idrogeologici (trasmissività, parametri di immagazzinamento, portate sorgive, coefficienti di recessione) a partire da dati di campo; implementare modelli numerici sulla base di un modello concettuale idrogeologico; dare risposta, tramite modellazione numerica, a quesiti relativi al flusso ed al trasporto di contaminanti negli acquiferi, con particolare focus sulla gestione sostenibile della risorsa in vista dei cambiamenti climatici e la gestione dei rischi associati ad inquinamento; valutare la significatività dei risultati ottenuti alla luce delle caratteristiche del modello.						
Obiettivi inglese: By the end of the course, students will gain an understanding of the following: the main hydrogeological analytical models to process data obtained from hydrodynamic tests conducted in the field (such as pumping tests and slug tests), and for the interpretation of spring hydrographs; the principles of numerical modeling of flow and transport using finite difference methods; the notions of conceptual modeling, numerical model implementation, parameterization, calibration, and validation.						
The student will develop the skills to: employ analytical models for deducing essential hydrogeological parameters from field data (such as transmissivity, storage parameters, spring discharge, recession coefficients); implement numerical models grounded in hydrogeological conceptual frameworks; utilize numerical simulations to address inquiries concerning the flow and transport of contaminants in aquifers, with a focus on sustainable resource management in view of climate changes and the assessment of risks associated with groundwater contamination; assess the significance of the modeling outcomes in relation to the specific attributes of the model.						
6050 000 000 B4864 - 0 - PALEOECOLOGIA E CAMBIAMENTI CLIMATICI	CON	GEO/01	6	32/10/12/0	No	Voto
Ambito: 1144 - Attivita' formative affini o integrative						C
Obiettivi: La Paleoeologia studia gli ecosistemi del passato, le loro dinamiche nel tempo geologico e funge da ponte fra le scienze biologiche e geologiche. Durante il corso, lo studente apprende elementi per condurre analisi paleoecologiche quantitative con particolare riguardo alle dinamiche macrobentoniche marine in relazione alla ciclicità climatica del Quaternario. Le competenze acquisite saranno utili per svolgere indagini sia in ambito geologico, sia in ambito biologico.						
Nel dettaglio, le associazioni macrobentoniche quaternarie forniscono segnali ambientali quantificabili (per via dell'elevata equivalenza tassonomica con le faune attuali) che contribuiscono a migliorare l'interpretazione in chiave stratigrafico-sequenziale delle successioni sedimentarie. L'analisi delle dinamiche paleobiologiche nel record sedimentario consente anche la ricostruzione di ecosistemi e della loro variabilità prima dell'avvento delle società moderne (=elevato impatto antropico). Il record fossilifero quaternario quindi ci consente di ricostruire delle "baseline" (sistemi di riferimento), per ecosistemi attuali in modo da valutarne il grado di alterazione, anche in considerazione dei futuri scenari di riscaldamento globale.						
Al termine del corso lo studente possiede conoscenze sulle principali tecniche di campionamento e analisi di macroinvertebrati bentonici e di alcuni dei principali taxa di molluschi mediterranei utili a delineare paleoambienti direttamente in affioramento. Inoltre, lo studente acquisirà familiarità con le principali tecniche di elaborazione dati utilizzate in ambito paleoecologico per ricostruire "baseline" di ecosistemi marini e valutare quindi l'impatto antropico sugli attuali ecosistemi marini e costieri.						
Obiettivi inglese: Paleoeology studies past ecosystems and their dynamics over geological time and acts as a bridge between the biological and geological sciences. During the course, the student learns elements to conduct quantitative paleoecological analysis on marine macrobenthic dynamics and focus on the climatic cyclicity of the Quaternary.						
In detail, the Quaternary macrobenthic associations provide quantifiable environmental signals (due to the high taxonomic equivalence with the modern faunas) that improve the sequence-stratigraphic interpretation of sedimentary successions. Paleobiological dynamics in the sedimentary record also allow the reconstruction of ecosystems and their variability before the advent of modern societies (= high anthropic impact). Therefore, the Quaternary fossil record will enable us to reconstruct "baselines" (reference systems) for current ecosystems to assess the degree of alteration and consider future global warming scenarios. At the end of the course, the student has knowledge of the main sampling and analysis techniques of benthic macroinvertebrates and some of the main taxa of Mediterranean mollusks useful to outline paleoenvironments directly in the field. In addition, the student will become familiar with the main data processing techniques used in the Conservation Paleobiology to reconstruct "baselines" of marine ecosystems and then evaluate the anthropic impact on current marine and coastal ecosystems.						

6050 000 000 B4866 - 0 - SISTEMI COSTIERI CON GEO/02 6 40/0/12/0 No Voto

Ambito: 1144 - Attività formative affini o integrative

Obiettivi: Al termine del corso, lo studente apprende le conoscenze e le competenze necessarie per l'analisi dei processi e delle dinamiche evolutive di sistemi costieri a varie scale temporali (dalla scala milankoviana alla scala secolare e sub-secolare). In particolare, lo studente è in grado di: i) pianificare ed applicare un approccio multidisciplinare; ii) gestire differenti tipologie di dati (litologici, paleontologici, geochimici) in ambito stratigrafico e iii) valutare criticamente le interazioni fra ambienti deposizionali-clima-attività antropica.

Obiettivi inglese: By the end of the course, students will be able to practically apply the acquired knowledge and skills for the analysis of depositional and environmental dynamics of coastal systems at various timescales (from Milankovitch to sub-centennial scales). Specifically, students will be able to: i) plan and apply a multi-proxy investigation; ii) efficiently deal with different data types (e.g., lithological, paleontological, geochemical data) within a stratigraphic context and iii) evaluate critically the interactions between depositional environments, climate variability and human activities.

Gruppo: 4) Tirocinio curriculare obbligatorio

TAF: Ambito:

Cfu min: Cfu max:

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
6050 000 000 29746 - 0 - TIROCINIO	CON			9	0/0/225/0	No	Giudizio

Ambito: 1146 - Tirocini formativi e di orientamento

Obiettivi: Al termine del tirocinio, lo studente possiede competenze tecnico-professionali, scientifiche e/o gestionali in uno o più settori delle Scienze della Terra che contribuiranno all'inserimento nel mondo del lavoro e/o della ricerca. In particolare, lo studente ha acquisito competenze specifiche in uno o più dei seguenti settori delle Scienze della Terra: indagine geologica e/o geofisica del territorio e del sottosuolo; valutazione dei rischi geologici; gestione sostenibile delle georisorse, comprese le risorse idriche sotterranee; caratterizzazione e gestione dei siti contaminati; geologia e/o geofisica applicata alle opere di ingegneria civile ed alla gestione dell'ambiente e del territorio; analisi e modellazione di dati relativi a processi geologici. Lo studente è in grado di svolgere una o più delle seguenti attività: selezionare, analizzare ed interpretare dati di terreno e/o di laboratorio e/o di indagini in sito, anche di tipo sperimentale; valutare ed interpretare dati per la programmazione e progettazione di interventi geologici; preservare e valorizzare il patrimonio geologico e paleontologico; lavorare in ampia autonomia dimostrando capacità di adattarsi a nuove situazioni; relazionarsi con tecnici e professionisti di altre specializzazioni e discipline.

Obiettivi inglese: By the end of the internship, the student has gained a technical-professional, scientific and/or management knowledge in one or more fields of the Earth Sciences that can contribute to his/her successful entry into the professional and/or research work. In particular, the student has gained a specific knowledge in one or more of the following fields of the Earth Sciences: geological and/or geophysical investigations of the territory and subsurface; geological risk assessment; sustainable exploitation of georesources, included the underground water resources; identification and management of contaminated sites; engineering geology and environmental and land management; in situ acquisition, analysis and modelling of geological data. The student is able to carry out one or more of the following activities: to select, analyse and interpret field and/or laboratory and/or in situ investigation data, including experimental data; to evaluate and interpret data for the planning and design of geological interventions; to preserve and enhance the geological and paleontological heritage; to work independently, thus demonstrating the ability to adapt to new situations; to interact with technicians and experts from other fields and disciplines.

Gruppo: 5) Prova Finale

TAF: Ambito:

Cfu min: 25 Cfu max: 25

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
Opzione 1				0-25			

6050 000 000 B4827 - 0 - PROVA FINALE (25 CFU)	CON	25	0/0/0/0	No	
Ambito: 1018 - Per la prova finale	E				
<p>Obiettivi: La Prova Finale per il conseguimento della laurea magistrale consiste nella redazione di una tesi di laurea scritta ed elaborata in modo originale dallo studente, e nella sua discussione di fronte ad una Commissione di Laurea Magistrale. La tesi di laurea sviluppa un problema scientifico o applicativo su un argomento coerente con gli obiettivi del corso di studio, sotto la guida di un relatore, e deve comprendere sempre una fase di analisi ed interpretazioni di dati, eventualmente di tipo sperimentale, che può prevedere anche la raccolta di dati sul campo e/o in laboratorio e/o da indagini in situ. Al termine della Prova Finale lo studente deve dimostrare autonomia di lavoro e capacità di valutazione critica dei risultati ottenuti. Lo studente deve sapere esporre e discutere con chiarezza e piena padronanza i risultati del suo elaborato. La Prova Finale può essere collegata a un progetto o ad un'attività di tirocinio.</p> <p>Obiettivi inglese: The Final Examination to achieve the master's degree consists in drafting a written original thesis, and in its discussion in front of a Degree Commission. The degree thesis elaborates on a scientific research question focusing on a topic that is consistent with the objectives of the study course, under the guidance of a supervisor. It has to comprise a phase of analysis and interpretation of the gathered data, possibly of an experimental nature, which may also include the collection of data in the field and/or in the laboratory and/or from in situ investigation. By the end of the Final Examination the students have to demonstrate that they are capable to operate autonomously and to critically evaluate the obtained results. Students have to present and discuss the results of their dissertation with clarity and full mastery. The Final Examination can be linked to a project or an internship activity.</p>					
Opzione 2		0-25			
6050 000 000 94904 - 0 - PREPARAZIONE DELLA PROVA FINALE ALL'ESTERO (6 CFU)		6	0/0/150/0	No	Giudizio
Ambito: 1018 - Per la prova finale	E				
<p>Obiettivi: Al termine delle attività di Preparazione della Prova Finale lo studente ha raccolto, analizzato ed interpretato dati sul campo e/o in laboratorio, eventualmente di tipo sperimentale, utili allo sviluppo di un problema scientifico definito nell'ambito della Prova Finale. La Preparazione della Prova Finale è svolta dallo studente presso una istituzione ospite rappresentata da una università, azienda, ente di ricerca, struttura pubblica e/o privata, studio professionale e/o laboratorio all'estero, nell'ambito di un progetto non regolato dalle procedure per lo svolgimento dei tirocini.</p> <p>Obiettivi inglese: By the end of the activities of Preparation for the Final Examination the student has collected, analysed and interpreted data, possibly of an experimental nature, in the field and/or in the laboratory, that are useful for tackling and solving a scientific problem defined in the context of the Final Examination. The Preparation for the Final Examination is carried out by the student at a host institution represented by a foreign university, company, research institution, public or private structure and/or laboratory, as part of a project that is not directly regulated by the procedures regulating the internships.</p>					
6050 000 000 86014 - 0 - PROVA FINALE (19 CFU)		19	0/0/0/0	No	
Ambito: 1018 - Per la prova finale	E				
<p>Obiettivi: La Prova Finale per il conseguimento della laurea magistrale consiste nella redazione di una tesi di laurea scritta ed elaborata in modo originale dallo studente, e nella sua discussione di fronte ad una Commissione di Laurea Magistrale. La tesi di laurea sviluppa un problema scientifico o applicativo su un argomento coerente con gli obiettivi del corso di studio, sotto la guida di un relatore, e deve comprendere sempre una fase di analisi ed interpretazioni di dati, eventualmente di tipo sperimentale, che può prevedere anche la raccolta di dati sul campo e/o in laboratorio e/o da indagini in situ. Al termine della Prova Finale lo studente deve dimostrare autonomia di lavoro e capacità di valutazione critica dei risultati ottenuti. Lo studente deve sapere esporre e discutere con chiarezza e piena padronanza i risultati del suo elaborato. La Prova Finale può essere collegata a un progetto o ad un'attività di tirocinio.</p> <p>Obiettivi inglese: The Final Examination to achieve the master's degree consists in drafting a written original thesis, and in its discussion in front of a Degree Commission. The degree thesis elaborates on a scientific research question focusing on a topic that is consistent with the objectives of the study course, under the guidance of a supervisor. It has to comprise a phase of analysis and interpretation of the gathered data, possibly of an experimental nature, which may also include the collection of data in the field and/or in the laboratory and/or from in situ investigation. By the end of the Final Examination the students have to demonstrate that they are capable to operate autonomously and to critically evaluate the obtained results. Students have to present and discuss the results of their dissertation with clarity and full mastery. The Final Examination can be linked to a project or an internship activity.</p>					
6050 000 000 86277 - 0 - TIROCINIO ALL'ESTERO IN PREPARAZIONE ALLA PROVA FINALE (6 CFU)		6	0/0/150/0	No	Giudizio
Ambito: 1018 - Per la prova finale	E				
<p>Obiettivi: Al termine del tirocinio, lo studente ha acquisito competenze scientifiche, tecnico-professionali e/o gestionali in uno o più settori delle Scienze della Terra, nell'ambito di un progetto formativo congiunto tra l'Università di Bologna ed una istituzione ospite rappresentata da una università, azienda, ente di ricerca, struttura pubblica e/o privata, studio professionale e/o laboratorio all'estero, specificamente finalizzato alla raccolta, analisi ed interpretazione di dati sul campo e/o in laboratorio, eventualmente di tipo sperimentale, utili allo sviluppo di un problema scientifico definito nell'ambito della Prova Finale.</p> <p>Obiettivi inglese: By the end of the internship, the student has acquired scientific, technical-professional and/or management skills in one or more fields of the Earth Sciences, as part of a joint training project between the University of Bologna and a host institution represented by a foreign university, company, research institution, public or private structure and/or laboratory, specifically aimed at the collection, analysis and interpretation of data, possibly of an experimental nature, in the field and/or in the laboratory, that are useful for tackling and solving a scientific problem defined in the context of the Final Examination.</p>					

6050 000 000 88051 - 0 - TIROCINIO IN PREPARAZIONE DELLA PROVA FINALE (6 CFU)	6	0/0/150/0	No	Giudizio
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Ambito: 1018 - Per la prova finale

E

Obiettivi: Al termine del tirocinio, lo studente ha acquisito competenze tecnico-professionali, scientifiche e/o gestionali in uno o più settori delle Scienze della Terra, nell'ambito di un progetto formativo congiunto tra l'Università di Bologna ed una istituzione ospite rappresentata da una università, azienda, ente di ricerca, struttura pubblica o privata, studio professionale e/o laboratorio in Italia, specificamente finalizzato alla raccolta, analisi ed interpretazione di dati sul campo e/o in laboratorio e/o da indagini in situ, eventualmente di tipo sperimentale, utili allo sviluppo di un problema scientifico definito nell'ambito della Prova Finale.

Obiettivi inglese: By the end of the internship, the student has acquired scientific, technical-professional and/or management skills in one or more fields of the Earth Sciences, as part of a joint training project between the University of Bologna and a host institution represented by a university, company, research institution, public or private structure and/or laboratory in Italy, specifically aimed at the collection, analysis and interpretation of data, possibly of an experimental nature, in the field and/or in the laboratory and/or from in situ investigation, that are useful for tackling and solving a scientific problem defined in the context of the Final Examination.

Opzione 3

0-25

6050 000 000 94530 - 0 - PREPARAZIONE DELLA PROVA FINALE ALL'ESTERO (12 CFU)	12	0/0/300/0	No	Giudizio
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Ambito: 1018 - Per la prova finale

E

Obiettivi: Al termine delle attività di Preparazione della Prova Finale lo studente ha raccolto, analizzato ed interpretato dati sul campo e/o in laboratorio, eventualmente di tipo sperimentale, utili allo sviluppo di un problema scientifico definito nell'ambito della Prova Finale. La Preparazione della Prova Finale è svolta dallo studente presso una istituzione ospite rappresentata da una università, azienda, ente di ricerca, struttura pubblica e/o privata, studio professionale e/o laboratorio all'estero, nell'ambito di un progetto non regolato dalle procedure per lo svolgimento dei tirocini.

Obiettivi inglese: By the end of the activities of Preparation for the Final Examination the student has collected, analysed and interpreted data, possibly of an experimental nature, in the field and/or in the laboratory, that are useful for tackling and solving a scientific problem defined in the context of the Final Examination. The Preparation for the Final Examination is carried out by the student at a host institution represented by a foreign university, company, research institution, public or private structure and/or laboratory, as part of a project that is not directly regulated by the procedures regulating the internships.

6050 000 000 B4828 - 0 - PROVA FINALE (13 CFU)	13	0/0/0/0	No	
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Ambito: 1018 - Per la prova finale

E

Obiettivi: La prova finale per il conseguimento della laurea magistrale consiste nella redazione e nella discussione pubblica di una tesi scritta ed elaborata in modo originale dallo studente su un argomento coerente con gli obiettivi del corso di studio, sotto la guida di un relatore.

Il lavoro di tesi deve essere di tipo sperimentale e comprendere sempre una fase di raccolta dati sul campo e/o in laboratorio.

La dissertazione deve dimostrare la padronanza degli argomenti, capacità critica, l'attitudine a operare in modo autonomo e una capacità di comunicazione di buon livello.

Obiettivi inglese: The final test for obtaining the master's degree consists in the elaboration and public discussion of an original thesis written and elaborated by the student on a topic consistent with the objectives of the study course, under the guidance of a supervisor. The thesis work must be experimental and always include a data collection phase in the field and/or in the laboratory. The dissertation must demonstrate adequate knowledge of the topics, critical ability, and the ability to operate autonomously and good communication skills.

6050 000 000 86152 - 0 - TIROCINIO ALL'ESTERO IN PREPARAZIONE DELLA PROVA FINALE (12 CFU)	12	0/0/300/0	No	Giudizio
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Ambito: 1018 - Per la prova finale

E

Obiettivi: Al termine del tirocinio, lo studente ha acquisito competenze scientifiche, tecnico-professionali e/o gestionali in uno o più settori delle Scienze della Terra, nell'ambito di un progetto formativo congiunto tra l'Università di Bologna ed una istituzione ospite rappresentata da una università, azienda, ente di ricerca, struttura pubblica e/o privata, studio professionale e/o laboratorio all'estero, specificamente finalizzato alla raccolta, analisi ed interpretazione di dati sul campo e/o in laboratorio, eventualmente di tipo sperimentale, utili allo sviluppo di un problema scientifico definito nell'ambito della Prova Finale.

Obiettivi inglese: By the end of the internship, the student has acquired scientific, technical-professional and/or management skills in one or more fields of the Earth Sciences, as part of a joint training project between the University of Bologna and a host institution represented by a foreign university, company, research institution, public or private structure and/or laboratory, specifically aimed at the collection, analysis and interpretation of data, possibly of an experimental nature, in the field and/or in the laboratory, that are useful for tackling and solving a scientific problem defined in the context of the Final Examination.

6050 000 000 88053 - 0 - TIROCINIO IN PREPARAZIONE DELLA PROVA FINALE (12 CFU)

12

0/0/300/0

No

Giudizio

Ambito: 1018 - Per la prova finale

E

Obiettivi: Al termine del tirocinio, lo studente ha acquisito competenze tecnico-professionali, scientifiche e/o gestionali in uno o più settori delle Scienze della Terra, nell'ambito di un progetto formativo congiunto tra l'Università di Bologna ed una istituzione ospite rappresentata da una università, azienda, ente di ricerca, struttura pubblica o privata, studio professionale e/o laboratorio in Italia, specificamente finalizzato alla raccolta, analisi ed interpretazione di dati sul campo e/o in laboratorio e/o da indagini in situ, eventualmente di tipo sperimentale, utili allo sviluppo di un problema scientifico definito nell'ambito della Prova Finale.

Obiettivi inglese: By the end of the internship, the student has acquired scientific, technical-professional and/or management skills in one or more fields of the Earth Sciences, as part of a joint training project between the University of Bologna and a host institution represented by a university, company, research institution, public or private structure and/or laboratory in Italy, specifically aimed at the collection, analysis and interpretation of data, possibly of an experimental nature, in the field and/or in the laboratory and/or from in situ investigation, that are useful for tackling and solving a scientific problem defined in the context of the Final Examination.

Legenda:

CFU: crediti formativi universitari

TAF: tipologia attività formativa (A-di base; B-caratterizzanti; C-affini o integrative; F-ulteriori attività formative; D-a scelta autonoma dello studente; S- stages e tirocini presso imprese, enti pubblici o privati, ordini professionali; E-per la prova finale)

SSD: settore scientifico disciplinare

F/E/L/N: indica le ore Frontali/Esercitazioni/Laboratori/Ore di esercitazione e/o laboratorio tenute da non docenti

Freq.: segnala l'esistenza di un obbligo di frequenza

Ver.: indica la modalità di verifica del profitto finale

TIP.: indica la tipologia delle forme didattiche. Queste possono essere CON: convenzionali, E-L: in e-learning, MIX: miste, C/E: convenzionali e/o e-learning. Il corso di studio può definire annualmente una delle modalità.